STALLINGS STREAM AND WETLAND RESTORATION

FINAL RESTORATION PLAN

Jones County, North Carolina
SCO Project Number 050647101

Prepared for:
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Ecosystem Enhancement PROGRAM

Status of Plan: Revised Final - Version 2
Submission Date: May 30,2007

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EXECUTIVE SUMMARY

The Stallings Restoration Site is located approximately six miles southeast of Kinston, North Carolina (Figure 11.1) in northern Jones County. The site is located along Wyse Fork Road (SR 1002) and Webb Farm Road (SR 1306), north of the intersection of Flat Swamp and Wyse Fork Road. This project is located in the Coastal Plain physiographic region and is in the 03020204010050 14-digit HUC of the Neuse River basin. The site consists of 130 acres of agricultural fields with an altered, multi-branched perennial stream that flows from the Brown property through the Stallings property before discharging into Flat Swamp (Figure 11.4). NCDOT purchased the Stallings property in July of 2003 and placed a conservation easement on three acres of the Brown farm along the main tributary west of Wyse Fork Road.

The Stallings Restoration Plan includes the following: 1) restoration of the stream channels and associated riparian buffers, 2) restoration and enhancement of a bottomland hardwood riparian wetland system, 3) and preservation of the existing bottomland hardwood wetland and buffer to Flat Swamp. Using Rosgen classification, the existing channels are classified as G5 stream types, which are narrow and entrenched. Due to straightening and continued maintenance, the channels are much shorter than the natural condition and lack the riffle-pool sequences that provide energy dissipation and habitat.

Wetlands will be restored within the newly constructed floodplains of the restored channels. Riparian buffers will be replanted along all stream channels on the Stallings property and along the main channel on the Brown property creating a wildlife corridor from Flat Swamp to a nonriverine wet hardwood forest west of the project site. Existing herbaceous wetlands along Flat Swamp will be enhanced with the planting of bottomland hardwood tree species and wetland shrubs as appropriate. The existing forested wetlands and buffer along Flat Swamp will be preserved.

Restoration is part of a broad, watershed-based approach for the re-establishment of physical, chemical, and biological components of an aquatic ecosystem. This physiographic province has lost a significant portion of the historic wetland systems and stream habitat through intensive agricultural practices. Flat Swamp (27-101-15-2-1) is a major tributary to Rattlesnake Branch (27-101-5-2), which flows into Beaver Creek which then discharges into the Trent River. Flat Swamp, Rattlesnake Branch, Beaver Creek and the Trent River are all nutrient sensitive waters (NCDWQ, 1998). The restoration of the unnamed tributaries and wetlands on the Stallings site will improve physical, chemical and biological components of the Flat Swamp watershed and downstream waters.

The restoration of the stream channels and riparian buffers using the principals of natural channel design, will greatly benefit this stream system by improving the biological integrity, increasing dissolved oxygen, and moderating the pH level and water temperature of the stream. The Stallings Restoration Site may also provide future habitat for some 'federal species of concern.' The Stallings Site will be returned to a more natural state through stream and buffer restoration, wetland hydrology restoration where feasible and installation of woody wetland vegetation.

The Stallings Restoration Site offers the potential to restore 4,159 linear feet of stream, 35 acres of riparian buffer, and 5.3 acres of riverine bottomland hardwood forest wetlands. Additionally, 17 acres of bottomland hardwood forest wetland will be preserved and 5.5 acres will be enhanced along Flat Swamp. The following table provides acreages and footages for the project. For more information see Table 10.1.

Before and After Area Lengths and Acreages for Stallings Restoration Site

Area	Before	After
Stream A	1714 feet	2413 feet
Stream B	387 feet	395 feet
Stream C	1059 feet	1351 feet
Total Stream Length	**3160** feet	**4159 feet**
Buffer Restoration		34.9 acres
Buffer Enhancement		8.3 acres
Buffer Preservation		2.5 acres
Total Buffer Acres		**45.7 acres**
Restoration of riverine bottomland hardwood wetlands along restored stream channels		5.3 acres
Riverine Wetland Enhancement		5.5 acres
Wetland Preservation		17.0 acres
Total Wetland Acres		**27.8 acres**

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1.0 Project Site Location

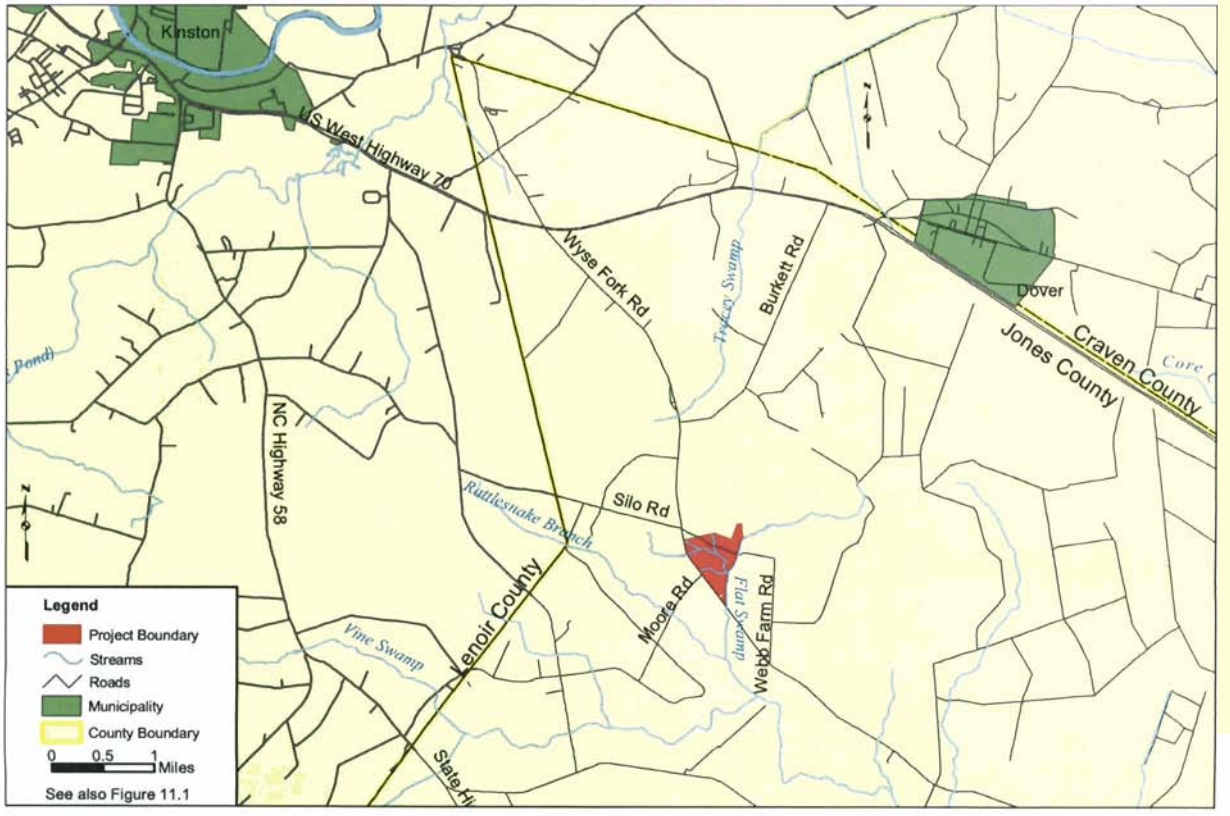
1.1 DIRECTIONS TO PROJECT SITE

The Stallings Restoration Site is located approximately six miles southeast of Kinston, North Carolina (Figure 11.1) in northern Jones County. From Kinston travel east on US70, turn right on Wyse Fork Rd (SR 1002) and travel approximately 3.5 miles. The site is located to the east of Wyse Fork Road (SR 1002) between Webb Farm Road (SR 1306) and Flat Swamp. Webb Farm Road intersects the northern end of the site.

1.2 USGS HUC & NCDWQ RIVER BASIN DESIGNATIONS

The Site is within the Neuse River basin and the United States Geological Survey (USGS) 14-digit Hydrologic Unit Code 03020204010050. An altered perennial stream, with multiple branches, flows from the Brown property through the Stallings property before discharging into Flat Swamp (Figure 11.4).

1.3 PROJECT VICINITY MAP



2.0 Watershed Characterization

2.1 DRAINAGE AREA

The Stallings Site is located on an unnamed tributary to Flat Swamp with a watershed of approximately 450 acres in size at the confluence with Flat Swamp (Figure 11.2).

2.2 SURFACE WATER CLASSIFICATION / WATER QUALITY

The unnamed streams are tributaries of Flat Swamp, which is classified as C Sw NSW from its source to Rattlesnake Branch. The "Use Support Rating" has not been determined for this section of Flat Swamp.

2.3 PHYSIOGRAPHY, GEOLOGY AND SOILS

The project watershed is located in the eastern portion of the Coastal Plain Physiographic Province of North Carolina. Broad, flat interstream areas are the dominant topographic features of this province. Slopes are generally less than four percent. Elevations in the watershed range from approximately 46 to 72 feet above mean sea level. The soil survey for Jones County (Barnhill, 1981) indicates that the area is underlain by Goldsboro loamy sand, Grifton fine sandy loam, Meggett loam, and Stockade fine sandy loam (Figure 11.3). The watershed geology contains Tertiary Period material including the Pinehurst Formation and the Comfort Member and New Hanover Member of the Castle Hayne Formation. The Pinehurst formation is unconsolidated medium to coarse-grained sand with common cross-bedding and rhythmic bands of clayey sand. The Comfort Member is Bryozoan-echinoid skeletal limestone with common solution cavities. The New Hanover Member is a thin, micritic phosphate-pebble conglomerate.

2.4 HISTORICAL LAND USE AND DEVELOPMENT TRENDS

The watershed is a mixture of forested lands, agricultural row crops, two-lane roadways, and scattered single-family homes (Table 10.3). Agricultural drainages have been constructed and maintained on the Brown, Stallings, and neighboring properties. The Stallings Site and adjacent properties are utilized primarily for agricultural purposes. The Stallings Site borders the western perimeter of the Great Dover Swamp, which contains a number of large Carolina bays, pocosins, and managed and unmanaged forests. In addition, the Great Dover Swamp is part of a large public holding linking Angoloa Bay, Holly Shelter Gamelands, Hofmann Forest and the Croatan National Forest. No zoning exists in this part of Jones County and little development is expected in the future.

Across Flat Swamp to the east of the Stallings Site is the Jones County Flat Swamp wetland mitigation site for impacts that occurred during the development of the Buckhorn Reservoir in Wilson County (Figure 11.2). The Jones County Flat Swamp site provides a portion of the bottomland hardwood forest mitigation needs for the Buckhorn Reservoir that was built by the City of Wilson. The 160-acre mitigation site was planted in 1998/1999 with a variety of wet hardwood tree species. The Jones County Flat Swamp Site and the Stallings Restoration Site will restore a block of approximately 307 acres of woodland and wildlife habitat in the Flat Swamp watershed.

2.5 PROTECTED SPECIES

Some populations of flora and fauna have been in, or are in, the process of decline either due to natural forces or their inability to coexist with human activities. Federal law (under the provisions of the Endangered Species Act of 1973, as amended) requires that any action, likely to adversely affect a species classified as federally protected, be subject to review by the USFWS. Other species may receive additional protection under separate state laws.

Letters were sent to the USFWS and the NCNHP on November 18, 2005 requesting comments on the project study area. A response letter dated November 29, 2005 was received from the NCNHP stating "The Natural Heritage Program has no record of rare species, significant natural communities, or priority natural areas at the site or within a mile of the project area" (Appendix 13).

Plants and animals with federal classifications of 'endangered,' 'threatened,' 'proposed endangered,' and 'proposed threatened' are protected under the provisions of Section 7 and Section 9 of the Endangered Species Act of 1973, as amended. The USFWS lists two federally protected species for Jones County, the red cockaded woodpecker (*Picoides borealis*) and the American alligator (*Alligator mississippiensis*).

Red-cockaded woodpecker (*Picoides borealis*)

The federal and state status for the red cockaded woodpecker is 'endangered.' An endangered species is one whose continued existence as a viable component of the State's fauna is determined to be in jeopardy. Red-cockaded woodpeckers (RCW) are mostly black and white birds with barred backs and wings and a large white cheek patch. Its habitat preference is wet pine flatwoods and pine savannas. The project watershed does not have trees of suitable age and size to support RCW colonies. The upper half of the watershed is forested but according to NCGAP data this area is predominantly pine plantation and Coastal Plain successional mixed forest. These areas are not suitable for nesting due to the small size of the pine trees and/or the presence of hardwood species in the canopy or understory. Foraging is unlikely as there is no suitable nesting habitat within half mile of the watershed. A search of the NCNHP database does not indicate any occurrences of RCWs within the project watershed or its vicinity and no individuals were observed during field surveys. Therefore, the Stallings restoration will have no effect on the red-cockaded woodpecker.

American Alligator (*Alligator mississippiensis*)

The American alligator has a federal status of T(S/A) which denotes threatened due to similarity of appearance – a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation. The State status for the American alligator is 'threatened.' A threatened species is one that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The American alligator is 6 to 17 feet long with a broadly rounded snout, distinguishing it from the American crocodile (*Crocodylus aeutus*). The American alligator is listed as "threatened due to similar appearance" to provide protection to the American crocodile, a species which it closely resembles. The American crocodile is a tropical species and is not found this far north of Florida. The American alligator inhabits fresh water swamps, marshes, abandoned rice fields, ponds, lakes, and backwaters of large rivers. Although its range once extended north in the coastal plain to the Dismal Swamp, the American alligator is now absent in the area north of the Albemarle Sound and in much of the upper coastal plain. Flat Swamp may provide suitable habitat for the American alligator but it is typically

found in larger streams and water bodies further south. None have been observed in Flat Swamp during field visits and the restoration of the Stallings site will not impact the swamp.

'Federal species of concern' are not afforded federal protection under the Endangered Species Act and are not subject to any of its provisions, including Section 7, until they are formally listed or proposed as 'threatened' or 'endangered.' However, the status of these species is subject to change, and therefore should be included for consideration. A 'federal species of concern' is defined as a species that is under consideration for listing, but for which there is insufficient information to support its listing. In addition, organisms that are listed 'endangered,' 'threatened,' or of 'special concern' by the NCNHP list of Rare Plant and Animal Species, are afforded state protection under the N.C. State Endangered Species Act and the N.C. Plant Protection and Conservation Act of 1979.

As of November 2005, there are thirteen 'federal species of concern' listed by the USFWS for Jones County. There are three vertebrates, the Southern hog-nosed snake (*Heterodon simus*), the Carolina gopher frog (*Rana capito capito*), and the "Neuse" madtom (*Notorus furiosus*), and one invertebrate, the Croatan crayfish (Procambarus plumimanus). The other nine species are vascular plants including quillwort (*Isoetes microvela*), Carolina bogmint (*Macbridea caroliniana*), Carolina goldenrod (*Solidago pulchra*), Carolina spleenwort (*Asplenium heteroresiliens*), Chapman's sedge (*Carex chapmanii*), Godfrey's sandwort (*Minuartia godfreyi*), Savanna cowbane (*Oxypolis ternate*), Spring-flowering goldenrod (*Solidago verna*), and Venus flytrap (*Dionea muscipula*). None of these species were observed during site visits.

The restoration at the Stallings Site may provide future habitat for some of these 'federal species of concern' such as the Southern hog-nosed snake, Carolina gopher frog, Carolina bogmint, and Godfrey's sandwort.

2.6 CULTURAL RESOURCES

The Stallings Restoration Site consists of former agricultural fields with no apparent historical or cultural significance. There is a brick foundation, approximately 25 by 40 feet, along Wyse Fork Road near Copeland Farm Road. The foundation is overgrown with vegetation. A letter was sent to the State Historic Preservation Office (SHPO) on November 18, 2005 requesting comments on the project study area and specifically the foundation on the site. A response was received on January 4, 2006 that requested an investigation of the Stallings site because of its proximity to the Civil War Battle of Kinston. An archaeological survey was completed by another firm in mid-2006 and submitted to SHPO for review. As a result of the survey report, SHPO concluded that 'the proposed project would not adversely impact any significant cultural resources' (Appendix 13).

2.7 POTENTIAL CONSTRAINTS

2.7.1 Property Ownership and Boundary

The Stallings site is owned by the State of North Carolina. A conservation easement has been placed on 3 acres of the Brown property on the west side of Wyse Fork Road in order to provide additional buffer along the main tributary. Wyse Fork Road serves as the southern and western boundary of the Stallings property while Flat Swamp bounds the eastern side. The northern boundary follows a dirt road north of Webb Farm Road.

2.7.2 Site Access

The site is easily accessible from Wyse Fork Road along the western edge of the property and from Webb Farm Road, which crosses the northern portion of the property. There are several existing driveway culverts along Wyse Fork and Webb Roads that allow access on to the Stallings site.

2.7.3 Utilities

A large transmission line, owned by Progress Energy, cuts through the middle of the Stallings Site south of Webb Road. The right-of-way (ROW) for the transmission line is 180 feet wide and extends from Flat Swamp through the middle of the site and across Wyse Fork Road. Five sets of transmission line towers are located within the ROW within the project area. Phone conversations and emails with Mr. Buzz Bryson of Progress Energy in early 2003 have indicated that an agreement may be reached with Progress Energy that would allow stream restoration and limited plantings within the ROW. Prior to any work being proposed within the ROW, a Memorandum of Agreement should be developed with Progress Energy to allow restoration activities.

2.7.4 FEMA / Hydrologic Trespass

A check of FEMA flood zone mapping for Jones County indicates that all of Flat Swamp and the lower reaches of the tributaries on the Stallings Site are within the 100-year flood hazard zone (http://www.ncfloodmaps.com/default_swf.asp). The analysis indicates that the proposed channel geometry will not increase the 100-year flood elevations within the project area. In fact, the analysis indicates that the water surface elevation will be reduced by 0.05 feet at the downstream end (HEC-RAS Section 34) of the project. This analysis is discussed in Section 7.3.2 of this report.

3.0 Project Site Streams

A detailed topographic survey of the Stallings Restoration Site was completed on December 15, 2001 by NCDOT. In addition, a field survey of existing channel conditions was completed on November 6, 2001. Further topographic and stream surveys were conducted in October 2005 (Sheet 12.1). Field survey measurements were gathered using proper surveying techniques (Harrelson *et al.*, 1994). Measurements included, but were not limited to, longitudinal profile of the thalweg, water surface, bankfull, low bank, and terrace; cross section of riffle and pool including bank slope, water depth and width of flood-prone area; valley length; belt width; straight length; pool-to-pool spacing and channel material. A field verification of the watershed area delineated from the Dover USGS topographic quadrangle was conducted (Figure 11.4). The detailed stream survey and watershed data provide existing condition information and identify design constraints, such as culvert elevations. Photographs of the site are included in Appendix 1.

3.1 CHANNEL CLASSIFICATION

The unnamed tributary to Flat Swamp on the Stallings Site is shown on both the USGS Dover topographic quadrangle and the Soil Survey of Jones County. The main channel and its three branches

include first, second, and third order streams that lie along the natural contours of the landscape. Regular maintenance (vegetation removal, channel bed material removal, and grade alteration) has created the current dimension, pattern, and profile. For discussion and design purposes the main channel and its tributaries were split into sections or reaches and given letter designators for easier reference. See Sheet 12.2 for the stream designators and Appendix 1 for photos of existing conditions.

The main channel (reach A) originates to the west of Wyse Fork Rd, on the Brown property, crosses the site from west to east and joins with Flat Swamp. One tributary (reach B) connects to the main channel from the north and a second tributary (reach C) enters from the south near the confluence with Flat Swamp. On February 21, 2001, Dave Penrose (a biologist for the North Carolina Department of Natural Resources, Division of Water Quality – Wetlands Unit) visited the Stallings Site to determine the intermittent versus perennial status of the streams. After macroinvertebrate sampling and a visual inspection (DWQ Biological Reconnaissance Form, Appendix 4), Mr. Penrose determined that the main stream and the second order stream south of Webb Farm Road, reaches A and B were perennial. The presence of fish and fingernail clams *(Sphaeriidae* spp.*)* validates the streams as perennial. The second order stream north of Webb Farm Road and the second order stream flowing into the main stream from Wyse Fork Road were determined to be intermittent (Figure 11.4). The southernmost first order tributary (reach C) was determined to be a small perennial stream just downstream of the Wyse Fork Road culvert. The North Carolina Division of Water Quality (NCDWQ) method for determining ephemeral and perennial/intermittent channels was also utilized to evaluate the unnamed tributaries to Flat Swamp and Flat Swamp itself on April 11, 2002 during an extended dry period. This method resulted in the same determinations as found in February 2001. NCDWQ Stream Classification forms are provided in Appendix 3.

Stream channels are classified using five criteria: width-to-depth ratio, entrenchment ratio, slope, sinuosity, and channel materials. Width-to-depth ratio is the ratio of the bankfull width to the mean depth of the bankfull channel, which is an indication of the channel's ability to dissipate energy and transport sediment. Entrenchment ratio is the vertical containment of the stream and the degree to which the channel is incised in the valley floor. Entrenchment ratio indicates if the stream is able to access its floodplain. Flood-prone width divided by the bankfull width yields the entrenchment ratio. The slope is the change in water surface elevation per unit of stream length. Slope can be analyzed over the entire reach, to determine if the slope is stable within the existing channel material, or over sections, to determine the condition of pools and riffles. Sinuosity is the ratio of stream length to valley length. Extremely low sinuosity channels in eastern North Carolina typically indicate a straightened channel. Channel bed and bank materials indicate the channel's resistance to hydraulic stress and ability to transport sediment (Rosgen, 1994). All five of the criteria are interrelated and were used as a set to determine the current condition of the channel.

According to the five criteria the existing channels are classified as a G5. Moderate to high entrenchment, low width-to-depth ratio and moderate sinuosity, determines the 'G' classification. The '5' classification indicates a predominantly sand bed channel. The existing channel data are provided in Table 10.5. The main stream is approximately 6 to 8 feet wide and the bed is approximately 4 feet below the top of the bank. All of the existing channels can be characterized as having minimal riffle-pool sequence and low sinuosity. The substrate consists predominantly of sand. Base water flow fluctuates dramatically from fast flowing and relatively deep water, to no flow with water pooled only in scattered locations. During a Stallings Site visit on June 22, 2001, water was observed flowing slowly to the east towards Flat Swamp. Minnows were observed within the main channel and the tributaries.

Beavers are located throughout Flat Swamp and adjacent drainages and have caused tree damage and some flooding. During site visits, two old breached beaver dams were noted near the lower end of the main tributary on the Stallings Site. Beaver dams can create a backwater effect, raising waters levels in Flat Swamp that can back up into the tributaries on the site. Although beavers are a natural part of the Flat Swamp system, a beaver management plan will need to be developed to minimize damage to the stream restoration and the restored riparian buffer. This issue is discussed further in Section 7.6 of this document. During periods of high water, Flat Swamp creates backwater that inundates the lower portions of reaches C and A. The proposed design takes this backwater into account by stopping short of the periodically inundated reaches.

3.2 DISCHARGE

Bankfull discharge is defined as the dominant channel forming flow that moves the most sediment over time (Rosgen, 1994). This generally equates to a 1.2 to 1.5 year storm event in North Carolina. Bankfull discharge is estimated using various methods. Coastal Plain Regional Curves developed by the Stream Restoration Institute at North Carolina State University were reviewed (NCSRI, 2004). These curves provide a graphical representation of bankfull discharge to drainage area. USGS regional regression methods for determining peak discharge were also examined (Pope *et al.*, 2001). This method employs long-term gage data to develop equations based on hydro-physiographic region. Coastal plain regression equations were used to calculate various peak discharges for 2, 5, 10, 50 and 100-year events. A log-log plot of these discharged can then be extrapolated to determine a 1.2 to 1.5 year discharge. The third and final method is based on channel morphology. Once bankfull areas and bed roughness were determined from field surveys, Manning's equation is applied to calculate the mean velocity in the channel. This velocity is then multiplied by the channel area to determine the discharge. The existing bankfull velocity is approximately 1.4 ft/s equating to bankfull discharges ranging from 4.0 to 11.0 ft^3/s for the different stream reaches. The calculated discharge compares well to the NCSU regional curves and the USGS regression method. Table 10.2 provides drainage areas and bankfull discharges for each reach.

3.3 CHANNEL MORPHOLOGY

Bankfull width of the existing stream channels at the Stallings Site is approximately 5.7 feet and bankfull depth is approximately 0.73 feet. The streams have a sinuosity of 1.07; however, due to past straightening of the channels, there are no radii to measure for radius of curvature ratios or meander length ratios. The width-to-depth ratio of 7.85 is moderate and the entrenchment ratio of 1.92 is highly entrenched as expected for a G type stream. The Stallings Restoration Site's streambed material is sand dominated. Photographs of the existing channels are presented in Appendix 1. A complete morphological table for the existing stream channel is presented in Table 10.5.

The bank height ratios also vary between the reaches. Bank height ratios note the difference between the bankfull elevation and the lowest stream bank. Commonly, stable channels exhibit bank height ratios between 1.0 and 1.3; however, these numbers may increase based on stream classification and overall entrenchment. The existing ratios vary within the site from about 2.5 to 3.5. Additional information including existing pattern data for the existing channels can be found with all of the morphological data in Table 10.5

The composition of the streambed and banks is an important facet of stream character, influencing channel form and hydraulics, erosion rates and sediment supply. All streambeds on the Stallings Site were

characterized using the modified Wolman Pebble Count (Rosgen, 1994). According to the modified Wolman Pebble Count procedure, the average d_{50} (50% of the sampled population is equal to or finer than the representative particle diameter) is less than 2.0 mm for all streams, which falls into the sand size category. Pebble counts were taken at representative locations along each reach. The locations included both riffle and pool cross sections.

3.4 CHANNEL STABILITY ASSESSMENT

The existing channels on the Stallings Site were analyzed for overall stability. This analysis included the morphological assessment as mentioned above, and calculations of shear stress and stream power. The existing channels exhibited shear stresses of approximately 0.11 lb/ft^3, which equates to a stream power of 0.154 lb/ft^2/s. In a relatively flat, sand bed system such as the Stallings Site, the stream power is within an acceptable range. Field observations indicated no severe bank erosion or lateral migration of the channel. Existing herbaceous vegetation along the channel banks and within the channel also help channel stability. The proposed channels were designed to mimic or slightly reduce the shear and power of the existing channels.

3.5 BANKFULL VERIFICATION

In degraded systems bankfull indicators are often not present or are unreliable due to maintenance practices and the stream's degrading processes. The existing bankfull elevations and bankfull cross sectional areas were determined in the field by locating depositions or inner berms, scour lines, vegetation lines, or slope breaks in the bank. These bankfull dimensions were then compared to the Coastal Plain Regional Curves for verification (NCSRI, 2004).

3.6 VEGETATION

The streambanks of the unnamed tributaries on the Stallings Site are vegetated mostly with grasses, wet herbaceous species, with scattered shrubs and tree saplings. Portions of the streams are overgrown with vegetation such as cattails (*Typha* sp.), black willow saplings (*Salix nigra*), smooth alder (*Alnus serrulata*), and jewelweed (*Impatiens* spp.). Some of this vegetation is growing in the channel bottoms. Much of the riparian buffers along the unnamed tributaries were used for row crop production and grass field borders and were maintained, mowed, and planted for crop production. The riparian buffer along Flat Swamp varies in width from 5 to 100 feet within the Site. The buffer contains boxelder (*Acer negundo*), black gum (*Nyssa sylvatica*), overcup oak (*Quercus lyrata*), red maple (*Acer rubrum*), ironwood (*Carpinus caroliniana*), sweetgum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), loblolly pine (*Pinus taeda*), and black willow.

4.0 Reference Streams

A reference reach provides natural channel design criteria that are based on measured morphological relationships from stable channels. With no suitable reference reach available on the Stallings site, a search was carried out for suitable reference reaches for the design of the new channel using topographic maps followed by field investigations. Criteria used to identify a potential reference reach included:

current land use, drainage area, stream order, absence of man-made alterations or beaver dams, stream classification, and stream condition. Visual inspections were conducted along the channel of each potential reference reach. Each reach was walked and notes were taken on the vegetative cover, bank stability, sinuosity, channel classification, and channel condition. The inspection was performed to ensure that the contributing watershed was not adversely affecting the condition of the reach.

The three streams identified as reference reaches were; Jack Cabin Branch, Beaverdam Branch, and Bullard Branch. Jack Cabin Branch and Beaverdam Branch are both located in Jones County, North Carolina and were surveyed on October 10, 2001 and December 5, 2001, respectively. Bullard Branch is located in Duplin County, and was surveyed on March 14, 2002 (Figure 11.5). All three of the surveys were performed using techniques outlined in the USDA Stream Cannel Reference Sites: An Illustrated Guide to Field Technique (Harrelson *et al.*, 1994), and Rosgen's Natural Channel Design (Rosgen, 1996).

Measurements taken included, but were not limited to, longitudinal profile, cross section of a riffle and a pool detailing the following data: thalweg, water surface, bankfull, low bank, and terrace elevation; bank slope; width of flood-prone area; belt width; valley length; straight length; pool-to-pool spacing and channel materials. The data were utilized to form dimensionless ratios for natural channel design. NCDWQ Stream Classification forms for each reference channel are included in Appendix 9.

4.1 REFERENCE WATERSHED CHARACTERIZATION

Jack Cabin Branch is a first order tributary flowing north from the White Oak Pocosin to the Trent River in Jones County, North Carolina. Jack Cabin Branch is shown as a blue line stream on the Phillips Crossroads quadrangle (Figure 11.6). The reference reach survey was conducted upstream (south) of the Highway 41 stream crossing. The watershed is approximately 877 acres primarily in the White Oak Pocosin. The surrounding land use is predominantly forested, encompassing a few secondary roads (Figure 11.14). The watershed contains only the one small tributary and no impoundments. Soils in the watershed are predominantly Pantego and Torhunta (Figure 11.10).

The Beaverdam Branch reference reach is a first order tributary flowing north from the Hofmann Forest into Mill Run, which is a tributary to the Trent River. Beaverdam Branch is a blue line stream on the Jacksonville NE quadrangle (Figure 11.7). The watershed is approximately 1,408 acres primarily in the White Oak Pocosin and Hofmann Forest. The watershed is predominately forested with approximately 35 percent of the watershed used for farmland or homesteads with minimal roadway influence (Figure 11.15). The watershed contains only one tributary and no impoundments. The reference reach survey was undertaken downstream (north) of the Davis Field Road (SR 1119) crossing. Muckalee soils are found along the streams while the predominant soil in the watershed is Pantego (Figure 11.11).

Bullard Branch is a first order tributary flowing southerly from the southeast corner of Summerlins Crossroads to the Goshen Swamp in Duplin County. The branch is identified as a blue line stream on the Summerlins Crossroads Quadrangle (Figure 11.8). The reference reach was surveyed upstream (north) of Kelly Road (SR 1511). The reference reach watershed is approximately 499 acres and is located southeast of Summerlins Crossroads. The watershed is predominately forested with approximately 20 percent of the land used for agricultural practices or homesteads (Figure 11.16). The watershed is bounded to the north and west by secondary roadways, Outlaws Bridge Road (SR 1306) and Summerlins Crossroad Road (SR 1004), respectively. The watershed contains only the one tributary and no impoundments were identified.

Muckalee soils are found along the streams while the predominant soil in the watershed is Pantego (Figure 11.12).

4.2 CHANNEL CLASSIFICATION

The Jack Cabin Branch reference reach is classified as a C5 stream type. The reach was transporting its sediment supply without aggrading or degrading while maintaining its dimension, pattern, and profile. The reach used for the detailed survey was 280 feet long and was dry at the time of survey. The survey included a longitudinal profile, cross sections, bed material evaluation, and a buffer characterization and system stability evaluation.

The Beaverdam Branch reference reach is characterized as a C5 stream type. The reach is transporting its sediment supply without aggrading or degrading while maintaining its dimension, pattern and profile. Bankfull width of the reach is approximately 20.3 feet and bankfull depth is approximately 1.1 feet. The reach used for the survey was 301 feet in length. The survey included a longitudinal profile, cross sections, bed material evaluation, buffer characterization, and system stability evaluation.

The Bullard Branch reference reach is characterized as a C5 stream type. The reach is transporting its sediment supply without aggrading or degrading while maintaining the dimension, pattern, and profile. The section of the reach surveyed was 189 feet in length. The survey included a longitudinal profile, cross-sections, bed material evaluation, buffer establishment, and system stability evaluation.

4.3 DISCHARGE

Bankfull discharge is defined as the dominant channel forming flow that moves the most sediment over time (Rosgen, 1994). This generally equates to a 1.2 to 1.5 year storm event in North Carolina. Bankfull discharge is estimated using various methods. Coastal Plain Regional Curves developed by the Stream Restoration Institute at North Carolina State University were reviewed (NCSRI, 2004). These curves provide a graphical representation of bankfull discharge to drainage area. The second method is based on channel morphology. Once bankfull areas and bed roughness were determined from field surveys, Manning's equation is applied to calculate the mean velocity in the channel. This velocity is then multiplied by the channel area to determine the discharge. Jack Cabin Branch has an average bankfull velocity of 1.95 ft/s which equates to a discharge of 32.0 cfs. Beaverdam branch has an average velocity of 3.2 ft/s which equates to a bankfull discharge of 81.2 cfs. Bullard Branch has an average velocity of 1.43 ft/s which equates to a bankfull discharge of 15.15 cfs. The calculated discharge compares well to the NCSU regional curves.

4.4 CHANNEL MORPHOLOGY

Bankfull width of the Jack Cabin Branch reference reach is approximately 14.5 feet and bankfull depth is approximately 1.1 feet. The reference reach has a sinuosity of 1.8 and a radius of curvature to bankfull width ratio of 0.7 – 2.0. The restored channel will have slightly different values, because the absence of mature vegetation makes it difficult to construct stable streambanks with tight curvatures. The width-to-depth ratio of 12.8 is moderate and the entrenchment ratio of 5.4 is slightly entrenched as expected for a C type stream. Both the reference reach and the Stallings Restoration Site's streambed material are sand dominated. Photographs of Jack Cabin Branch are presented in Appendix 6. The reference reach data for Jack Cabin Branch are presented in Table 10.5.

The Beaverdam Branch reference reach has a sinuosity of 1.5 and a radius of curvature to bankfull width ratio of 0.4 to 1.6. The restored channel will have slightly different values, because the absence of mature vegetation makes it difficult to construct stable streambanks with tight curvatures. The width-to-depth ratio of 18.2 is moderate to high and entrenchment ratio of 10.4 is slightly entrenched as expected for a C type stream. Both the reference reach and the Stalling Site's streambed material are dominated by sand. Photographs of Beaverdam Branch are presented in Appendix 6. The reference reach data for Beaverdam Branch are presented in Table 10.5.

The bankfull width of the Bullard Branch reach is approximately 11.5 feet and bankfull depth is approximately 0.8 feet. The measured sinuosity of 1.2 and radius of curvature to bankfull width ratio of 0.8 to 1.1 are tighter than what will be constructed, due to the ability of the mature vegetation to hold the streambanks. The width-to-depth ratio of 14.1 is moderate and entrenchment ratio of 11.1 is slightly entrenched as is expected for a C type stream. Both the reference reach and the Stallings Restoration Site's streambed material are dominated by sand. Photographs of Bullard Branch are located in Appendix 6. A summary of the data obtained for the Bullard Branch reference reach is located in Table 10.5.

4.5 CHANNEL STABILITY ASSESSMENT

Each reference reach was analyzed for overall stability. This analysis included the morphological assessment as mentioned above, and calculations of shear stress and stream power. Jack Cabin Branch exhibits a shear stress of 0.668 lb/ft^3 and a stream power of 0.846 lb/ft^2/s. Beaverdam Branch exhibits a shear stress of 0.374 lb/ft^3 and a stream power of 0.485 lb/ft^2/s. Bullard Branch exhibits a shear stress of 1.19 lb/ft^3 and a stream power of 1.56 lb/ft^2/s. Field observations indicated no severe bank erosion or lateral migration of the channel. Heavy vegetation, which occurs over the majority of the stream banks, is providing valuable protection. The proposed channel design for the Stallings Site utilizes lower shear stresses and stream power due to the lack of vegetation upon completion of construction.

4.6 BANKFULL VERIFICATION

In reference systems, bankfull is typically the top of bank or very near so. The existing bankfull elevations and bankfull cross sectional areas were determined in the field by locating the top of bank or back of point bars. These bankfull dimensions were then compared to the Coastal Plain Regional Curves for verification (NCSRI, 2004). The morphological data, including bankfull dimensions, for each reference reach is presented in Table 10.5.

4.7 VEGETATION

The reach of Jack Cabin Branch used as a reference flows through a well-established buffer. The canopy is comprised of yellow poplar (*Liriodendron tulipifera*), red maple, sweetgum, American holly (*Ilex opaca*), sweetbay magnolia (*Magnolia virginiana*), horse sugar (*Symplocos tinctoria*), and water oak (*Quercus nigra*). Some of the plants in the understory include Virginia chainfern (*Woodwardia virginica*), doghobble (*Leucothoe axillaris*), grape vines (*Vitis* spp.), greenbrier (*Smilax* spp.), and various types of grasses.

The reach of Beaverdam Branch used as a reference has a well-established vegetated buffer. The canopy is comprised of sweetgum, ironwood, red maple, swamp chestnut oak (*Quercus michauxii*), yellow poplar, white oaks (*Quercus alba*), and American holly. Some of the plants in the understory are Chinese

privet (*Ligustrum sinense*), giant cane (*Arundinaria gigantean*), poison ivy (*Toxicodenderon radicans*), cross vine (*Bignonia capriolata*), greenbrier, and various types of grasses.

The reach of Bullard Branch used as a reference also flows through a well-established buffer. The canopy is comprised of red maple, American holly, water oak, tulip poplar, sweetgum, swamp chestnut oak, and black willow. Some of the plants in the understory are giant cane, greenbrier, grape vines and bracken fern (*Pteridium aquilinum*).

5.0 Project Site Wetlands

5.1 JURISDICTIONAL WETLANDS

The methods outlined in the US Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory, 1987) were used to delineate the jurisdictional wetlands on the Stallings property (Appendix 2). Approximately 23 acres of existing wetlands are located along Flat Swamp and along the southern portion of the main unnamed tributary (Figure 11.4). Scott Jones of the USACE verified jurisdictional wetlands during a site visit on December 1, 2005. There are seven acres of bottomland hardwood forest north Webb Farm Rd. The 16 acres of wetlands south of Webb Farm Rd consist of bottomland hardwood forest (12 acres) along much of Flat Swamp and freshwater marsh/meadow (4 acres) under the maintained Progress Energy ROW and along the lower reach of the main tributary. The bottomland hardwood forest is dominated by cherrybark oak (*Quercus falcata* var. *pagodaefolia*), red maple, black gum, American elm (*Ulmus Americana*), box elder, sycamore, swamp cottonwood (*Populus heterophylla*), and black willow. The wetland along the main tributary has been cleared of all vegetation in the past and is currently covered in smartweed (*Polygonum pensylvanicum*), cattails, sedges (*Carex* sp.), and other herbaceous vegetation.

Portions of the bottomland hardwood forest wetland appear to have been altered by human and beaver activity. Timber harvesting and increased flooding have created an open swamp appearance immediately adjacent to the channel and north of the power line right-of-way. Typical water levels in the swamp are one to two feet below the edge of field elevation. A broken, low soil berm can be found along portions of the field edge just inside the woodline. The berm is likely the remnants of debris piles pushed to the edge of the swamp years ago when the fields were cleared.

5.2 HYDROLOGICAL CHARACTERIZATION

5.2.1 Hydrologic Budget for Restoration Site

Hydrology for the existing wetland areas comes from both overbank flooding from Flat Swamp and poor drainage of rainfall runoff. Field observations also indicate that significant storm water flows push water levels in all the stream channels to the top of bank and over the bank into the lower field along the main tributary. This overbank flooding appears to occur at least once per year making the existing wetlands riverine in nature. Agricultural practices and some crowning of the fields encourage more rapid runoff, which collects at the bottom of the fields near Flat Swamp, contributing to the hydrology of the existing wetlands. The existing wetlands will be enhanced and enlarged as part of the Stallings Restoration Plan.

5.3 SOIL CHARACTERIZATION

The soil survey for Jones County (Barnhill, 1981) indicates that the area is underlain by Goldsboro loamy sand, Meggett loam, and Stockade fine sandy loam (Figure 11.3). The presence of hydric soils (Meggett, and Stockade) on the Stallings property was verified during the June 22, 2001 site visit. According to the United States Department of Agriculture Farm Services Agency, the site is designated as prior converted (PC) cropland.

5.3.1 Taxonomic Classification

The Meggett series consists of very deep, poorly drained, slowly permeable soils that formed in clayey marine sediments and alluvial materials on Pleistocene terraces. These soils are on broad nearly level, low lying parts of the Coastal Plain. They are saturated in winter and spring and floodplain areas are flooded frequently. Slopes range from 0 to 3 percent. The water table is at a depth of 0 to 1 foot below the ground surface from December to April. Meggett soils are fine, mixed, thermic Typic Albaqualfs and are classified as hydric soils by the Natural Resources Conservation Service (NRCS). Meggett loam is the predominant soil type on the Stallings Site.

The Stockade series consists of very poorly drained soils that formed in loamy sediments on marine terraces. These soils are located on level to nearly level, low-lying drainageways and depressions. Slope ranges from 0 to 2 percent. Permeability is moderately rapid in the A horizon, moderate to moderately rapid in the B horizons, and rapid in the C horizon. The depth of the water table is less than 10 inches below or is above the surface for more than six months during most years. This soil is subject to frequent flooding for long durations. Stockade soils are fine-loamy, mixed, thermic Typic Umbraqualfs and are classified as hydric soils by the NRCS. Stockade fine sandy loam is found on the southeastern end of the Stallings property, adjacent to Flat Swamp.

The only non-hydric soil within the Stallings Site limits is Goldsboro loamy sand. The Goldsboro series consists of very deep, moderately permeable, moderately well drained soils that formed in unconsolidated stratified Coastal Plain sediments, dominantly of medium texture. These soils are located on uplands in broad interstream divides in the Coastal Plain and have slopes ranging from 0 to 10 percent. The water table is at a depth of 1.5 to 2.5 feet below the surface from December to April. Goldsboro soils are classified as fine-loamy, siliceous, thermic Aquic Paleudults. Goldsboro loamy sand is found on the upstream end of the reach on the Brown property, and on the upstream reach of the tributary that crosses Webb Farm Road at the northern end of the Stallings Site.

5.3.2 Profile Description

Eleven soil profiles were evaluated across the Stallings Site and reference area (Figure 11.3, Table 10.4 and Appendix 5). Profiles 1 through 8 are located within the project area on the Stallings Site. Profiles 9 through 11 are located in or near the jurisdictional wetland on the Stallings Site and are discussed within the riverine reference wetland information (Section 6.2).

Profiles 1 through 7 are all located within the area mapped as Meggett loam in the Jones County Soil Survey. Excluding profile 5, the above sampling points were similar to the typical series description as described in the Soil Survey of Jones County. The colors in profile 5 indicated a much lower water table, which is similar to the nearby Goldsboro series. Most of these seven soil pedons contained a restrictive

clay layer beginning between 10 and 30 inches and extending beyond the depth of analysis (48 to 56 inches). At the sample location closest to the existing stream channels, Profile 4, clay content reduced dramatically at 42 inches in depth. Redoximorphic features were evident within the restrictive layer in all cases. A number of the soils were holding water on the surface, but were physically dry beneath the surface layer.

Profiles 2, 3, and 4 form a catena from the interstream divide down to the edge of Stream Reach B. The upper limit of the very plastic, ultra-dense clay layer was shallowest (20 inches) closest to the stream and gets deeper (27 inches) closer to the interstream divide. Possibly due to compaction, water was perched on the surface of profile 2 but was not saturated throughout the sample. Profile 3 and the majority of profile 2 were not physically wet but did exhibit low chroma matrices indicative of water movement in the pedon. Profile 4 was saturated beginning at 10 inches and throughout the remainder of the sample.

Profile 8 is located in the higher ground near Webb Farm Road in an area mapped as Goldsboro loamy sand. The sample evaluated is similar to the typical pedon description. The low chroma matrix does not begin until 33 inches. A restrictive clay layer is present starting at 30 inches and extending beyond the depth of analysis (54 inches). A few redoximorphic features are present from 8 to 16 inches but are not extremely apparent until 24 inches and deeper.

In general, soils across the project site exhibit low chroma colors fairly near to the soil surface indicative of existing water movement. The thick subsoil consists of a dense clay layer that currently perches surface water. The topsoil within the former agricultural fields is 6 to 10 inches deep, and contains a fair amount of organic matter. No constraints for stream and wetland restoration were observed onsite. Detailed profile descriptions for the eleven sampling sites are located in Appendix 5.

5.4 PLANT COMMUNITY CHARACTERIZATION

Vegetative communities present on the Stallings Site include fallow fields, agricultural row crops and bottomland hardwood forest. The bottomland hardwood forest within Flat Swamp includes larger canopy trees scattered on higher hummocks and along the swamp edge. Although these areas have not been maintained, the beaver activity and historic logging of the wetland buffer appear to have altered the northern portion into a more open swamp community dominated by red maple, box elder, green ash (*Fraxinus pennsylvanica*), sweetgum, and sycamore. The southern portion of the wetland area is more of a bottomland hardwood forest dominated by yellow poplar, swamp cottonwood, cherrybark oak, swamp chestnut oak, and swamp dogwood (*Cornus stricta*) on the drier hummocks. The understory includes many re-sprouts of canopy species along with smooth alder, black willow, ironwood, and Virginia willow (*Itea virginica*). Herbaceous species were sparse but included lizard's tail (*Saururus cernuus*), smartweed, wool grass (*Scirpus cyperinus*), duckweed (*Lemna* and *Spirodela* spp.), and soft rush (*Juncus effusus*). The area within the transmission line ROW at the confluence with the unnamed tributary is dominated by herbaceous and shrubby species. Common species identified included: soft rush, smartweed, wool grass, cattail, buttonbush (*Cephalanthus occidentalis*), and black willow. Schafale and Weakley classification is not applicable as the ROW is not a natural community.

The majority of the Stallings, Brown, and surrounding properties have been planted in row crops each year. Cotton and corn were the dominant crops noted on the Stallings property during field investigations carried out in 2001 and 2002. The fields were not farmed in 2005 and have grown up in various pioneer species that include dog fennel (*Eupatorium capillifolium*), broomsedge (*Andropogon virginicus*),

common woodsorrel (*Oxalis* sp.), and panic grass (*Dicanthelium* sp.). Two fields at the northwest corner of the Stallings Site have been left fallow in recent years. Various grasses including broomsedge, blackberries (*Rubus* sp.), and scattered loblolly pine saplings have colonized these fallow areas. A small area just south of Webb Farm Road is dominated by black willow.

6.0 Reference Wetlands

A comprehensive review of potential reference wetlands was conducted prior to beginning fieldwork. Based on a review of USGS quadrangles for the Dover and surrounding quadrangles and the Jones County Soil Survey, a total of ten potential reference wetlands were identified. The potential reference wetlands were visited on November 15, 2001 and April 12, 2002. Land use activities, hydrologic schemes, and vegetative communities were noted in all potential reference wetlands. Detailed notes were taken of the species present in each layer of the vegetative communities, the hydrology, and the topography. Soil characteristics were investigated through augering. The methods outlined in the US Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory, 1987) were used to evaluate the reference wetlands (Appendix 7).

Based on this survey and the desire to create a contiguous system, it was decided to use Flat Swamp in the southern portion of the Stallings property as the reference wetland for the riverine bottomland hardwood wetland (Figure 11.9). Although much of the Flat Swamp riparian area has been disturbed by beaver activity, a stand of bottomland hardwoods on the southern end of the Stallings property has not been altered significantly and is still a good reference for a bottomland hardwood community.

The reference wetland is located north of Wyse Fork Road and is characterized by a central stream channel 15 - 20 feet wide and a flooded bottomland hardwood forest 500 - 600 feet wide (Figure 11.9). According to National Wetlands Inventory (NWI) mapping, the Flat Swamp reference wetland is a palustrine, forested, broad-leaved deciduous, temporarily flooded wetland (PFO1A). The NCDWQ Wetland Rating Worksheet yielded a relatively high rating (66) for the Flat Swamp reference wetland (Appendix 8). The wetland rated particularly high in water storage and pollutant removal.

6.1 HYDROLOGICAL CHARACTERIZATION

Groundwater, overbank flow, and additional flooding from beaver activity drive the hydrology in Flat Swamp. The surface soils ranged from moist to saturated. Water levels in Flat Swamp fluctuate seasonally and with the influence of beaver activity. In August of 2001, the water in the channel was approximately three feet in depth and was approximately two feet below the ground surface of the wetland. In April of 2002, the channel was full and most of the wetland area was flooded with 6 to 12 inches of water. In October of 2005, water levels in Flat Swamp and its tributaries were very low, two feet below normal water levels.

6.1.1 Gauge Data Summary

Monitoring gauge data collected from November 2002 to December 2003 showed the groundwater levels in the bottomland hardwood forest to be within 12 inches of the surface during the majority of the time period (Appendix 10).

6.2 SOIL CHARACTERIZATION

6.2.1 Taxonomic Classification

The Flat Swamp reference wetland soil is mapped as Stockade (Figure 11.13). This series consists of very poorly drained soils that formed in loamy sediments on marine terraces. These soils are located on level to nearly level, low-lying drainageways and depressions. Slope ranges from 0 to 2 percent. Permeability is moderately rapid in the A horizon, moderate to moderately rapid in the B horizons, and rapid in the C horizon. The depth of the water table is less than 10 inches below or is above the surface for more than six months during most years. This soil is subject to frequent flooding for long duration. Stockade soils are Fine-loamy, mixed, thermic Typic Umbraqualfs and are classified as a hydric soil by the NRCS. Stockade fine sandy loam is found on the southeastern end of the Stallings property, adjacent to Flat Swamp.

Much of the rest of the Stallings Site and bottomland hardwood forest is mapped as Meggett loam. The Meggett series consists of very deep, poorly drained, slowly permeable soils that formed in clayey marine sediments and alluvial materials on Pleistocene terraces. These soils are on broad nearly level, low lying parts of the Coastal Plain. They are saturated in winter and spring and floodplain areas are flooded frequently. Slopes range from 0 to 3 percent. The water table is at a depth of 0 to 1 foot below the ground surface from December to April. Meggett soils are fine, mixed, thermic Typic Albaqualfs and are classified as a hydric soil by the NRCS.

6.2.2 Profile Description

Profiles 9 and 10 are located within the jurisdictional wetland and are mapped as Stockade fine sandy loam in the Harnett County Soil Survey. Stockade soils are dark, hydric soils that remain saturated throughout much of the year. The soils evaluated on-site were similar to this classification. Both profiles were dark and saturated, but differed from the typical profile description in that both contained clay-textured soils within 16 inches of the surface. Profile 11 is located near the edge of the wetland near the Meggett/Goldsboro line. The soil represents the drier areas associated with the riverine bottomland hardwood forests in the vicinity. The sample has perched surface water and a dense clay subsoil.

6.3 PLANT COMMUNITY CHARACTERIZATION

6.3.1 Community Description

The dominant species within the riverine bottomland hardwood forest canopy included red maple, box elder, green ash, sweetgum and sycamore. On the drier hummocks, yellow poplar, swamp cottonwood, cherrybark oak and swamp chestnut oak were observed. Many of the canopy species adjacent to the reference wetland appeared stressed from inundation in the wetter areas of Flat Swamp. The stressed areas were not used for the reference wetland. The understory of the reference wetland was dominated by canopy species along with black willow, Virginia willow, and ironwood. Shrubs and vines included tag alder, swamp dogwood, giant cane, and greenbrier. Herbaceous species varied with the degree of flooding and included lizard's tail, smartweed, sedges, cattails, wool grass, duckweed, and soft rush. See Appendix 6 for photographs, Appendix 7 for Wetland Data Forms, and Figure 11.17 for the vegetative communities.

6.3.2 Basal Area

The woody vegetation basal area for the wetland reference area was calculated using a prism with basal area factor of 10. The basal area for the bottomland hardwood reference is approximately 220 square feet per acre.

7.0 Project Site Restoration Plan

7.1 RESTORATION PROJECT GOALS AND OBJECTIVES

The health of a watershed is dependent on the quality of the headwater system(s), individual tributaries, and major channels. High quality tributaries with vegetated buffers filter contaminants, maintain moderate water temperatures, provide high quality aquatic and terrestrial habitat and regulate flows downstream. Land use practices in the Flat Swamp and Rattlesnake Branch Creek watersheds have maximized available land for agricultural uses. Flat Swamp is a major tributary to Rattlesnake Branch, which flows into Beaver Creek, which then discharges into the Trent River. Flat Swamp, Rattlesnake Branch, Beaver Creek and the Trent River are all nutrient sensitive waters (NCDWQ, 1998). Agricultural land use practices have narrowed or removed many natural, vegetated buffers along streams within the Trent River watershed as well as draining and converting nonriverine wet hardwood forests to cropland. The restoration of the Stallings unnamed tributary and wetlands will enhance structural and functional elements within the Flat Swamp watershed.

The goal of the Stallings restoration project is to restore a stable stream and wetland system to the project site (Table 10.1). This involves the restoration of the stream channels and associated riparian buffers, the restoration of a bottomland hardwood wetland system along the restored reaches, the enhancement of existing wetlands, and preservation of the bottomland hardwood buffer and forested wetland adjacent to Flat Swamp (Figure 11.18).

Priority 1 and Priority 2 stream restoration will be carried out on the unnamed tributaries on the Stallings site. Priority 1 will involve reconnecting the stream channels to their floodplains which will allow overbank flooding to more easily access existing and restored riverine wetlands. Priority 2 restoration will create a new wider floodplain at the existing stream elevation which will reduce bank stress during flood events. Water quality functions will be improved due to the creation of more storage for floodwaters and increased filtering of pollutants. The stream restoration will also improve the aquatic habitat in the channels by restoring riffle / pool sequences and adding structures such as cross vanes and root wads which will help stabilize the channel as well as add diversity to the instream habitat. Barring any outside water quality issues, the restoration should improve the aquatic species diversity and abundance in the stream channels.

The restoration of riverine wetlands along the restored stream channels and the restoration of riparian buffers out to 200 feet on either side of the stream channels and Flat Swamp will greatly improve the water quality within the channels compared to what it was as agricultural fields. The re-establishment of the riparian buffers with hardwood species will also greatly improve the wildlife habitat on the property.

These measures will improve the physical, chemical and biological components of the unnamed tributaries and the Stallings property, as well as Flat Swamp and downstream waters.

Specific project goals:

- Provide a stable network of stream channels (4,159 linear feet of stream restoration)
- Restore 34.9 acres, enhance 8.3 acres, and preserve 2.5 acres of riparian buffers along stream channels
- Improve aquatic and terrestrial habitat within the Flat Swamp watershed
- Establish a wildlife corridor between the newly restored site, the existing Jones County Flat Swamp Mitigation Site to the east, and natural areas to the west of the property
- Restore 5.3 acres of natural riverine wetlands
- Enhance 5.5 acres and preserve 17 acres of riverine wetlands

7.1.1 Designed Channel Classification and Wetland Type

The proposed stream channels were designed using Rosgen's Natural Channel Design Methodology (Rosgen, 1996). Typical morphological characteristics were obtained from stable reference reaches, checked against the appropriate regional curves, and utilized as design dimension, pattern, and profile parameters. A combination of Priority 1 and Priority 2 restoration techniques are proposed for the restoration. Priority 2, the re-establishment of a new floodplain at the stream's existing elevation, will be used near Wyse Fork Road and Webb Road as the existing culvert elevations are set and will not be changed. As the restoration moves downstream, the channels will be brought up in elevation to more fully reconnect to their existing floodplain (Priority 1). Reach C will transition back to Priority 2 restoration to better connect with the existing wetland.

Utilizing reference reach surveys, dimensionless ratios were calculated in order to determine stable channel dimension, pattern and profile ranges for the restoration. The stream design parameters also include the stream being able to transfer sediment through the reach without aggrading or degrading. Maintaining the parameters for the natural stable dimension, pattern and profile, the proposed stream design is located in the lowest part of the natural stream valley. The proposed alignments are also outside of the existing channels as much as practicable to ease construction. See Sheets 12.5 to 12.10 for plan views of each stream reach. The longitudinal profile was designed in order to achieve bankfull elevations as close to the existing valley floor as possible. Facet slopes for each feature are derived from reference reach ratios. To ensure the channel functions naturally, the proposed profile is tied into the existing channel below the restoration. At a minimum, grade control structures are added at the upper and lower limits of each reach. Additional structures will be added for habitat and stability. Flood analysis ensures that the stream restoration project will not increase flood stage following construction.

The proposed channel design follows that of a stable C5 stream (Sheet 12.3). A typical C5 stream is a slightly entrenched, meandering, sand dominated, riffle-pool channel with a well-developed floodplain (Rosgen, 1996). The C5 stream type is typical of coastal plain areas such as the Stallings Site. C channels typically exhibit a width-to-depth ratio greater than twelve. The proposed width-to-depth ratio at the

Stallings site for all streams is twelve. With adequate riparian vegetation, it is anticipated that the constructed channels will become narrower over time and morph into more of an E type channel. E channels are low width to depth ratio streams that are extremely efficient in transporting their sediment. E channels are not proposed in the design, as they require deep-rooted vegetation to maintain bank stability.

Wetlands on the Stallings project site will be significantly increased through the restoration and enhancement of riverine bottomland hardwood forest along the stream channels. Re-connecting the stream channels to their floodplains will allow more frequent overbank flooding to occur. This overbank flooding along with the poor hydrologic conductivity of the wetland soils will provide the hydrology needed to support the restored bottomland hardwood forest community along the restored channels. The existing wetlands along the lower reach of the main channel will be enhanced by planting wet hardwood trees outside the Progress Energy ROW.

7.1.2 Target Wetland and Buffer Communities

Coastal Plain Riverine Bottomland Hardwood Forest will be restored along the restored stream channels. Typical plant species identified in the reference wetland, as well as those identified in the Schafale and Weakley (1990) descriptions for the target wetlands were utilized as a guide in developing the planting scheme (Table 10.7). The existing wetlands along the lower reach of the main tributary will be enhanced by planting species that were found in the reference bottomland hardwood forest.

Forested riparian buffers will be planted along all stream channels on the project site as well as along areas of Flat Swamp where the surface water nears the edge of the field. Buffers will be planted out 200 feet from the top of bank or from the edge of the normal surface water in Flat Swamp. All riparian buffers, except within the Progress Energy ROW, will be planted with bottomland hardwood tree species. Due to height restrictions, restored or enhanced areas under the power line right-of-way will consist of grass and shrub communities. In areas where the 200 foot buffer area overlaps with wetland enhancement or restoration areas, acreages will be attributed to the wetlands.

7.2 SEDIMENT TRANSPORT ANALYSIS

7.2.1 Methodology

A stable stream has the ability to transfer its sediment load without aggrading (depositing sediment) or degrading (scouring sediment) over long periods of time. The stream design is based on a comparison with the existing channel's aggrading/degrading pattern and adjusting the proposed channel's shear stress and stream power such that the channel has the ability to transfer its sediment load in a stable manner. The geometry and the profile of the proposed stream combine to provide a stream that will convey the bankfull discharge and transport the stream's sediment supply. Grade control devices will be installed to further reduce the possibility of degradation within the restored channel.

7.2.2 Calculations and Discussion

When working with a sandbed channel the standard practice is to evaluate the stream power of the channel. Stream power is the product of the shear stress and the bankfull flow velocity. Table 10.6 provides proposed shear stress and stream power for each reach. The proposed channel plan, dimension,

and profile are designed such that the stream power is close to or slightly less than the existing channel conditions. As mentioned above, the existing channels exhibited bank stability and low stream power.

7.3 HEC-RAS ANALYSIS

7.3.1 No-rise, LOMR, CLOMR

The methodology used to evaluate the hydrologic analysis required the evaluation of the existing stream's bankfull elevation and corresponding bankfull area. Due to the severe alterations in the stream channels at the Stallings site, bankfull indicators were not easily observed in the field. For this reason, the Coastal Plain Regional Curves were used to verify the bankfull dimensions surveyed (NCSRI, 2004). Also, bankfull discharge was verified with the regional curves equation below.

$$Q = 16.56\ (A_{watershed})^{0.72}\quad R^2 = 0.90\ \text{(NCSRI, 2004)}$$

Hydrologic Engineering Center's River Analysis System (HEC-RAS) was used to evaluate how the discharge flows within the proposed channel geometry (USACE, 1997). This evaluation verifies that the proposed plan, dimension, and profile would adequately carry the discharge at the bankfull stage, the point where water begins to overflow onto the floodplain (USACE, 1997).

Given that the project involves modifications to a stream channel, it is important to analyze the effect of these changes on flood elevations. Floodwater elevations were analyzed using the HEC-RAS Version 3.0.1 software from the US Army Corps of Engineers Hydrologic Engineering Center (USACE, 1997).

HEC-RAS is a software package that is designed to perform one-dimensional, steady flow, hydraulic calculations for water surface profiles for a network of natural and constructed channels. The model is based on the energy equation, and the energy losses are evaluated by friction (Manning's equation) and contraction/expansion (coefficient multiplied by the change in velocity head). The momentum equation is used in situations where the water surface profile rapidly varies, such as hydraulic jumps and stream junctions. The USGS method was used, instead of the rational or highway methods, in an effort to calibrate the existing water surface elevations to the historical information. The HEC-RAS analysis was executed several times utilizing the USGS, Highway and Rational discharge values. The USGS values provided a result similar to the historical record.

Discharge rates for the design have been evaluated with the North Carolina Coastal Plain Regional Curve. The bankfull discharge for the Stallings site ranges between 4.0 and 11.0 ft^3/s (Table 10.2). The existing bankfull velocity is approximately 1.4 ft/s. The proposed design will slightly reduce the velocity, and allow the proposed geometry, pattern and profile to reduce the shear stress and stream power from the existing condition. The existing and proposed geometries were evaluated at the bankfull discharge rates, using HEC-RAS. This evaluation verifies that he proposed plan, dimension, and profile would adequately carry the discharge at the bankfull stage, the point where water begins to overflow onto the floodplain.

7.3.2 Hydrologic Trespass

Backwater analysis was performed for the existing and proposed conditions for both the bankfull and 100-year discharges. Geometric data and steady flow data are both required to run HEC-RAS. The 100-year discharges were determined using the USGS Rural Coastal Plain flood-frequency equations (Pope *et*

al., 2001). The USGS method was used, instead of the rational or highway methods, in an effort to calibrate the existing water surface elevations to the historical information. The adjacent property owner, Mr. Brown, indicated that the fields to the west of Wyse Fork Road flood every five to ten years. The HEC-RAS analysis was executed several times utilizing the USGS, Highway and Rational discharge values. The 100-year discharge determined using the USGS Rural Coastal Plain flood-frequency equations is consistent with the historical water surface elevation.

The analysis indicates that the proposed channel geometry will not increase the 100-year flood elevations within the project area. In fact, the analysis indicates that the water surface elevation will be reduced by 0.05 feet at the downstream end of the project (Appendix 11, HEC-RAS Section 34). Table 10.2 shows the stream designator, drainage area for each reach, and the 100-year discharge. The HEC-RAS cross-sectional layout is shown in Sheet 12.4.

The HEC-RAS model was used to evaluate the effect of the project on flood elevations (Appendix 11). The analysis shows that the restored channel adequately carries the bankfull stage and flood elevations are not increased within the project area during the 100-year discharge and bankfull discharge.

7.4 HYDROLOGIC MODIFICATIONS

Since the success of the wetlands is measured, at least in part, according to hydrologic criteria (i.e., frequency of saturated soils), hydrologic modeling represents an important design tool. Ten RDS groundwater monitoring gauges were installed on the site in April of 2002. The gauges were located in the hydric soils to give an indication of the groundwater levels across the Stallings Site. Figure 11.4 shows the location of the gauges for hydrologic monitoring. The gauges tend to show a normal cyclic fluctuation of groundwater being nearest to the surface during the wetter winter months and lower during drier summer and fall months (Appendix 10). The gauge data also confirm that groundwater levels are highest nearer Flat Swamp and that the hydrology in the fields has been lowered.

DRAINMOD (Appendix 12) was used to help predict the success of hydrologic criteria for the proposed wetlands on the Stallings Site.

7.4.1 Hydrologic Modeling/Riverine Bottomland Hardwood Forest Wetland

The riverine bottomland hardwood forest will be restored within the newly constructed floodplain of the restored stream channels. Hydraulic support for riverine wetlands is primarily from overbank flooding from the adjacent stream. Guidance from the USACE suggests that the overbank flooding should occur at a frequency of at least three years out of every five to be considered riverine. Site investigations indicate that overbank flooding tends to occur at least once a year along the main tributary.

DRAINMOD, a computer model developed at North Carolina State University (Skaggs, 1990), was used to help determine the probability that the proposed riverine bottomland hardwood forest wetlands on the Stallings Site would meet specific hydrologic success criteria for all wetlands (Appendix 12). For the restored wetlands to be considered successful from a jurisdictional point of view, groundwater must be within 12 inches of the ground surface for consecutive days representing more than 12.5% of the growing season for five consecutive growing seasons. The growing season for Jones County is from March 15 (day 74) to November 11 (day 315), 241 days. Therefore, 12.5% of the growing season is 30 days.

The DRAINMOD model requires four major types of inputs: weather, drainage (depth to groundwater), soil information, and crop type (depth to root zone). The nearest meteorological station to the Stallings Site is located in the City of New Bern. North Carolina State University provided the necessary precipitation and temperature files for the New Bern station in DRAINMOD format for the years 1951 to 1991. The precipitation data used is in hundredths of inches. The inputs for the temperature files consisted of a daily maximum and minimum temperature in degrees Fahrenheit. DRAINMOD uses the temperature data files to compute potential evapotranspiration using the Thornthwaite equation. This equation uses the latitude (35° 04' N) and heat index (estimated at 75 degrees Fahrenheit) for the location along with the temperature data.

Drainage information used to run the model was derived from the Jones County Soil Survey (Barnhill, 1981) as well as groundwater gauges installed on the Stallings Site. The soil parameters used in the model are as follows: soil water characteristic, drain volume, upward flux, and infiltration. Values for each of these parameters were not available for the specific soils found at the Stallings Site. Therefore, values for similar soil types were used. The values used for the soil water characteristic were those for Goldsboro sandy loam – the soil most closely resembling the Meggett Soil found at the Site. The values used for volume drained and infiltration were those for Portsmouth sandy loam. The values used for upward flux were those for the sandy loam found in the DRAINMOD Manual.

The proposed "crop" on the Stallings Site is trees. Wetland trees generally have shallow roots. For the purposes of this model, the root depth was specified at 18 inches.

DRAINMOD was used to investigate four cross sections (Sheet 12.5 and 12.12) between existing channels on the Stallings Site. The modeling showed that for a typical year, the water table at all four locations met the jurisdictional wetland criteria. With the wetlands being restored within the newly created floodplain, the area will be flooded with every bankfull flow, thus meeting the riverine criteria. The water table, along with overbank flooding from the newly restored stream channels, will support a riverine bottomland hardwood forest adjacent to those channels (Appendix 12).

7.4.2 Narrative of Modifications

Much of the riverine bottomland hardwood forest will be restored through the excavation of the new floodplain along the restored streams and re-connecting the stream channels to their existing floodplains. The shallow floodplain will allow frequent overbank flooding along the stream channels that will provide the hydrology needed to support the bottomland hardwood forest community. Backwater effects at times of high water in Flat Swamp will add to flooding and saturation along the lower portion of the main tributary, expanding the wetland community into the lower portions of the existing fields. The existing herbaceous wetlands along the lower reaches of the main channel and along Flat Swamp, excluding the powerline ROW, will be enhanced by planting bottomland hardwood species.

7.5 SOIL RESTORATION

The recommended construction sequence will include removing the existing topsoil within the areas to be restored as well as removing the wetland vegetation from the existing channels prior to construction. The excavated material will be stockpiled and then spread across the wetland restoration areas to help jumpstart the vegetation and provide a more nutrient rich substrate for the establishment of planted vegetation. Compacted areas of the subsoil will be "deep ripped" prior to planting.

7.6 NATURAL PLANT COMMUNITY RESTORATION

7.6.1 Narrative & Plant Community Restoration

As previously discussed, the target wetland communities are bottomland hardwood forest along the stream channels and in the riparian zone, and mesic mixed hardwood forests in the extended buffer zone. The planting plan was designed to include species that would be found in the bottomland hardwood forest and mixed mesic hardwood forest (Coastal Plain subtype) communities as described by Schafale and Weakley's Classification of the Natural Communities of North Carolina (1990).

Based on the hydrologic model, grading plans, and best professional judgment, the Stallings Site has been divided into four planting zones (Table 10.7 and Sheet 12.11). Zone 1 consists of fast growing shrub species that can be live staked along the restored stream banks to facilitate bank stabilization. Zone 2 restores the riverine bottomland hardwood forest wetland along the restored stream channels and Flat Swamp. Zone 2 species will also be used to enhance the existing wetlands outside the powerline ROW and to restore wooded riparian buffers along the channels and associated riverine wetlands in the project site up to 50 feet from either side of the channels. Zone 3 consists of wetland shrub and small tree species that will be used to enhance and/or restore the riparian buffers within the power line ROW. Zone 4 includes plant species that can tolerate the drier conditions of the extended buffer areas (extending outward to 200 feet from the top of bank or surface water). Along the restored stream channels, Zone 4 will extend from the outer edge of Zone 2 out another 150 feet. It should be noted that the wetter species in Zones 2 and 4 should be planted in the lowest (wettest) areas of each zone.

Riparian buffers along the remaining "unrestored" channels on the Stallings site and Brown Property and along portions of Flat Swamp north of Webb Road will be planted with a mix of hardwood trees from Zone 4 and wetland shrub species (Zone 3) under the Progress Energy ROW.

The disturbed upland areas within the project site outside the proposed buffers will be sown in a wildlife food seed mix and left to undergo "old field succession." The remaining undisturbed upland areas will also be left to "old field succession." Proposed plantings for each zone are presented in Table 10.7

Trees and shrubs in Zones 2 and 3 will be planted on 8-foot centers, for a planting density of 680 stems per acre. Trees and shrubs in Zone 4 will be planted on 10-foot centers, for a planted density of 436 stems per acre. Natural recruitment of herbaceous vegetation should also occur throughout the Stallings Site due to the presence of a seed source both upstream and downstream.

It may be necessary to deep rip the disturbed portions of the Stallings Site in order to ensure proper root development and discourage runoff. Site modifications will help to provide adequate hydrology for those vegetative species proposed for planting.

7.6.2 On-site Invasive Species Management

It is not anticipated that invasive plant species will be a significant problem on the Stallings Restoration Site. During the first year of monitoring, any invasive species problems will be noted and specific management options will be proposed. These management options may involve chemical treatments, mechanical or hand removal of undesirable species.

7.7 WILDLIFE MANAGEMENT

Historic and current beaver activity on the site may require future management. The presence or absence of beavers, especially in small headwater streams can result in dramatic differences in vegetation along the stream channel and in-stream habitat (diversity/composition) due to beaver modifications. Beaver activity can be a problem in certain areas of a watershed because the dams that are built flood areas and slow the water flow contributing to increased sedimentation. Benefits derived from beavers include their ability to maintain wetland systems in the landscape and create new habitats for plants, fish, and other wildlife. Beaver ponds are critical for slowing stormwater runoff, trapping sediments, and maintaining summer base flows among other ecological benefits.

To address some of the detrimental aspects of beavers, the North Carolina legislature in 1992 created the Beaver Damage Control Advisory Board with the charge to develop, implement, and oversee a program to manage beaver damage on public and private lands. The goal of the Beaver Management Assistance Program (BMAP) is to educate the public and participating landholders about the best strategies for managing beaver damage including the pros and cons of removing beavers or using pond levelers, exclusion, or other non-lethal techniques. The BMAP program provides assistance to the NCDOT, city and county governments, soil and water conservation districts, private landholders, and others with beaver problems. The program is run by the USDA Wildlife Services through a cooperative agreement with the North Carolina Wildlife Resources Commission. Funding comes from state, county, federal, and private sources (**http://www.ncwildlife.com/pg06_coexistingwildlife/pg6b2.htm**).

Beaver management should include an initial trapping program on the Stallings Site, protection for tree seedlings planted in riparian areas, and removal of blockages in the restored stream channels during the monitoring period. Beaver management during the monitoring period will be administered by NCEEP staff as the need arises.

8.0 Performance Criteria

8.1 STREAMS

An as-built channel survey will be performed after construction. Permanent cross-sections will be established approximately one per 20 (bankfull-width) lengths representing pools and riffles. Profile surveys will be conducted on stream lengths equal to 30 bankfull widths per reach. Photo reference points will be established at each cross-section and located on the as-built plan. Three forms of monitoring will be used to evaluate the success of the project; photo documentation, ecological function, and channel stability measurements. During the monitoring phase photo documentation will be provided of channel aggradation or degradation if applicable, bank erosion if applicable, success of riparian vegetation, effectiveness of erosion control measures and presence or absence of developing instream bars. Ecological function will be evaluated by surveying the health and survival of vegetation. In addition the restoration reach should mimic reference reach conditions. The channel will be considered stable if there are little or insignificant changes from the as-built dimensions and longitudinal profile. In addition pool/riffle spacing should remain constant, pools should not aggrade or riffles degrade. Finally pebble counts should show a change in the size of bed material toward a desired composition.

8.2 WETLANDS

The wetland restoration areas will be monitored annually for five years following construction or until success criteria are met, whichever comes last.

Four shallow groundwater/surface water gauges will be installed in the restored riverine bottomland hardwood forest (Figure 11.18). Two gauges will be placed in the existing wetlands along the tributaries, and will be used as reference gauges to monitor water elevations in the restored riverine wetlands. Two additional gauges are located along the eastern property boundary to monitor water elevations in Flat Swamp. All the gauges will measure surface water and groundwater over a 20-inch or 40-inch vertical column on a daily basis. Data from each of the gauges will be downloaded on a bi-monthly basis.

Hydrologic success will be based on conditions at the Flat Swamp reference wetland and the wetlands adjacent to the on-site tributary. Success will be determined by the following Criterion:

Years One through Three - Currently the Flat Swamp reference wetland is saturated or inundated for nearly 30% of the growing season. Similar hydrologic data will be collected from the wetlands adjacent to the on-site tributary and also used for comparison. Hydrologic success criteria at the restored site will be met if the site demonstrates groundwater table levels within 12 inches of the soil surface for a minimum of 15% of the growing season (this criterion reflects a deviation of 50% from the duration of saturation within 12 inches at the reference site). Success for monitoring years one through three will be determined based on this 50% tolerance of deviation from the duration of wetland hydrology at the reference sites.

Years Four and Five - Success for monitoring years four and five will be determined based on a 20% tolerance of deviation from the duration of wetland hydrology at the reference sites. Therefore, it is expected that years four and five the site will achieve a minimum of 24% saturation.

Based on reference conditions and the stated Criterion, it is expected that reference soil saturation for years one through five will continue to exceed the regulatory 12.5% minimum requirement of the growing season for Jones County (USACE 1992). The growing season for Jones County as defined by the Jones County Soil Survey occurs from March 15 to November 11, a total of 241 days. In order to attain conditions suitable for the formation of wetland vegetation and hydric soils, the Site should be saturated within 12 inches of the surface or inundated for a consecutive period equal to 30 days. However, to meet hydrologic success criteria and mimic the reference wetland hydrology, the site should demonstrate wetland hydrology for a minimum of 36 days in years one through three. In years four and five, this will increase to a minimum of 57 days. Overbank flooding from the adjacent channel will also be noted during monitoring.

Reference areas will be monitored for the minimum of five years. The Stallings site will be compared to the references in order to track regional environmental conditions.

8.3 VEGETATION

Vegetative sample plots will be quantitatively monitored during the growing season. According to NCEEP guidance, 1-2% of the planted area should be sampled. Based on the approximate areas of the two restoration types (bottomland hardwood forest and riparian buffer), 30 100-meter square vegetation plots will be established on the Stallings site. Vegetation sampling plots will be proximal to hydrology monitoring gauges, wherever practical, to assist in correlating vegetation and hydrology parameters. In

each plot, species composition, density, and survival will be monitored. The four plot corners will be located using a Global Positioning System (GPS), permanently located with metal conduit stakes, and included in the "as-built" report for the Stallings Site.

The vegetative success of the bottomland hardwood forest will be evaluated based on the species density and survival rates. Wetland vegetation monitoring will be considered successful if at least 260 trees/acre are surviving at the end of five years for Zones 1 through 3. Vegetation in the extended buffer (Zone 4) will be considered successful if at least 320 trees/acre are surviving at the end of five years. These plants should be either planted species or desirable volunteers.

9.0 References

Barnhill, William L. 1981. Soil Survey of Jones County, North Carolina. USDA, Soil Conservation Service.

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

Harrelson, C.C., C.L. Rawlins and J.P. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. United States Department of Agriculture, Fort Collins, CO.

NCDWQ. 1998. Neuse River Basinwide Water Quality Plan. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, NC.

NCDWQ. 2001. Internal Technical Guide for Stream Work in North Carolina. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, NC.

NCSRI. 2004. Coastal Regional Curve. NC Stream Restoration Institute. http://www.bae.ncsu.edu/programs/extension/wqg/sri/coastal.htm. Accessed September 2004.

Pope, Benjamin F., Tasker, G.D., and J.C. Robbins. 2001. Estimating the Magnitude and Frequency of Floods in Rural Basins of North Carolina – Revised. US Geological Survey. Water-Resources Investigations Report 01-4207. Prepared in cooperation with the North Carolina Department of Transportation.

Rosgen, D. 1994. A Classification of Natural Rivers. *Catena* 22:169-199. Elsevier, Amsterdam.

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

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina Third Approximation. North Carolina Natural Heritage Program, Raleigh, NC.

Skaggs, R.W. 1990. DRAINMOD User's Manual. North Carolina State University. Raleigh, NC.

USACE. 1992. Clarification and interpretation of the 1987 Manual. Memo to USACE districts from Headquarters, US Army Corps of Engineers, Washington, DC, March 6, 1992; signed by MG Arthur E. Williams, Directorate of Civil Works.

USACE. 1997. HEC-RAS River Analysis System, Version 2.0. USACE, Hydrologic Engineering Center, Davis, CA.

10.0 Tables

Table 10.1 Restoration Structure and Objectives				
Restoration Reach	**Restoration Type**	**Priority Approach**	**Existing Linear Footage or Acreage**	**Designed Linear Footage or Acreage**
Stream A	Restoration	Priority 1 & 2	1714 feet	2413 feet
Stream B	Restoration	Priority 1 & 2	387 feet	395 feet
Stream C	Restoration	Priority 1 & 2	1059 feet	1351 feet
Total Stream Length			**3,160** feet	**4,159 feet**
Buffer	Restoration			34.9 acres
	Enhancement			8.3 acres
	Preservation			2.5 acres
Total Buffer Acres				**45.7 acres**
Riverine Wetland	Restoration			5.3 acres
	Enhancement			5.5 acres
	Preservation			17.0 acres
Total Wetland Acres				**27.8 acres**

Table 10.2 Drainage Areas and Discharge Project Number 050647101 (UT to Flat Swamp)			
Stream Design Reach	**Drainage Area (Acres)**	**Bankfull Discharge (cfs)**	**100-Year Discharge (cfs)**
B	362	11	339.1
A	174	6	224.0
C	83	4	146.8

Table 10.3 Land Use of Watershed Project Number 050647101 (UT to Flat Swamp)		
Land Use	**Acreage**	**Percentage**
Agriculture	247.1	53.4%
Forested	147.5	31.9%
Rural Residential	50.3	10.9%
Road	17.5	3.8%

Table 10.4 Summary of Soil Profiles Project Number 050647101 Stallings Stream and Wetland Restoration						
Sample Number	**Soil Depth (inches)**	**Depth to Saturated Soil**	**Matrix Color**	**Mottle Color**	**Texture**	**Notes**
1	0 - 7		10YR 4/2		Loamy sand	
	7 - 18		10YR 6/3	10YR 5/8 7.5YR 5/8	Sandy loam	Oxidized rhizospheres
	18 - 24		10YR 5/4	10YR 5/8	Loamy sand	Few small pebbles
	24 - 30		10YR 5/1	10YR 5/6 7.5YR 5/8	Sandy clay loam	
	30 - 34		N 7/	7.5YR 5/8 7.5YR 8/1	Sandy clay to sandy clay loam	
	34 - 43	Water in the hole at 36" (perched)	N 5/	7.5YR 5/8 7.5YR 6/8	Clay	
	43 - 48+		10YR 6/8 N 5/	5PB 5/1	Clay	
2	0 - 8	Water perched at surface, dry beneath	10YR 3/2		loam	
	8 - 12		10YR 6/2	10YR 3/2 10YR 5/8	sandy clay loam	
	12 - 27		10YR 5/1	10YR 5/8	clay	
	27 - 36		10YR 6/1	10YR 6/8 2.5Y 7/6	clay	
	36 - 50		10Y 6/1	10YR 6/8 10YR 5/8	clay	Found a 2.5" rounded rock around 45"
	50 - 56+		10Y 6/1	10YR 6/8 7.5YR 8/1 5PB 5/1 5G 5/2	clay	Few Mn concretions
3	0 - 6		10YR 4/2		loam	
	6 - 10		2.5Y 6/3		sandy loam	
	10 - 22		10YR 5/1	10YR 5/6 2.5Y 4/6	clay loam to clay	
	22 - 30		10Y 6/1	10YR 5/6 2.5YR 4/6	clay	
	30 - 40		10YR 6/1	10YR 6/8	clay	
	40 - 44		10YR 6/8	10YR 6/1	clay	Fe concretions
	44 - 48+		10Y 6/1	5PB 5/1 10GY 5/1 7.5YR 8/1	clay	

Table 10.4 Summary of Soil Profiles Project Number 050647101 Stallings Stream and Wetland Restoration						
Sample Number	**Soil Depth (inches)**	**Depth to Saturated Soil**	**Matrix Color**	**Mottle Color**	**Texture**	**Notes**
4	0 - 6		10YR 4/2	5YR4/6	loamy sand	
	6 - 10		2.5Y 6/3		loamy sand	
	10 - 20	Water at 10"	10YR 5/2	10YR 6/8	sandy clay loam and clay	
	20 - 26		10YR 5/2	10YR 6/8	clay	
	26 - 42		10Y 6/1	10YR 6/8 5PB 5/1 7.5YR 8/1	clay	Few Mn concretions
	42 - 64+		10Y 6/1	10YR 5/8 5PB 5/1	Sandy clay loam and sandy loam	Some clay films
5	0 - 6		10YR 4/3		loam	
	6 - 21		10YR 5/6		sandy loam	
	21 - 26		10YR 6/3	7.5YR 5/6	loamy sand	
	26 - 30		10YR 5/6	7.5YR 5/8	sandy clay loam	
	30 - 36		10YR 5/6	10YR 4/6 10YR 6/3	clay	
	36 - 42	Water in hole at 40"	10YR 6/1	7.5YR 5/8 2.5YR 4/8	sandy clay loam	
	42 - 48+		7.5YR 5/8	10YR6/1 2.5YR4/8	clay loam	
6	0 - 8		10YR 3/2		loamy sand	
	8 - 11		10YR 6/3	10YR 5/6	sandy loam	
	11 - 15		10YR 5/3	10YR 5/6 5YR 3/4	sandy clay	
	15 - 38	Water in hold at 36"	10YR 5/1	10YR 5/6	clay	
	38 - 44		N 6/	10YR 5/8 7.5YR 8/1	clay	
	44 - 51+		N 6/	10YR 5/8 5PB 5/1 5G 5/2	clay	
7	0 - 7		10YR 4/2		sandy loam	
	7 - 10		10YR 6/6		sandy loam	
	10 - 20		2.5Y 5/4	7.5YR 5/8 5YR 4/6	clay loam	
	20 - 33		10YR 5/6	2.5YR 4/6 7.5YR 5/8	clay	
	33 - 48+	Water in the hole at 43"	10Y 6/1	2.5YR 4/6 7.5YR 5/8	clay/sandy clay	Few small quartz pebbles

Table 10.4 Summary of Soil Profiles Project Number 050647101 Stallings Stream and Wetland Restoration						
Sample Number	**Soil Depth (inches)**	**Depth to Saturated Soil**	**Matrix Color**	**Mottle Color**	**Texture**	**Notes**
8	0 - 8	Perched water down to clay layer (24")	2.5Y 4/3		sandy loam	
	8 - 16		2.5Y 5/6	10YR 4/3 7.5YR 4/6	sandy loam	
	16 - 24	Saturated (perched)	2.5Y 6/4		sandy loam	
	24 - 30		10YR 5/6	7.5YR 5/8	sandy clay loam	Dry soil
	30 - 33		7.5YR 5/8	10YR 5/6	clay	
	33 - 42		10YR 6/2 2.5Y 5/6	7.5YR 4/6	clay	
	42-54+		10YR6/2	5YR 5/6 5YR 4/6	clay	
9	0-10		10YR 4/2	--	Fine sandy loam	Oxidized rhizospheres
	10-16	Saturated below 10"	10YR 3/2	10YR 4/3	Loamy sand	
	16+		10YR 3/1	10YR 4/4 10YR 5/8	Clay	
10	0-10	Standing water	10YR 2/1	--	Clay loam	
	10-16	Saturated throughout.	10YR 3/1	--	Clay	
	16-20		10YR 3/1	2.5Y 4/3	Clay	
	20+		2.5Y 4/1	7.5YR 5/8 10YR 5/6	Clay	
11	0 - 16	Standing water on surface, dry beneath	10YR 4/2	--	Sandy loam	
	16 - 24		10YR 4/2 10YR 6/6	--	Loamy sand	
	24 - 30		10YR 5/4	--	Coarse sandy clay	Dry soil
	30 - 34		10YR 5/8 10YR 5/4	--	Clay	Dry soil
	34+		10YR 5/8	--	Clay	

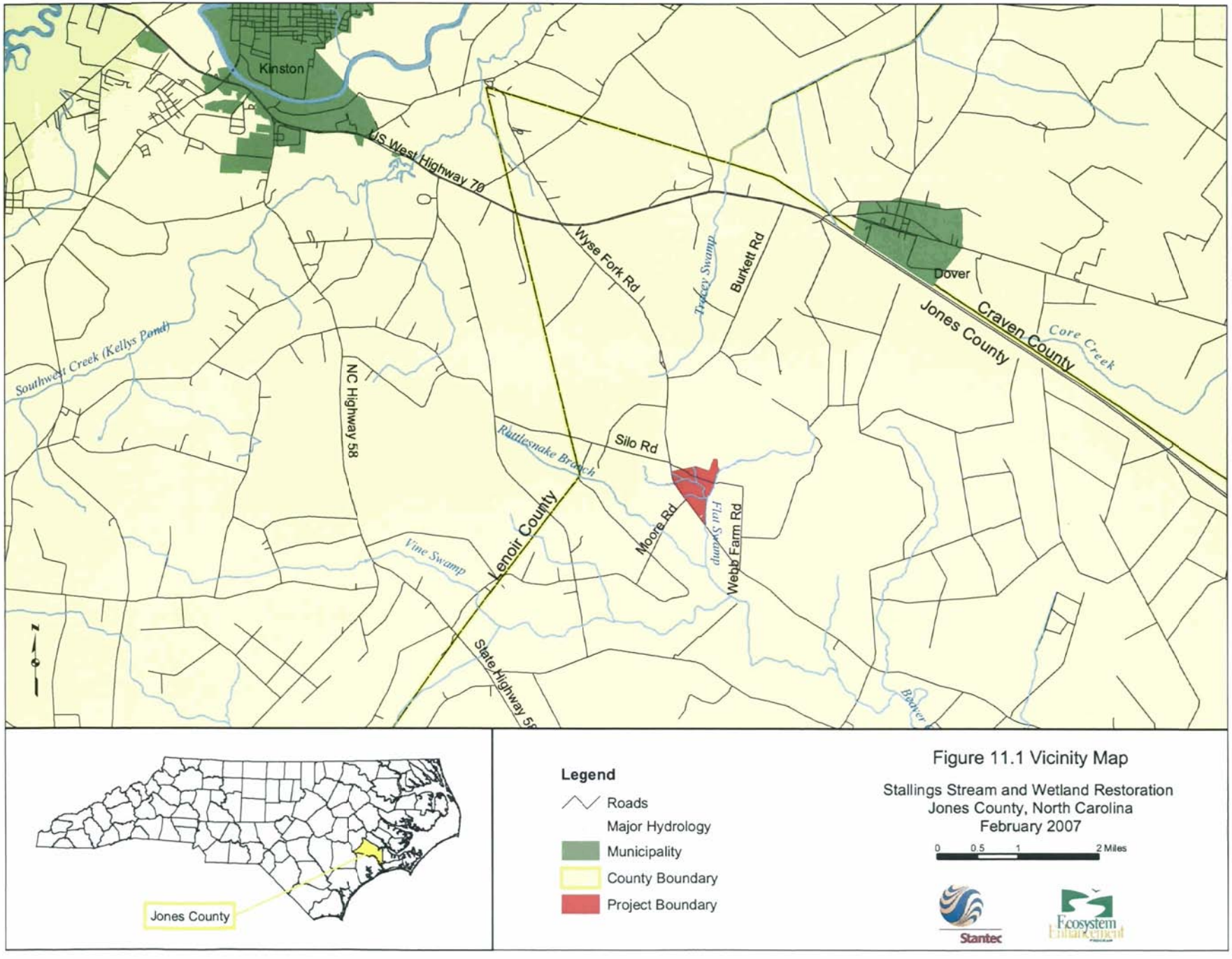
Table 10.5 Morphological Table: Project Number 050647101 Stallings Stream and Wetland Restoration																
Variables		**Existing Channel**		**Proposed Reach C**		**Proposed Reach A (upstream)**		**Proposed Reach A (downstream)**		**Proposed Reach B**		**Ref. Reach Jack Cabin Br.**		**Reference Reach Beaverdam Branch**		**Reference Reach Bullard Branch**
1. Stream Type		G5		C5		C5		C5		C5		C5		C5		C5
2. Drainage Area (sq. mi)		0.2		0.13		0.27				0.57		1.370		2.20		0.78
3. Bankfull Width (Wbkf) ft	Mean: Minimum: Maximum:	5.730	Mean: Minimum: Maximum:	6.5	Mean: Minimum: Maximum:	8.0	Mean: Minimum: Maximum:	10.5	Mean: Minimum: Maximum:	8.0	Mean: Minimum: Maximum:	14.500	Mean: Minimum: Maximum:	20.3	Mean: Minimum: Maximum:	11.5
4. Bankfull Mean Depth (dbkf) ft	Mean: Minimum: Maximum:	0.730	Mean: Minimum: Maximum:	0.5	Mean: Minimum: Maximum:	0.7	Mean: Minimum: Maximum:	0.8	Mean: Minimum: Maximum:	0.7	Mean: Minimum: Maximum:	1.100	Mean: Minimum: Maximum:	1.1	Mean: Minimum: Maximum:	0.8
5. Width/Depth Ratio (Wbkf/dbkf)	Mean: Minimum: Maximum:	7.850	Mean: Minimum: Maximum:	12.1	Mean: Minimum: Maximum:	12.1	Mean: Minimum: Maximum:	13.0	Mean: Minimum: Maximum:	12.1	Mean: Minimum: Maximum:	12.800	Mean: Minimum: Maximum:	18.2	Mean: Minimum: Maximum:	14.1
6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: Minimum: Maximum:	4.180	Mean: Minimum: Maximum:	3.5	Mean: Minimum: Maximum:	5.3	Mean: Minimum: Maximum:	8.5	Mean: Minimum: Maximum:	5.3	Mean: Minimum: Maximum:	16.400	Mean: Minimum: Maximum:	22.5	Mean: Minimum: Maximum:	9.3
7. Bankfull Mean Velocity (Vbkf) fps	Mean: Minimum: Maximum:	1.10	Mean: Minimum: Maximum:	1.6	Mean: Minimum: Maximum:	0.9	Mean: Minimum: Maximum:	0.6	Mean: Minimum: Maximum:	0.9	Mean: Minimum: Maximum:	1.8	Mean: Minimum: Maximum:	2.9	Mean: Minimum: Maximum:	1.3
8. Bankfull Discharge (Qbkf) cfs	Mean: Minimum: Maximum:	4.95	Mean: Minimum: Maximum:	5.6	Mean: Minimum: Maximum:	5.0	Mean: Minimum: Maximum:	5.0	Mean: Minimum: Maximum:	5.0	Mean: Minimum: Maximum:	29.5	Mean: Minimum: Maximum:	65.2	Mean: Minimum: Maximum:	12.1
9. Maximum Bankfull Depth (dmax) ft	Mean: Minimum: Maximum:	1.010	Mean: Minimum: Maximum:	0.9	Mean: Minimum: Maximum:	1.1	Mean: Minimum: Maximum:	1.3	Mean: Minimum: Maximum:	1.1	Mean: Minimum: Maximum:	2.100	Mean: Minimum: Maximum:	2.4	Mean: Minimum: Maximum:	1.2
10. Width of Flood Prone Area (Wfpa) ft	Mean: Minimum: Maximum:	11.000	Mean: Minimum: Maximum:	39	Mean: Minimum: Maximum:	48.0	Mean: Minimum: Maximum:	63.0	Mean: Minimum: Maximum:	48.0	Mean: Minimum: Maximum:	78.000	Mean: Minimum: Maximum:	210	Mean: Minimum: Maximum:	127
11. Entrenchment Ratio (Wfpa/Wbkf)	Mean: Minimum: Maximum:	1.920	Mean: Minimum: Maximum:	6.0	Mean: Minimum: Maximum:	6.0	Mean: Minimum: Maximum:	6.0	Mean: Minimum: Maximum:	6.0	Mean: Minimum: Maximum:	5.379	Mean: Minimum: Maximum:	10.345	Mean: Minimum: Maximum:	11.043
12. Meander Length (Lm) ft	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	67.5 55.0 80.0	Mean: Minimum: Maximum:	72.5 65.0 80.0	Mean: Minimum: Maximum:	56.5 56.0 57.0	Mean: Minimum: Maximum:	72.5 65.0 80.0	Mean: Minimum: Maximum:	71.500 49.000 94.000	Mean: Minimum: Maximum:	105 80 130	Mean: Minimum: Maximum:	45 36 54
13. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	10.4 8.5 12.3	Mean: Minimum: Maximum:	9.1 8.1 10.0	Mean: Minimum: Maximum:	5.4 5.3 5.4	Mean: Minimum: Maximum:	9.1 8.1 10.0	Mean: Minimum: Maximum:	4.931 3.379 6.483	Mean: Minimum: Maximum:	5.172 3.941 6.404	Mean: Minimum: Maximum:	3.913 3.130 4.696
14. Radius of Curvature (Rc) ft	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	17.5 15.0 20.0	Mean: Minimum: Maximum:	17.5 15.0 20.0	Mean: Minimum: Maximum:	25.5 20.0 31.0	Mean: Minimum: Maximum:	17.5 16.0 19.0	Mean: Minimum: Maximum:	18.000 10.000 26.000	Mean: Minimum: Maximum:	18.5 8 29	Mean: Minimum: Maximum:	11 9 13
15. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	2.7 2.3 3.1	Mean: Minimum: Maximum:	2.2 1.9 2.5	Mean: Minimum: Maximum:	2.4 1.9 3.0	Mean: Minimum: Maximum:	2.2 2.0 2.4	Mean: Minimum: Maximum:	1.241 0.690 1.793	Mean: Minimum: Maximum:	0.911 0.394 1.429	Mean: Minimum: Maximum:	0.957 0.783 1.130
16. Belt Width (Wblt) ft	Mean: Minimum: Maximum:	30.000	Mean: Minimum: Maximum:	40.0	Mean: Minimum: Maximum:	50.0	Mean: Minimum: Maximum:	40.0	Mean: Minimum: Maximum:	40.0	Mean: Minimum: Maximum:	67.000	Mean: Minimum: Maximum:	160	Mean: Minimum: Maximum:	35
17. Meander Width Ratio (Wblt/Wbkf)	Mean: Minimum: Maximum:	5.236	Mean: Minimum: Maximum:	6.2	Mean: Minimum: Maximum:	6.3	Mean: Minimum: Maximum:	3.8	Mean: Minimum: Maximum:	5.0	Mean: Minimum: Maximum:	4.621 0.000 0.000	Mean: Minimum: Maximum:	7.882 0.000 0.000	Mean: Minimum: Maximum:	3.043 0.000 0.000
18. Sinuosity (Stream length/ valley distance) (K)	Mean: Minimum: Maximum:	1.070	Mean: Minimum: Maximum:	1.3	Mean: Minimum: Maximum:	1.4	Mean: Minimum: Maximum:	1.0	Mean: Minimum: Maximum:	1.3	Mean: Minimum: Maximum:	1.800	Mean: Minimum: Maximum:	1.5	Mean: Minimum: Maximum:	1.2

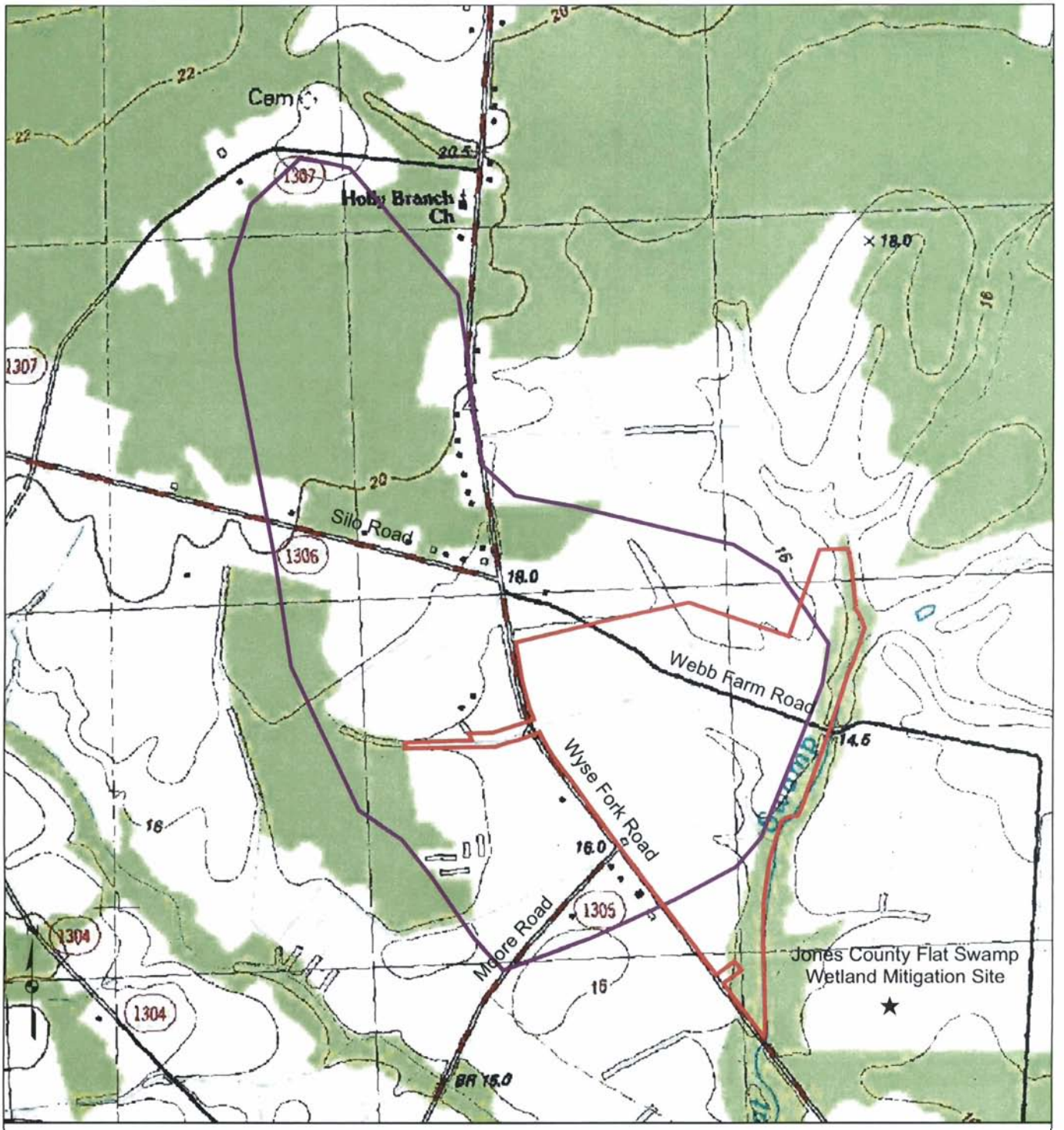
Variables		Existing Channel		Proposed Reach C		Proposed Reach A (upstream)		Proposed Reach A (downstream)		Proposed Reach B		Reference Reach Jack Cabin Branch		Reference Reach Beaverdam Branch		Reference Reach Bullard Branch
19. Valley Slope (ft/ft)	Mean: Minimum: Maximum:	0.003	Mean: Minimum: Maximum:	0.0051	Mean: Minimum: Maximum:	0.0023	Mean: Minimum: Maximum:	0.0023	Mean: Minimum: Maximum:	0.0080	Mean: Minimum: Maximum:	0.006	Mean: Minimum: Maximum:	0.0014	Mean: Minimum: Maximum:	0.003
20. Average Water Surface Slope for Reach (Savg)	Mean: Minimum: Maximum:	0.0029	Mean: Minimum: Maximum:	0.0020	Mean: Minimum: Maximum:	0.0010	Mean: Minimum: Maximum:	0.00397	Mean: Minimum: Maximum:	0.0014	Mean: Minimum: Maximum:	0.0036	Mean: Minimum: Maximum:	0.0090	Mean: Minimum: Maximum:	0.0024
21. Pool Slope (Spool) ft/ft	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.002 0.002 0.011	Mean: Minimum: Maximum:	0.00034 0.00018 0.005	Mean: Minimum: Maximum:	0.0003 0.0000 0.0006
22. Ratio of Pool Slope to Average Slope (Spool/Savg)	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.000 0.000 0.000	Mean: Minimum: Maximum:	0.556 0.556 3.056	Mean: Minimum: Maximum:	0.038 0.020 0.556	Mean: Minimum: Maximum:	0.126 0.000 0.252
23. Maximum Pool Depth (dpool) ft	Mean: Minimum: Maximum:	1.200	Mean: Minimum: Maximum:	1.4	Mean: Minimum: Maximum:	1.9	Mean: Minimum: Maximum:	2.3	Mean: Minimum: Maximum:	1.9	Mean: Minimum: Maximum:	2.600	Mean: Minimum: Maximum:	2.95 2.4 3.5	Mean: Minimum: Maximum:	2.15 1.8 2.5
24. Ratio of Maximum Pool Depth to Bankfull Mean Depth (dpool/dbkf)	Mean: Minimum: Maximum:	1.644	Mean: Minimum: Maximum:	2.6	Mean: Minimum: Maximum:	2.9	Mean: Minimum: Maximum:	2.8	Mean: Minimum: Maximum:	2.9	Mean: Minimum: Maximum:	2.364	Mean: Minimum: Maximum:	2.682 2.182 3.182	Mean: Minimum: Maximum:	2.688 2.250 3.125
25. Pool Width (Wpool) ft	Mean: Minimum: Maximum:	8.500	Mean: Minimum: Maximum:	7.8	Mean: Minimum: Maximum:	9.6	Mean: Minimum: Maximum:	12.6	Mean: Minimum: Maximum:	9.6	Mean: Minimum: Maximum:	22.300	Mean: Minimum: Maximum:	25.7	Mean: Minimum: Maximum:	14
26. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: Minimum: Maximum:	1.483	Mean: Minimum: Maximum:	1.2	Mean: Minimum: Maximum:	1.2	Mean: Minimum: Maximum:	1.2	Mean: Minimum: Maximum:	1.2	Mean: Minimum: Maximum:	1.538	Mean: Minimum: Maximum:	1.266	Mean: Minimum: Maximum:	1.217
27. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: Minimum: Maximum:	5.350	Mean: Minimum: Maximum:	4.7	Mean: Minimum: Maximum:	7.8	Mean: Minimum: Maximum:	12.8	Mean: Minimum: Maximum:	7.8	Mean: Minimum: Maximum:	20.400	Mean: Minimum: Maximum:	38	Mean: Minimum: Maximum:	22.2
28. Ratio of Pool Area to Bankfull Area (Apool/Abkf)	Mean: Minimum: Maximum:	1.280	Mean: Minimum: Maximum:	1.3	Mean: Minimum: Maximum:	1.5	Mean: Minimum: Maximum:	1.5	Mean: Minimum: Maximum:	1.5	Mean: Minimum: Maximum:	1.244	Mean: Minimum: Maximum:	1.689	Mean: Minimum: Maximum:	2.387
29. Pool to Pool Spacing (p-p) ft	Mean: Minimum: Maximum:	72.000 72.000 124.000	Mean: Minimum: Maximum:	33.8 27.5 40.0	Mean: Minimum: Maximum:	37.0 33.0 40.0	Mean: Minimum: Maximum:	28.0 28.0 28.5	Mean: Minimum: Maximum:	36.3 32.5 40.0	Mean: Minimum: Maximum:	72.500 47.000 98.000	Mean: Minimum: Maximum:	57.5 38 77	Mean: Minimum: Maximum:	35.5 30 41
30. Ratio of Pool-to-Pool Spacing to Bankfull Width (p-p/Wbkf)	Mean: Minimum: Maximum:	12.565 12.565 21.640	Mean: Minimum: Maximum:	5.2 4.2 6.2	Mean: Minimum: Maximum:	4.6 4.1 5.0	Mean: Minimum: Maximum:	2.7 2.7 2.7	Mean: Minimum: Maximum:	4.5 4.1 5.0	Mean: Minimum: Maximum:	5.000 3.241 6.759	Mean: Minimum: Maximum:	2.833 1.872 3.793	Mean: Minimum: Maximum:	3.087 2.609 3.565
31. Pool Length (Lp) ft	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	16.9 13.8 20.0	Mean: Minimum: Maximum:	18.0 16.0 20.0	Mean: Minimum: Maximum:	14.0 14.0 14.3	Mean: Minimum: Maximum:	18.1 16.3 20.0	Mean: Minimum: Maximum:	28.00 25.00 39.00	Mean: Minimum: Maximum:	33.7 29.5 39	Mean: Minimum: Maximum:	18.7 7 36
32. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	2.6 2.1 3.1	Mean: Minimum: Maximum:	2.3 2.0 2.5	Mean: Minimum: Maximum:	1.3 1.3 1.4	Mean: Minimum: Maximum:	2.3 2.0 2.5	Mean: Minimum: Maximum:	1.931 1.724 2.690	Mean: Minimum: Maximum:	1.660 1.453 1.921	Mean: Minimum: Maximum:	1.626 0.609 3.130
33. Riffle Slope (Sriff) ft/ft	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	0.0040	Mean: Minimum: Maximum:	0.0020	Mean: Minimum: Maximum:	0.0079	Mean: Minimum: Maximum:	0.0028	Mean: Minimum: Maximum:	0.012 0.002 0.011	Mean: Minimum: Maximum:	0.044 0.041 0.047	Mean: Minimum: Maximum:	0.0123 0.0029 0.025
34. Ratio of Riffle Slope to Average Slope (Sriff/Savg)	Mean: Minimum: Maximum:	N/A	Mean: Minimum: Maximum:	2.000	Mean: Minimum: Maximum:	2.000	Mean: Minimum: Maximum:	2.000	Mean: Minimum: Maximum:	2.000	Mean: Minimum: Maximum:	3.278 0.611 3.000	Mean: Minimum: Maximum:	4.889 4.556 5.222	Mean: Minimum: Maximum:	5.168 1.218 10.504

Table 10.6 Shear Stress and Power Project Number 050647101 Stallings Stream and Wetland Restoration		
Stream Reach	**Proposed Shear**	**Proposed Power**
Reach A	0.10 – 0.12 lb/ft^3	0.15 - 0.18 lb/ft^2.s
Reach B	0.046 – 0.054 lb/ft^3	0.05 – 0.06 lb/ft^2.s
Reach C	0.06 – 0.07 lb/ft^3	0.07 – 0.08 lb/ft^2.s

Table 10.7 Designed Vegetative Communities by Zone Project Number 050647101 Stallings Stream and Wetland Restoration		
Common Name	**Scientific Name**	**Southeast Region Indicator**
Zone 1 Streambank		
Smooth alder	*Alnus serrulata*	Facultative Wetland +
Swamp dogwood	*Cornus stricta*	Facultative Wetland -
Elderberry	*Sambucus Canadensis*	Facultative Wetland -
Virginia willow	*Itea virginica*	Facultative Wetland +
Zone 2 Riverine Bottomland Hardwood Forest		
Overcup Oak	*Quercus lyrata*	Obligate Wetland
Swamp Cottonwood	*Populus heterophylla*	Obligate Wetland
Swamp Chestnut Oak	*Quercus michauxii*	Facultative Wetland -
Green ash	*Fraxinus pennsylvanica*	Facultative Wetland
Swamp Black Gum	*Nyssa sylvatica var. biflora*	Obligate
American Sycamore	*Platanus occidentalis*	Facultative Wetland -
Cherrybark Oak	*Quercus falcata* var. *pagodaefolia*	Facultative +
Water Oak	*Quercus nigra*	Facultative
Zone 3 Powerline Right-of-Way – Wetland		
Smooth alder	*Alnus serrulata*	Facultative Wetland +
Ironwood	*Carpinus caroliniana*	Facultative
Buttonbush	*Cephalanthus occidentalis*	Obligate Wetland
Sweet pepperbush	*Clethra alnifolia*	Facultative Wetland
Swamp dogwood	*Cornus stricta*	Facultative Wetland -
Sweetbay	*Magnolia virginiana*	Facultative Wetland +
Wax myrtle	*Morella cerifera*	Facultative +
Redbay	*Persea borbonia*	Facultative Wetland
Elderberry	*Sambucus Canadensis*	Facultative Wetland -
Zone 4 Extended Buffer		
Bitternut Hickory	*Carya cordiformis*	Facultative
Eastern Red Cedar	*Juniperus virginiana*	Facultative Upland -
Wax myrtle	*Morella cerifera*	Facultative +
Black gum	*Nyssa sylvatica*	Facultative
American Sycamore	*Platanus occidentalis*	Facultative Wetland -
White Oak	*Quercus alba*	Facultative Upland
Water Oak	*Quercus nigra*	Facultative
Willow Oak	*Quercus phellos*	Facultative Wetland -
Slippery Elm	*Ulmus rubra*	Facultative

11.0 Figures


Kinston
US West Highway 70
Wyse Fork Rd
Trevey Swamp
Burkett Rd
Dover
Craven County
Jones County
Core Creek
Southwest Creek (Kellys Pond)
NC Highway 58
Rattlesnake Branch
Silo Rd
Lenoir County
Moore Rd
Elm Swamp
Webb Farm Rd
Vine Swamp
State Highway 58
Jones County
Legend
Roads
Major Hydrology
Municipality
County Boundary
Project Boundary
Figure 11.1 Vicinity Map
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007
0 0.5 1 2 Miles
Stantec
Ecosystem Enhancement



Legend

- Stream
- Project Boundary
- Watershed Boundary

Dover USGS 7.5' Quad

Figure 11.2 Project Site Watershed Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

0 750 1,500 3,000 Feet

Stantec

Ecosystem Enhancement Program

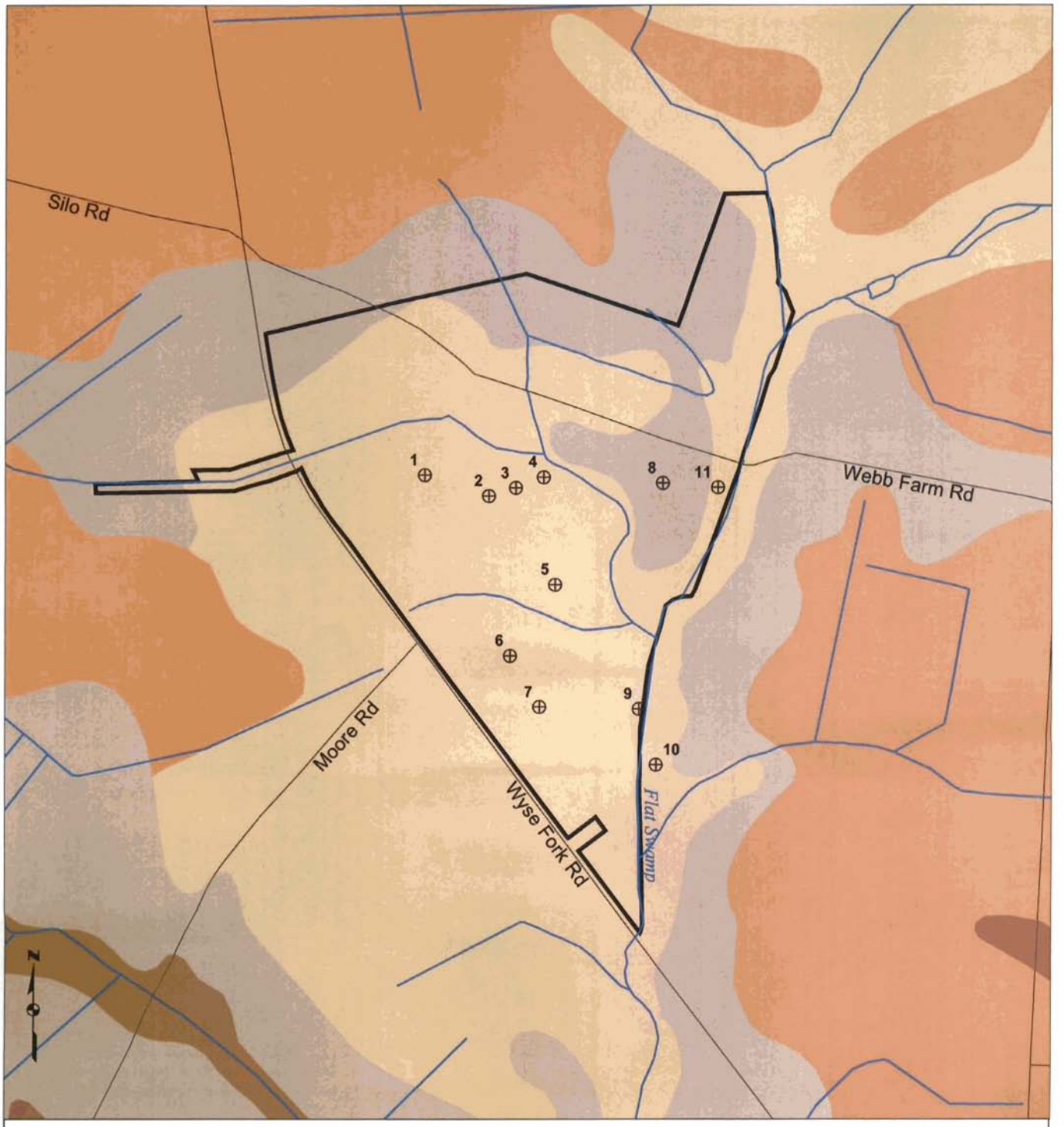
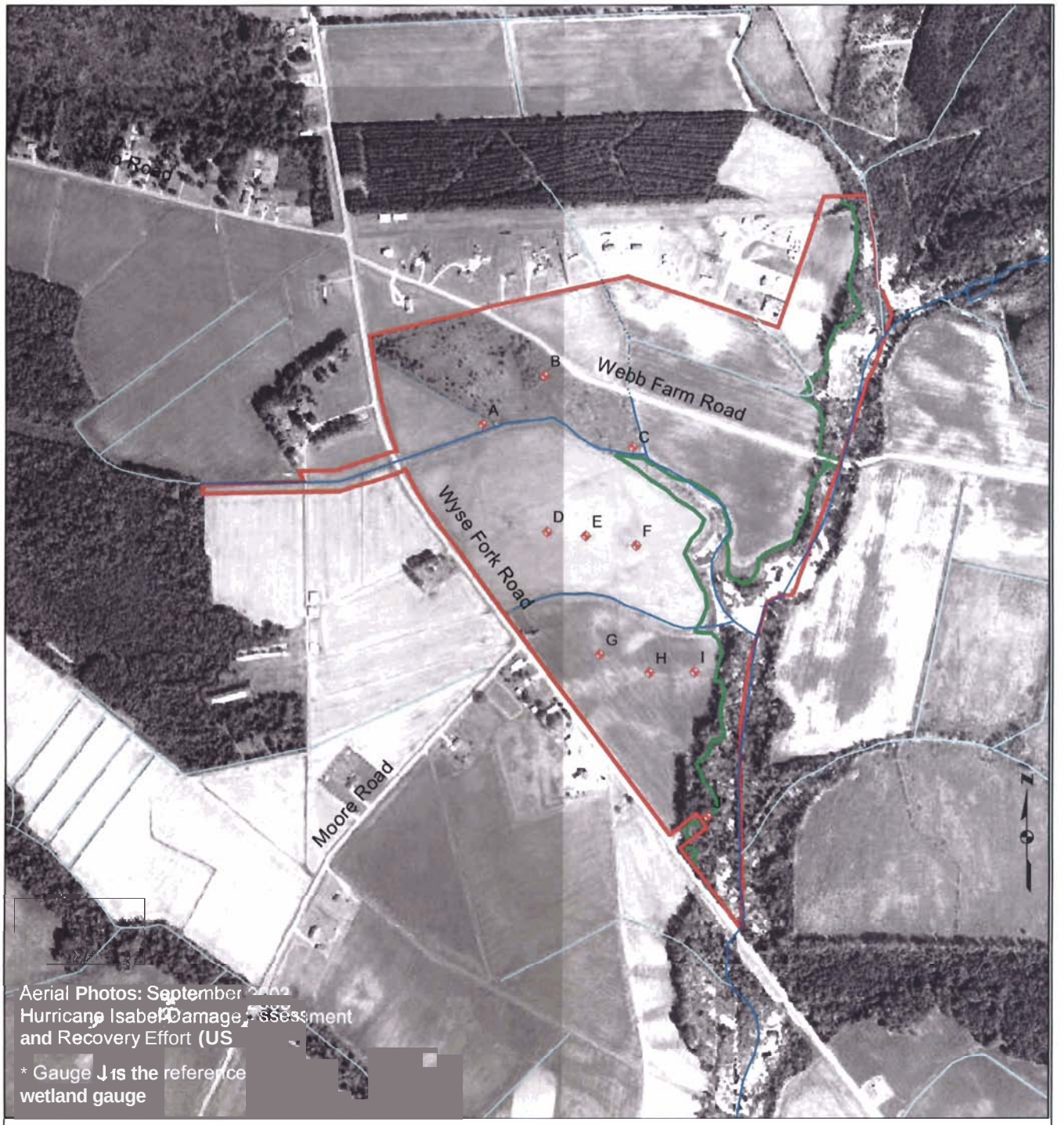


Figure 11.3 Project Site NRCS Soil Survey Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007



Legend

- Gauge Location
- Jurisdictional Wetland

Streams

- Intermittent
- Perennial
- Not evaluated
- Project Boundary

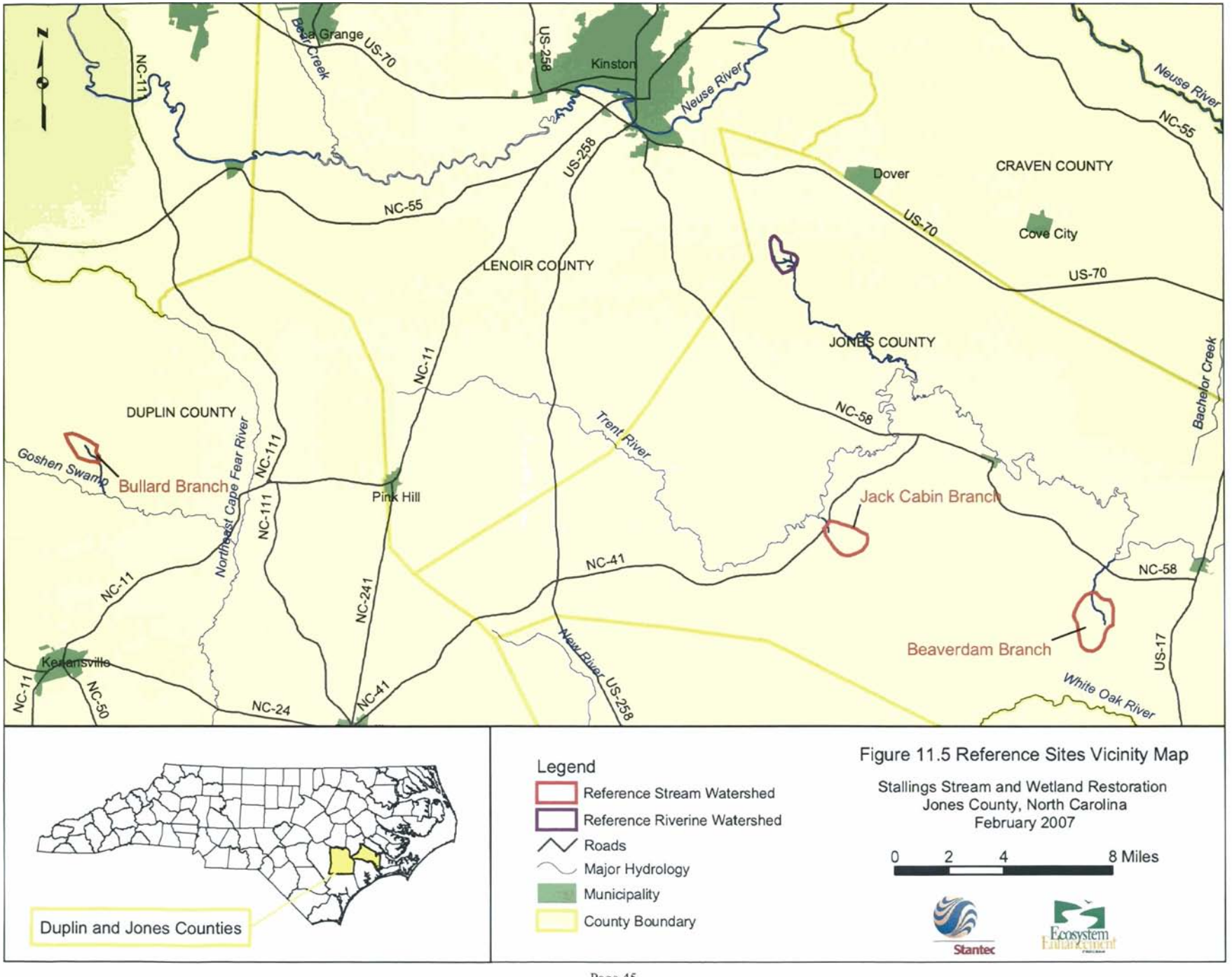
Figure 11.4 Project Site Hydrological Features Map

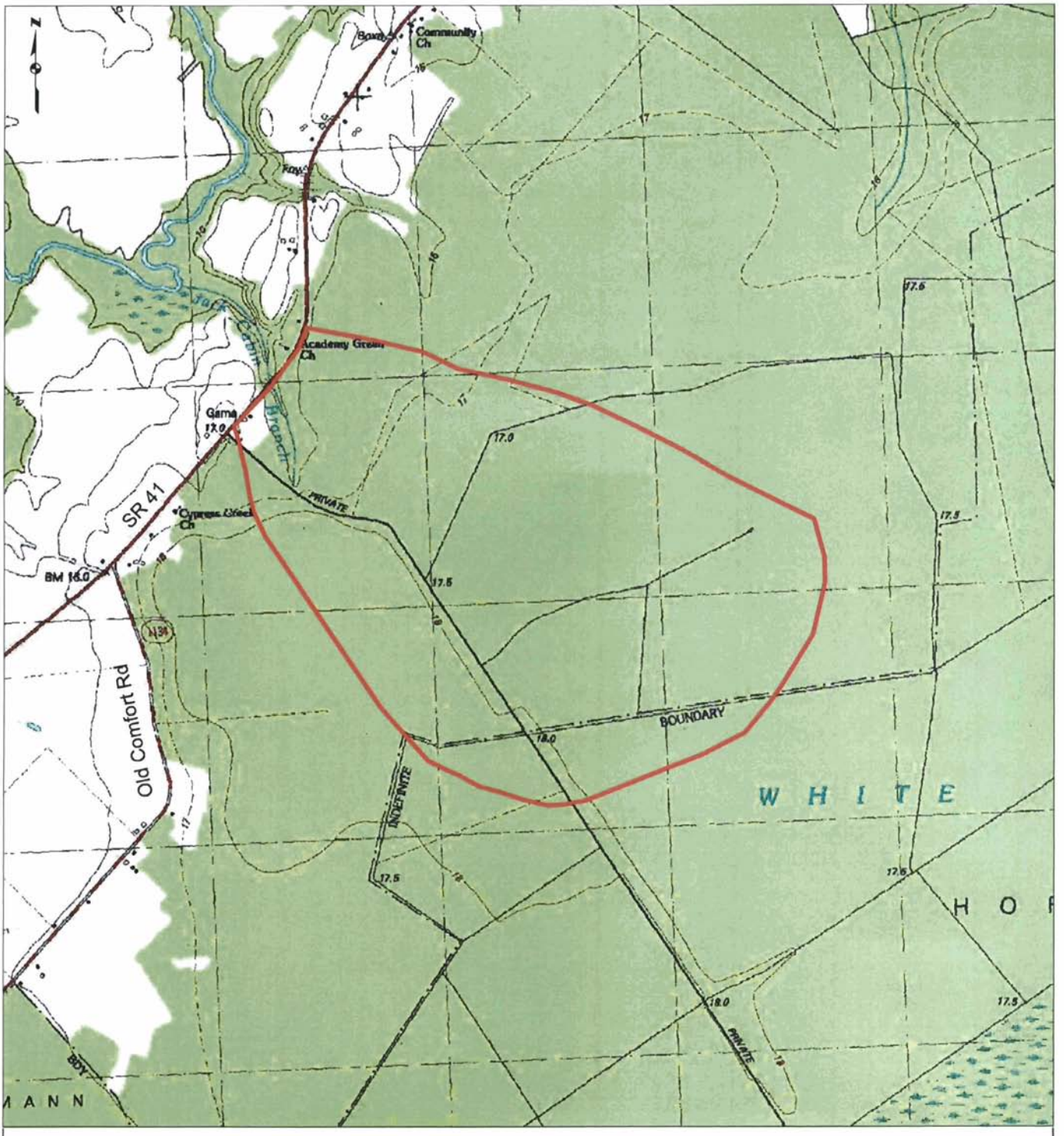
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

0 500 1,000 2,000 Feet

Stantec

Ecosystem Enhancement


N
Kinston
Neuse River
Dover
CRAVEN COUNTY
Cove City
LENOIR COUNTY
JONES COUNTY
DUPLIN COUNTY
Pink Hill
Trent River
Bachelor Creek
Goshen Swamp
Bullard Branch
Northeast Cape Fear River
Jack Cabin Branch
Beaverdam Branch
New River
White Oak River
Kenansville
US-70
US-258
NC-55
NC-11
NC-111
NC-58
NC-41
NC-241
NC-50
NC-24
US-17
Duplin and Jones Counties
Legend
Reference Stream Watershed
Reference Riverine Watershed
Roads
Major Hydrology
Municipality
County Boundary
Figure 11.5 Reference Sites Vicinity Map
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007
0 2 4 8 Miles
Stantec
Ecosystem Enhancement



Legend

Stream

Reference Watershed

Philips Crossroads USGS 7.5' Quad

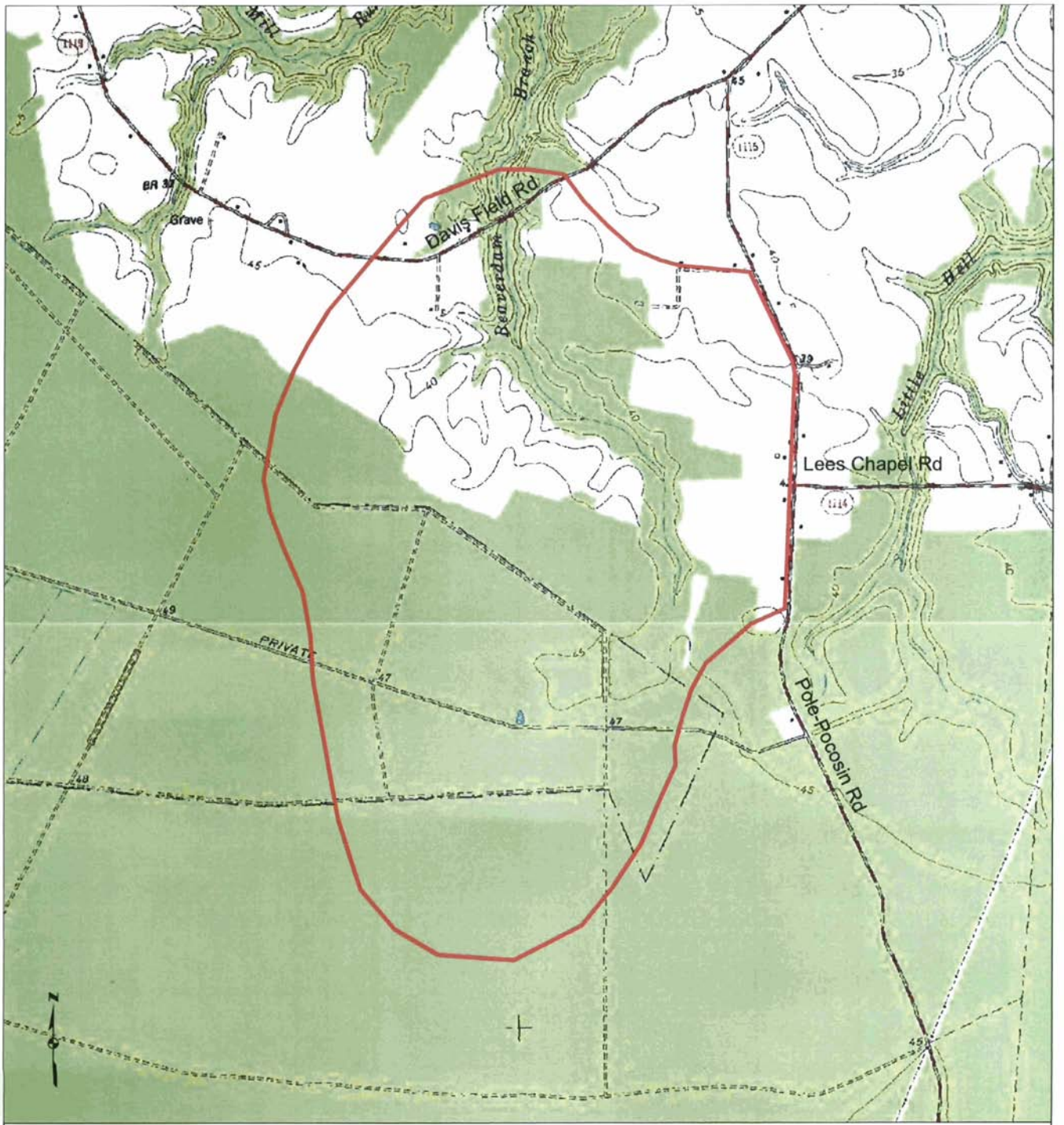
0 750 1,500 3,000 Feet

Figure 11.6 Jack Cabin Branch Reference Site Watershed Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

Stantec

Ecosystem Enhancement Program



Legend

Stream

Reference Watershed

Jacksonville NE USGS 7.5' Quad

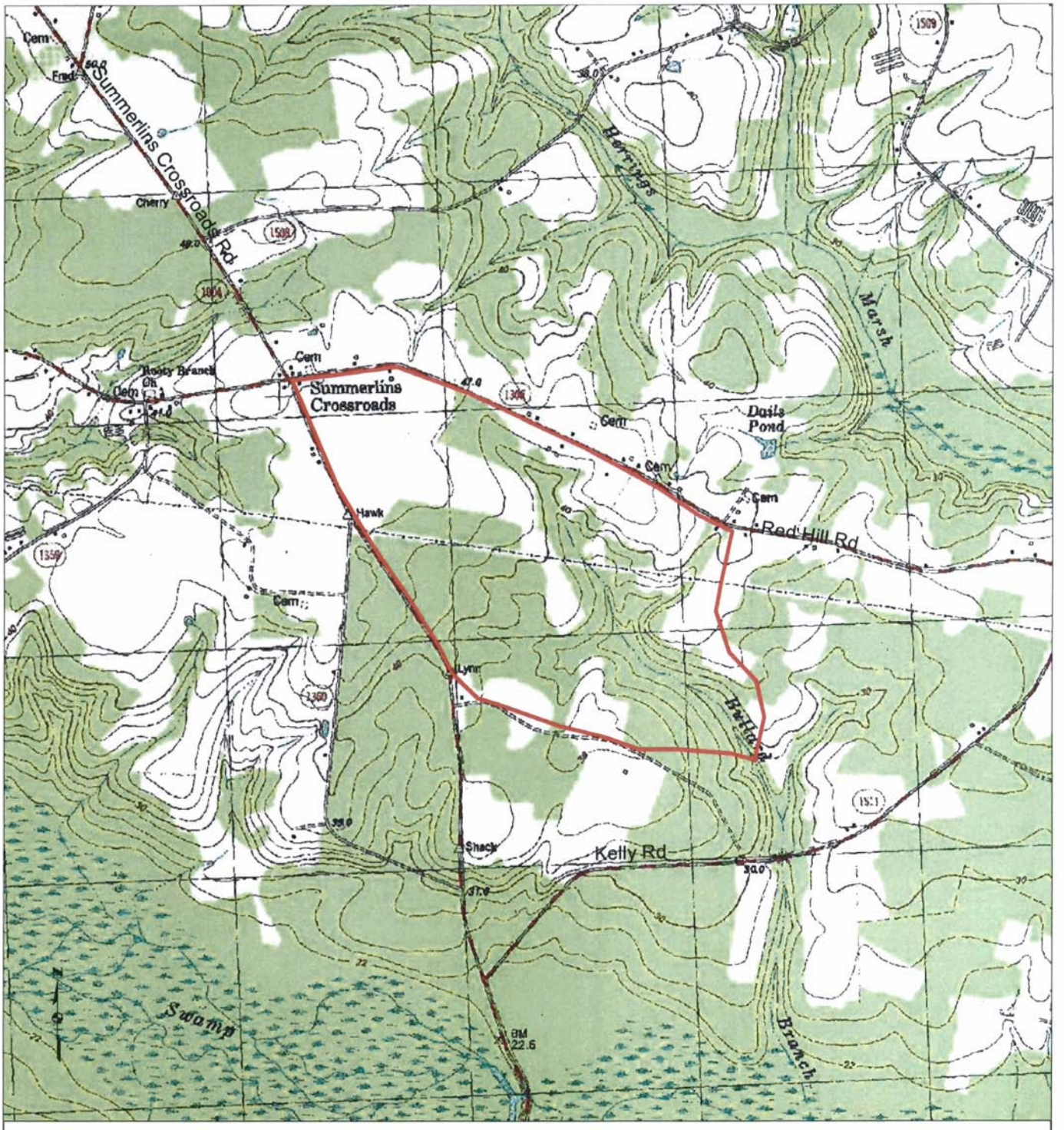
0 750 1,500 3,000 Feet

Figure 11.7 Beaverdam Branch Reference Site Watershed Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

Stantec

Ecosystem Enhancement Program



Legend

Stream

Reference Watershed

Summerlins Crossroads USGS 7.5' Quad

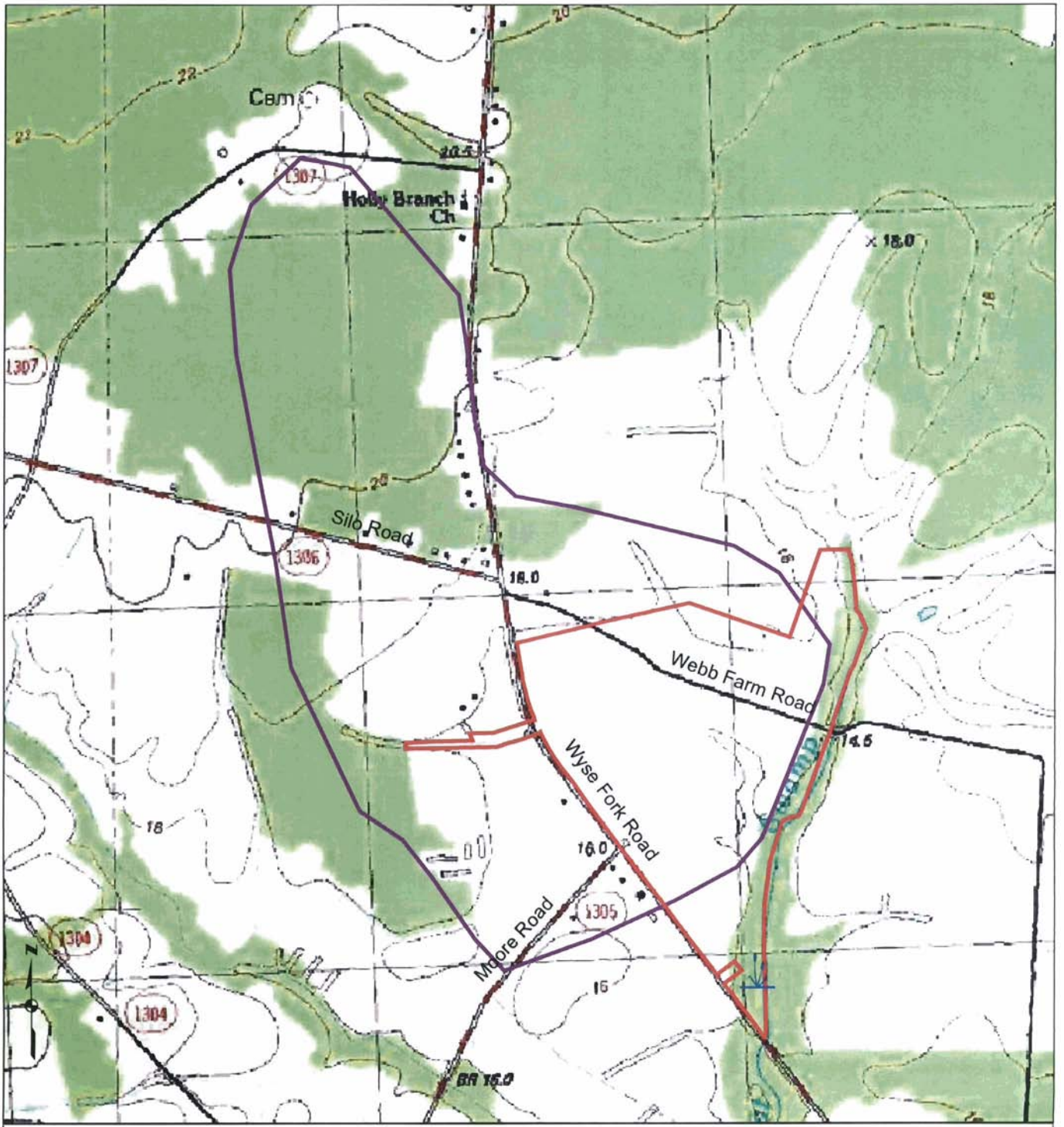
0 750 1,500 3,000 Feet

Figure 11.8 Bullard Branch Reference Site Watershed Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

Stantec

Ecosystem Enhancement Program



Legend

- Reference Wetland
- Stream
- Project Boundary
- Watershed Boundary

Dover USGS 7.5' Quad

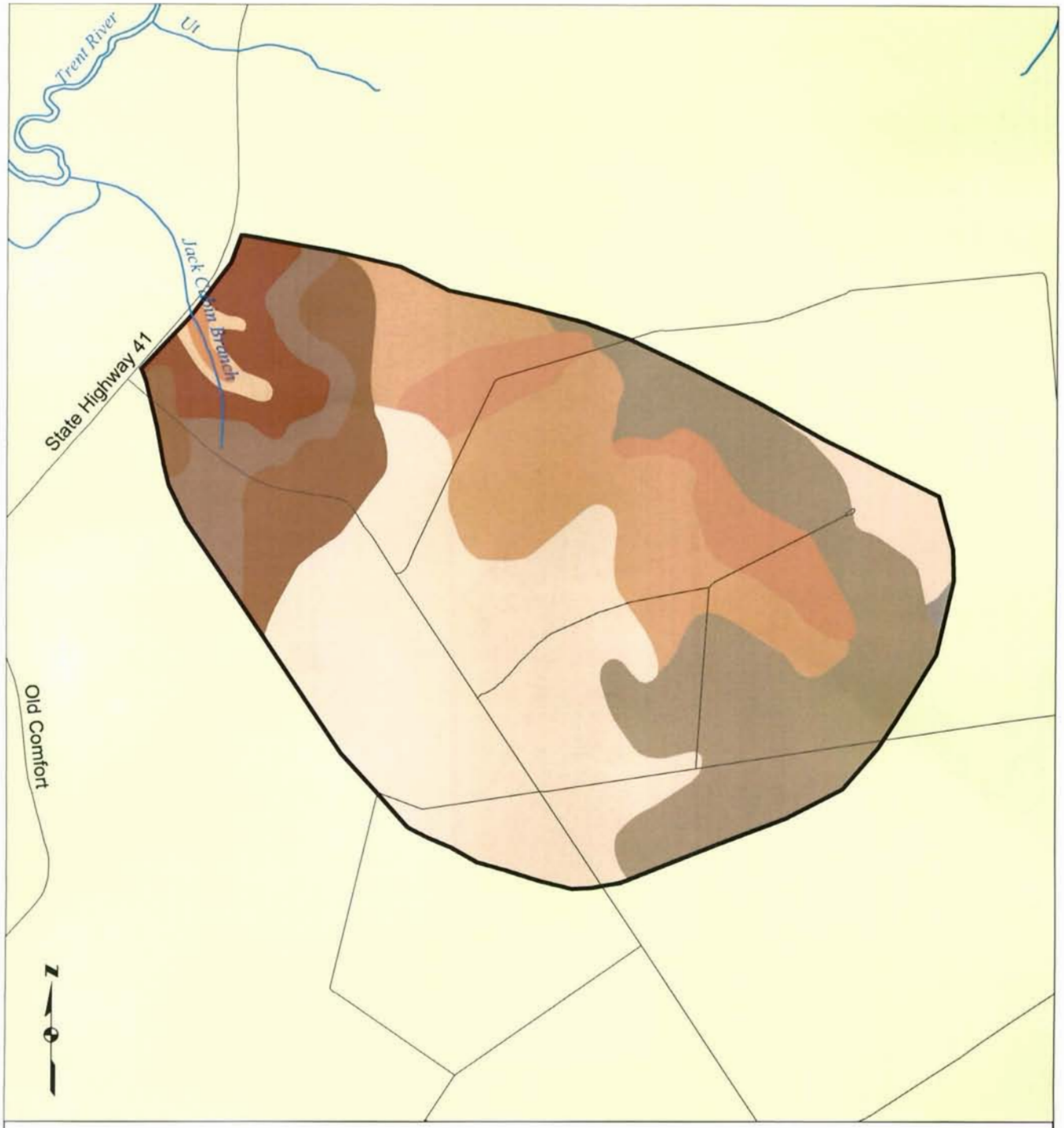
Figure 11.9 Reference Wetlands Watershed Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

0 750 1,500 3,000 Feet

Stantec

Ecosystem Enhancement Program



Legend

- Roads
- Streams
- Reference Watershed

Soils

- CrC - Craven
- Ct - Croatan
- GoA - Goldsboro
- Ly - Lynchburg
- Mk - Muckalee
- Pn - Pantego
- Ra - Rains
- St - Stallings
- To - Torhunta
- Wo - Woodington

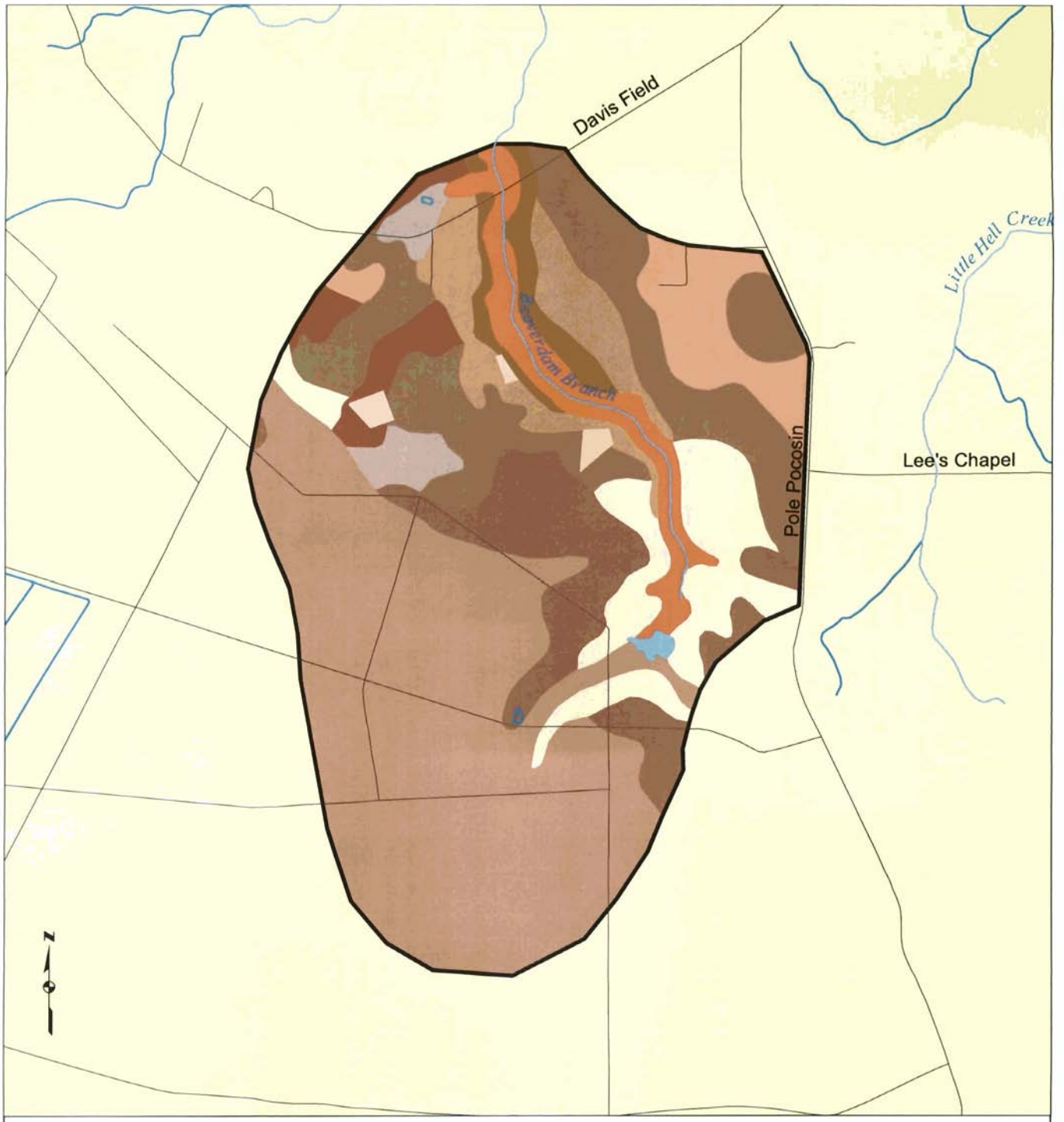
Figure 11.10 Jack Cabin Branch Reference Site NRCS Soil Survey Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

0 650 1,300 2,600 Feet

Stantec

Ecosystem Enhancement Program



Legend

- Streams
- Roads
- watershed Boundary

Soils

- CrB - craven
- GoA - Goldsboro
- Le - Leon
- Ly - Lynchburg
- M-W - Miscellaneous Water
- MaC - Marvyn
- Mk - Muckalee
- NoB - Norfolk
- On - Onslow
- Pn - Pantego
- Ra - Rains
- W - water

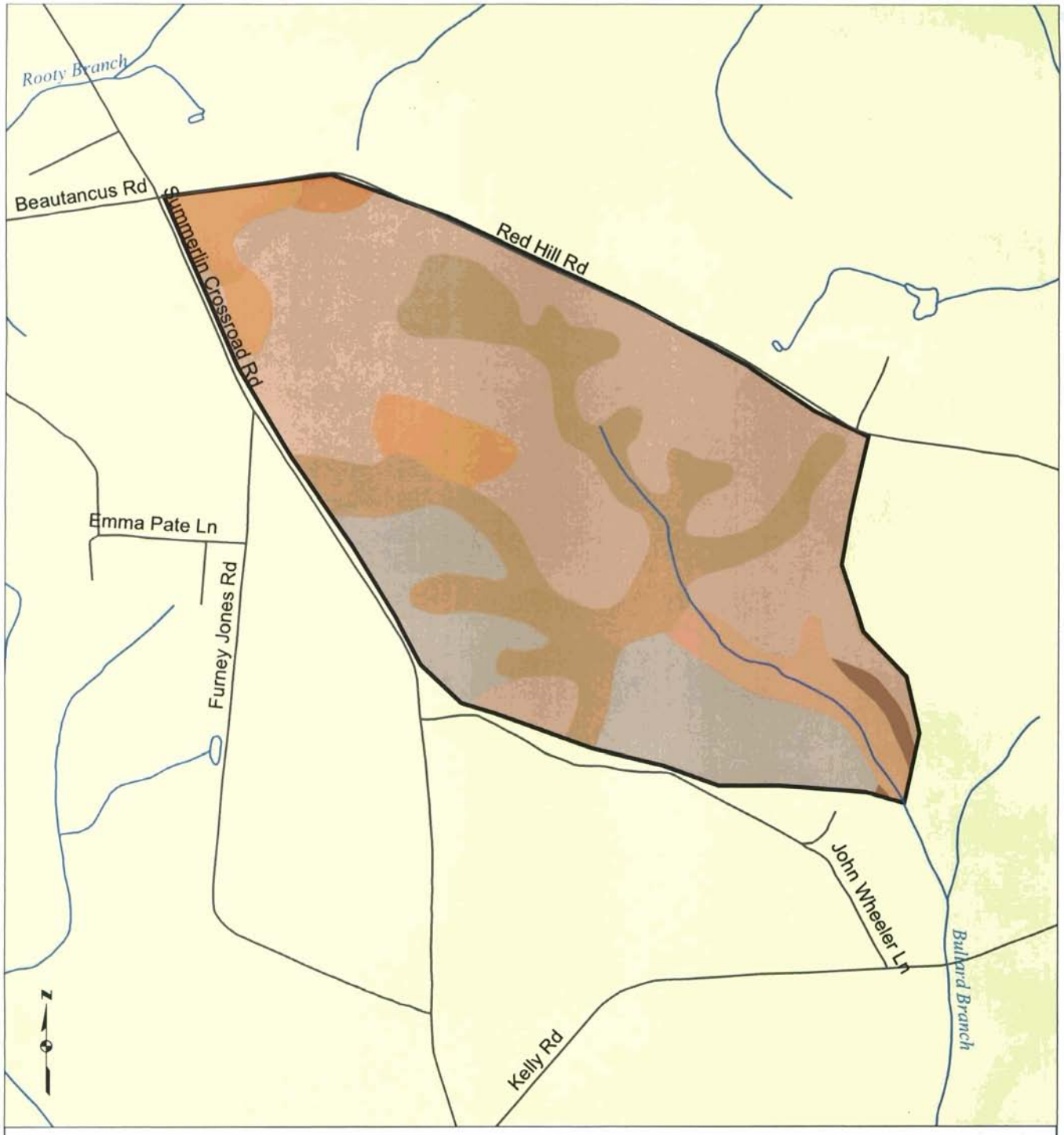
Figure 11.11 Beaverdam Branch Reference Site MRCS Soil Survey Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
Ferbruary 2007

0 750 1,500 3,000 Feet

Stantec

Ecosystem Enhancement



Legend

- Streams
- Roads
- Watershed Boundary
- AuB - Autryville
- BbA - Bibb
- BnB - Blanton
- FoA - Foreston
- McC - Marvyn
- NoA - Norfolk
- WoA - Woodington

Figure 11.12 Bullard Branch Reference Site NRCS Soil Survey Map

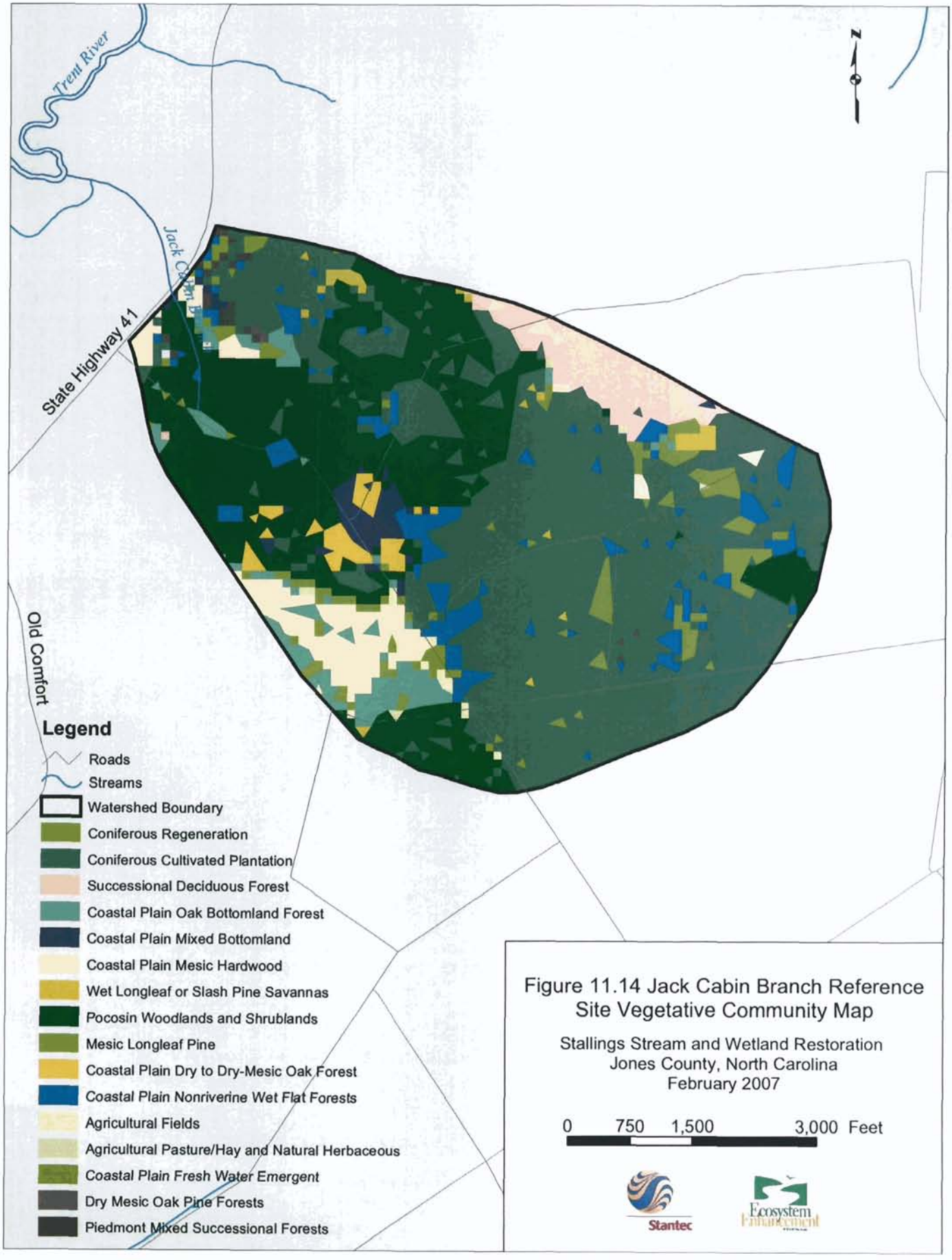
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

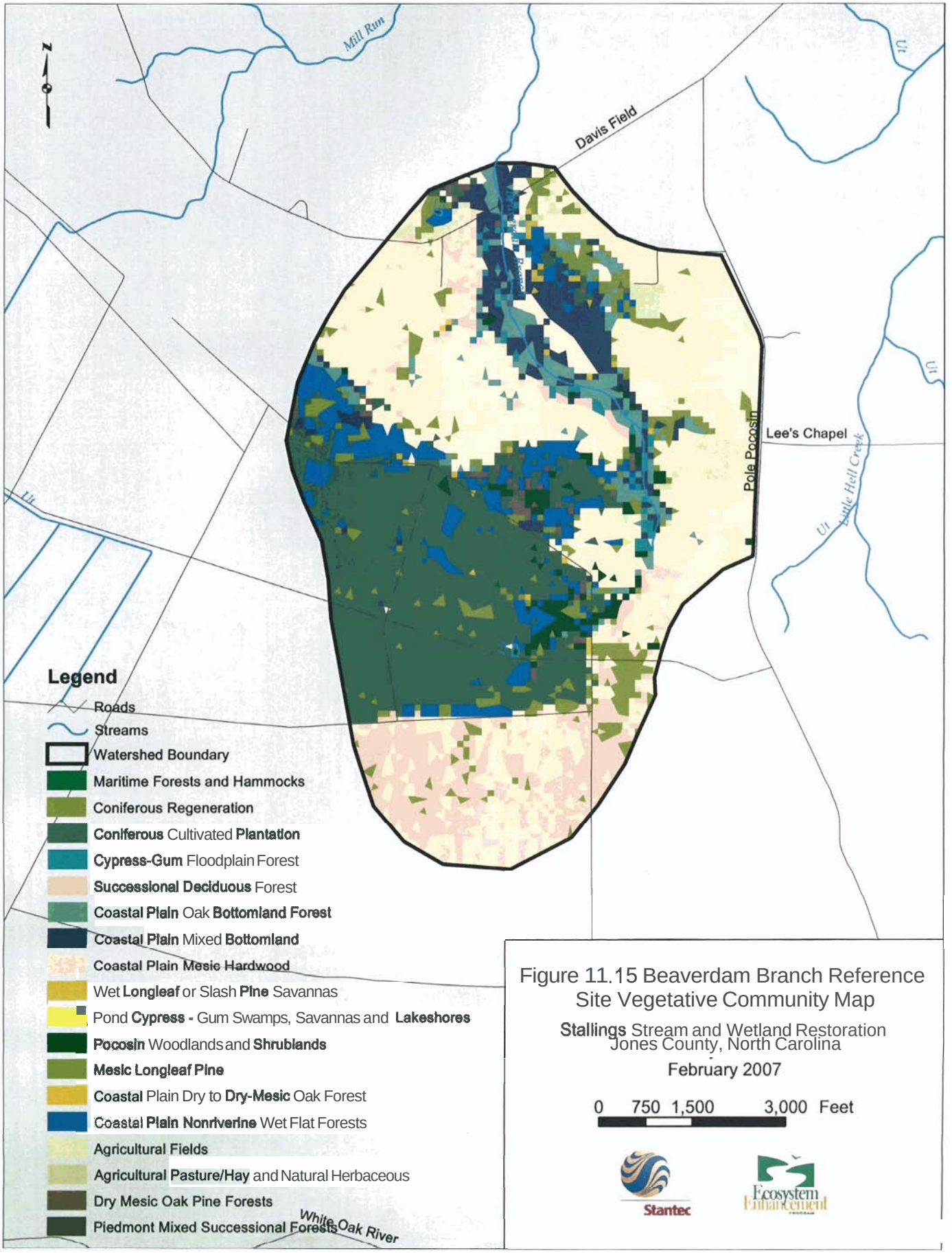
0 550 1,100 2,200 Feet

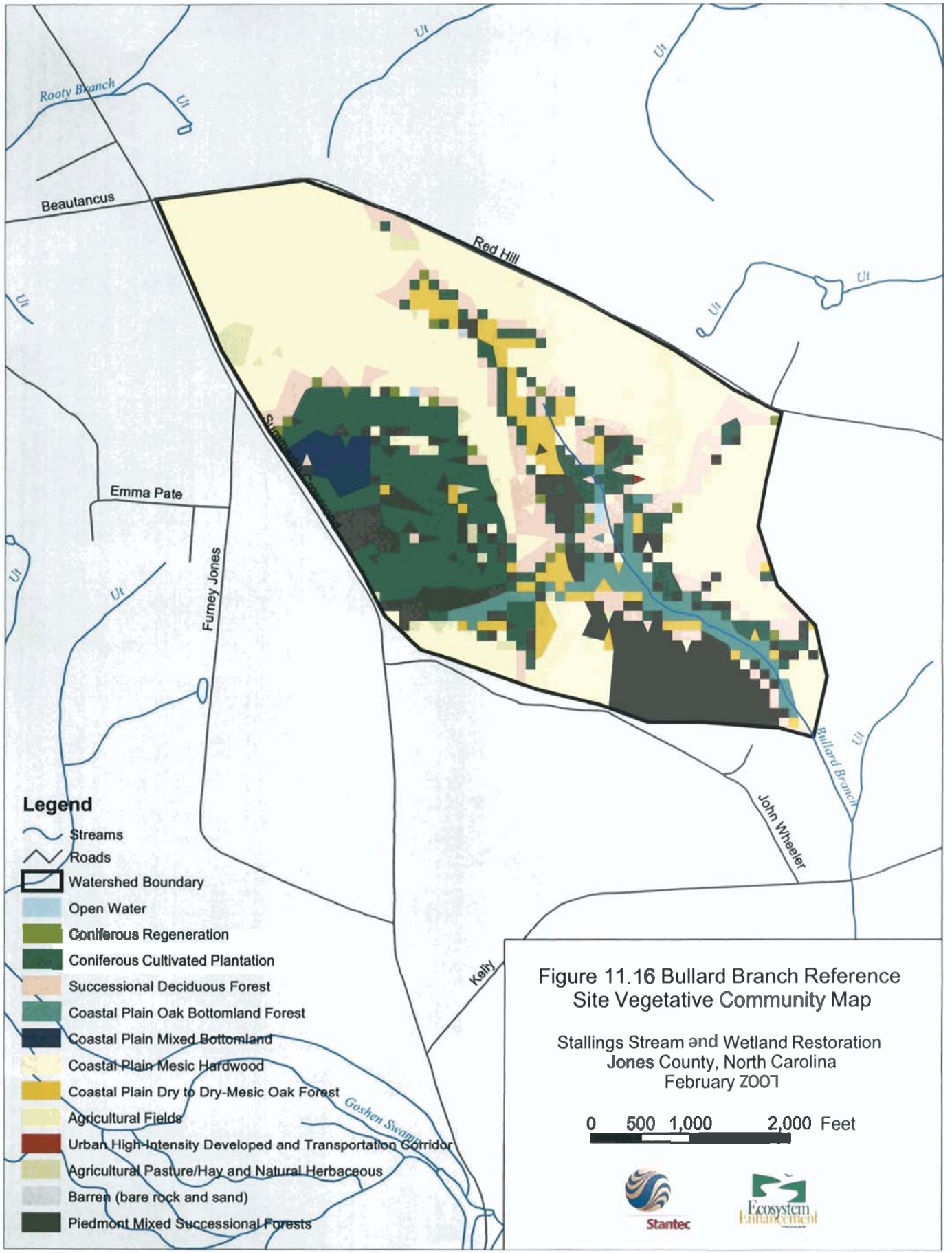
Stantec

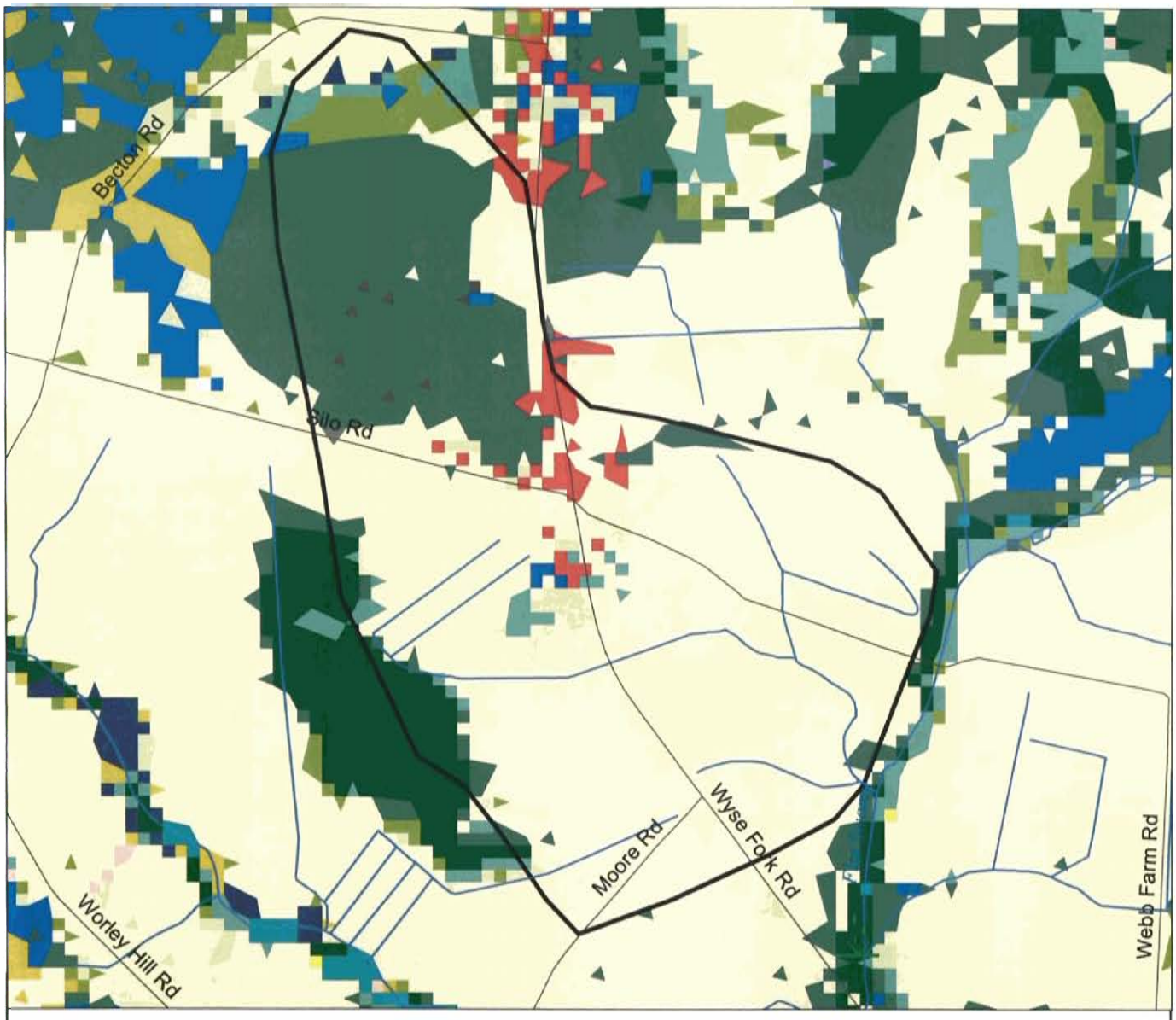
Ecosystem Enhancement Program

Figure 11.13 Reference Wetlands NRCS Soil Survey Map
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007


Trent River
Jack Cabin Branch
State Highway 41
Old Comfort
N
Legend
Roads
Streams
Watershed Boundary
Coniferous Regeneration
Coniferous Cultivated Plantation
Successional Deciduous Forest
Coastal Plain Oak Bottomland Forest
Coastal Plain Mixed Bottomland
Coastal Plain Mesic Hardwood
Wet Longleaf or Slash Pine Savannas
Pocosin Woodlands and Shrublands
Mesic Longleaf Pine
Coastal Plain Dry to Dry-Mesic Oak Forest
Coastal Plain Nonriverine Wet Flat Forests
Agricultural Fields
Agricultural Pasture/Hay and Natural Herbaceous
Coastal Plain Fresh Water Emergent
Dry Mesic Oak Pine Forests
Piedmont Mixed Successional Forests
Figure 11.14 Jack Cabin Branch Reference Site Vegetative Community Map
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007
0 750 1,500 3,000 Feet
Stantec
Ecosystem Enhancement


Mill Run
Davis Field
Lee's Chapel
Pole Pocosin
Little Hell Creek
Ut
Ut
Ut
Ut
White Oak River
Legend
Roads
Streams
Watershed Boundary
Maritime Forests and Hammocks
Coniferous Regeneration
Coniferous Cultivated Plantation
Cypress-Gum Floodplain Forest
Successional Deciduous Forest
Coastal Plain Oak Bottomland Forest
Coastal Plain Mixed Bottomland
Coastal Plain Mesic Hardwood
Wet Longleaf or Slash Pine Savannas
Pond Cypress - Gum Swamps, Savannas and Lakeshores
Pocosin Woodlands and Shrublands
Mesic Longleaf Pine
Coastal Plain Dry to Dry-Mesic Oak Forest
Coastal Plain Nonriverine Wet Flat Forests
Agricultural Fields
Agricultural Pasture/Hay and Natural Herbaceous
Dry Mesic Oak Pine Forests
Piedmont Mixed Successional Forests
Figure 11.15 Beaverdam Branch Reference Site Vegetative Community Map
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007
0 750 1,500 3,000 Feet
Stantec
Ecosystem Enhancement


Rooty Branch
Ut
Ut
Ut
Beautancus
Red Hill
Ut
Ut
Ut
Emma Pate
Furney Jones
Ut
Ut
Bullard Branch
Ut
John Wheeler
Kelly
Goshen Swamp
Legend
Streams
Roads
Watershed Boundary
Open Water
Coniferous Regeneration
Coniferous Cultivated Plantation
Successional Deciduous Forest
Coastal Plain Oak Bottomland Forest
Coastal Plain Mixed Bottomland
Coastal Plain Mesic Hardwood
Coastal Plain Dry to Dry-Mesic Oak Forest
Agricultural Fields
Urban High-Intensity Developed and Transportation Corridor
Agricultural Pasture/Hay and Natural Herbaceous
Barren (bare rock and sand)
Piedmont Mixed Successional Forests
Figure 11.16 Bullard Branch Reference Site Vegetative Community Map
Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007
0 500 1,000 2,000 Feet
Stantec
Ecosystem Enhancement



Reference Wetland
Roads
Streams
Watershed Boundary
Seepage and Streamhead Swamp
Coniferous Regeneration
Coniferous Cultivated Plantation
Cypress-Gum Floodplain Forest
Successional Deciduous Forest
Coastal Plain Oak Bottomland Forest
Coastal Plain Mixed Bottomland
Coastal Plain Mesic Hardwood
Wet Longleaf or Slash Pine Savannas
Tidal Swamp Forest
Pond Cypress
Pocosin Woodlands and Shrublands
Mesic Longleaf Pine
Coastal Plain Nonriverine Wet Flats
Agricultural Fields
Residential Urban
Ag/Pasture and Natural Herbaceous
Barren
Coastal Plain Fresh Water Emergent
Piedmont Mixed Successional Forests

0 500 1000 2000 Feet

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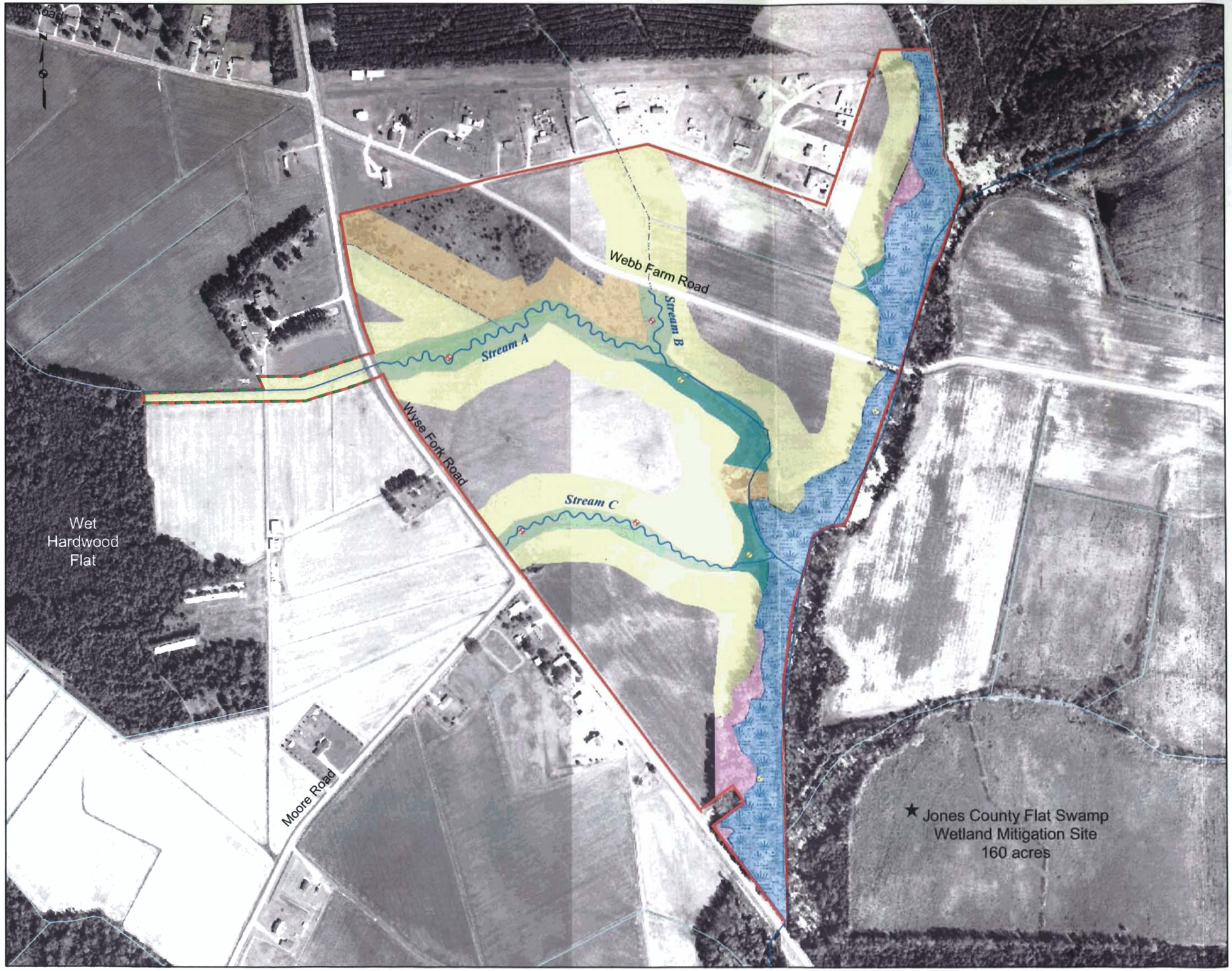
Figure 11.17 Reference Wetlands Vegetative Communities Map

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007



Legend

- Proposed Monitoring Gauges
- Reference Monitoring Gauges
- Project Boundary
- Restored Streams
- Intermittent Streams
- Perennial Streams
- Not evaluated
- Riverine Wetland Restoration
- Riverine Wetland Enhancement
- Riverine Wetland Preservation
- Buffer Restoration
- Buffer Enhancement
- Buffer Preservation
- Wildlife Corridor

Aerial Photos: September 2003
Hurricane Isabel Damage Assessment
and Recovery Effort (USGS)

Figure 11.18
Restoration Summary

Stallings Stream and Wetland Restoration
Jones County, North Carolina
February 2007

0 250 500 1,000 Feet

Stantec

Ecosystem Enhancement Program

12.0 Designed Sheets

Sheet 12.1. Topographic Map

Sheet 12.2. Stream Reach Designators

Sheet 12.3. Typical Cross Sections of Riffle and Pool

Sheet 12.4. HEC-RAS Cross Sectional Layout

Sheet 12.5. Plan View of Proposed Stream Restoration

Sheet 12.6. Plan View of Main Tributary Brown Property

Sheet 12.7. Plan View of Stream Reach A & Tributary

Sheet 12.8. Plan View of Stream Reach A & B

Sheet 12.9. Plan View of Stream Reach A

Sheet 12.10. Plan View of Stream Reach C

Sheet 12.11. Planting Plan

Sheet 12.12. DRAINMOD Cross Sectional Layout

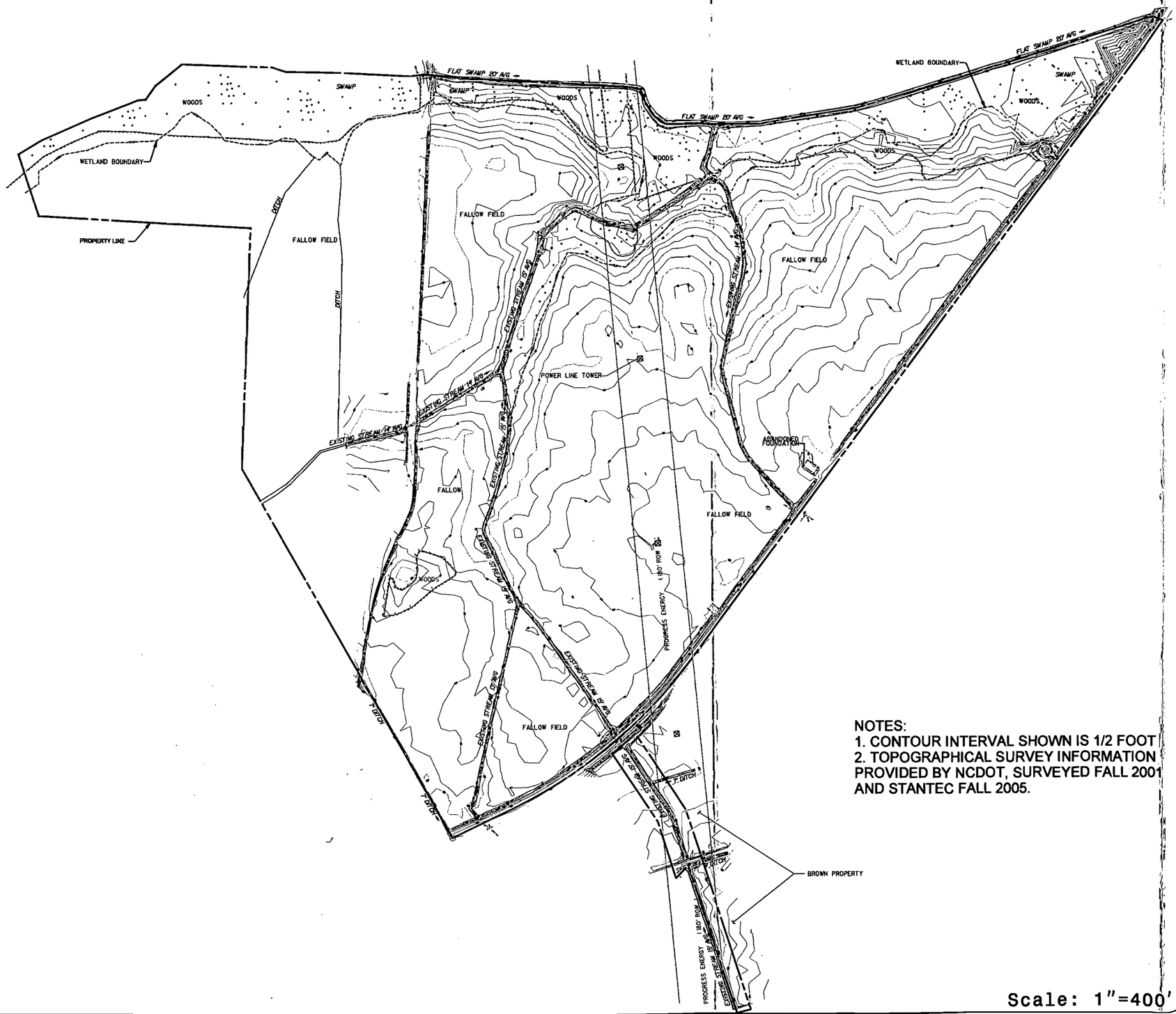
Sheet 12.13. Longitudinal Profile – Upper Reach A

Sheet 12.14. Longitudinal Profile – Lower Reach A

Sheet 12.15. Longitudinal Profile – Reach B

Sheet 12.16. Longitudinal Profile – Reach C

EXISTING CONDITIONS



NOTES:
1. CONTOUR INTERVAL SHOWN IS 1/2 FOOT
2. TOPOGRAPHICAL SURVEY INFORMATION PROVIDED BY NCDOT, SURVEYED FALL 2001 AND STANTEC FALL 2005.

Scale: 1"=400'

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Restoration Plan

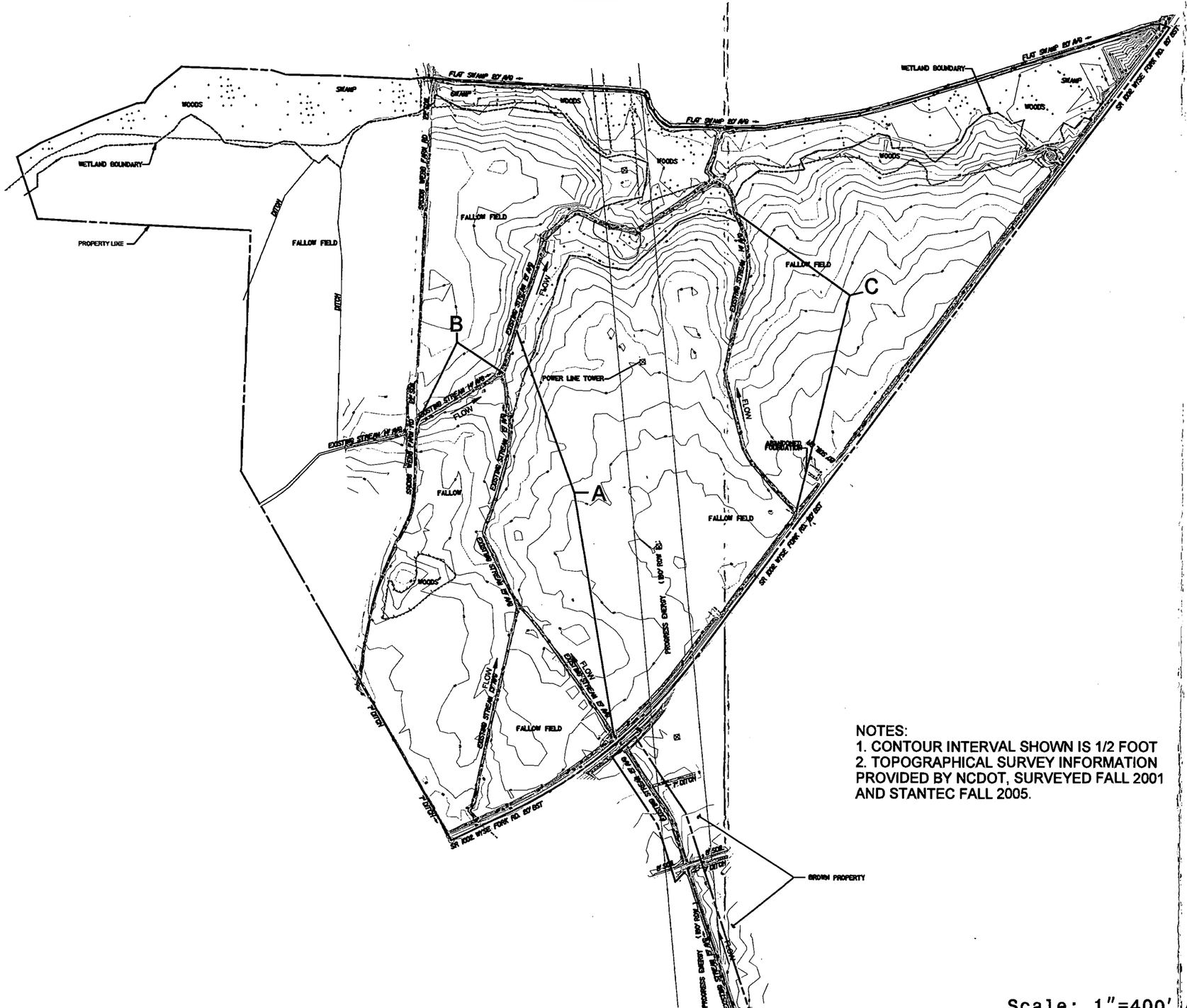
Stallings Site

Jones County, North Carolina

Topographic Map

SHEET 12.1

STREAM REACH DESIGNATORS



NOTES:
1. CONTOUR INTERVAL SHOWN IS 1/2 FOOT
2. TOPOGRAPHICAL SURVEY INFORMATION PROVIDED BY NCDOT, SURVEYED FALL 2001 AND STANTEC FALL 2005.

Scale: 1"=400'

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Restoration Plan

Stallings Site

Jones County, North Carolina

Stream Reach Designators

SHEET 12.2

TYPICAL SECTIONS

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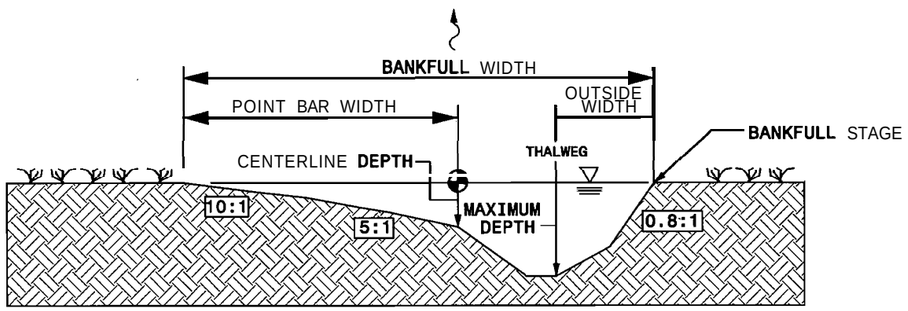
TYPICAL SECTION - POOL RIGHT

MIRROR ABOUT CENTERLINE FOR POOL LEFT

VARIABLE	UPSTREAM REACHA	DOWNSTREAM REACHA	REACH B	REACH C
BANKFULL WIDTH	9.6	12.6	9.6	7.8
POINT BAR WIDTH	5.6	7.4	5.6	4.5
MAX DEPTH (THALWEG)	1.9	2.3	1.9	1.4
OUTSIDE WIDTH	2.0	2.4	2.0	1.5
CENTERLINE DEPTH	0.9	1.2	0.9	0.7

ALL UNITS ARE IN FEET



THALWEG (DEEPEST POINT IN A CROSS SECTION)
IS LOCATED IN THE MIDDLE OF THE BASE WIDTH.

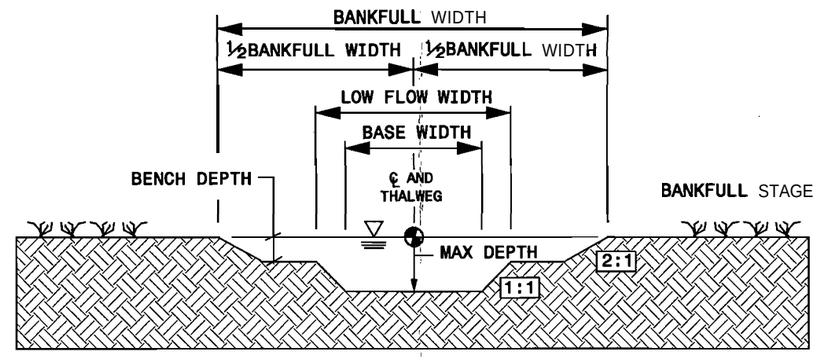
NOTES:
- ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
- ⌖ - GRADE POINT IS THE CENTERLINE OF THE STREAM
- ALL SHARP CORNERS SHOULD BE ROUNDED

SCALE: NTS

TYPICAL SECTION - RIFFLE

VARIABLE	UPSTREAM REACH A	DOWNSTREAM REACH A	REACH B	REACH C
BANWULL WIDTH	8.0	10.5	8.0	6.5
BASE WIDTH	2.8	4.2	2.8	2.5
MAXIMUM DEPTH	1.1	1.3	1.1	0.9
LOW FLOW	4.0	5.8	4.0	3.4
BENCH DEPTH	0.4	0.4	0.4	0.4

ALL UNITS ARE IN FEET



THALWEG (DEEPEST POINT IN CROSS SECTION) IS LOCATED IN CENTER OF CHANNEL IN A RIFFLE.

NOTES:
- ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
- ⌖ - GRADE POINT IS THE CENTERLINE OF THE STREAM
- ALL SHARP CORNERS SHOULD BE ROUNDED

SCALE: NTS

Restoration Plan

Stallings Site

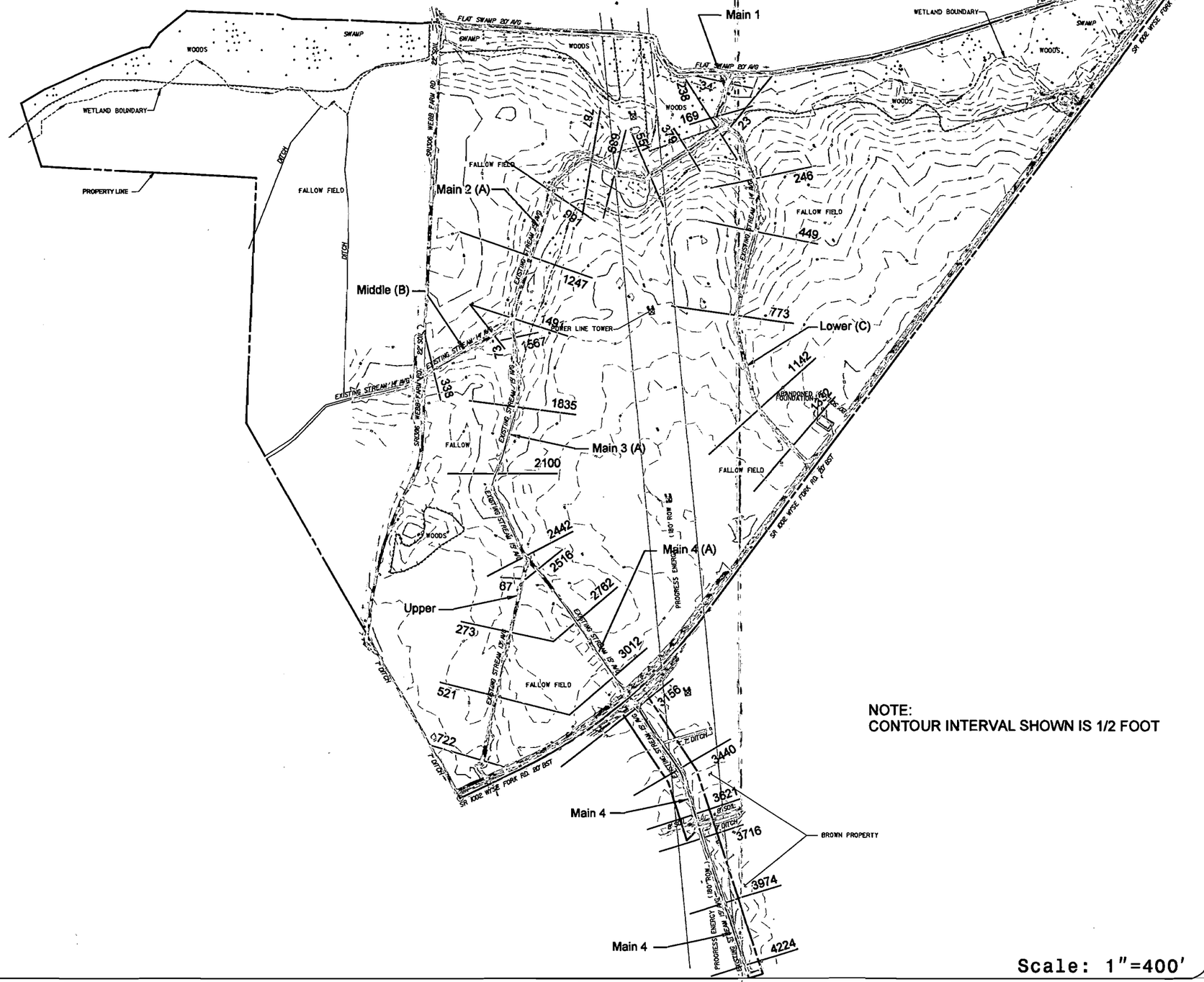
Jones County, North Carolina

Typical Cross Sections
of Riffle and Pool

Scale: NTS

SHEET 12.3

HEC-RAS CROSS-SECTIONAL LAYOUT



NOTE:
CONTOUR INTERVAL SHOWN IS 1/2 FOOT

Scale: 1"=400'

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Restoration Plan

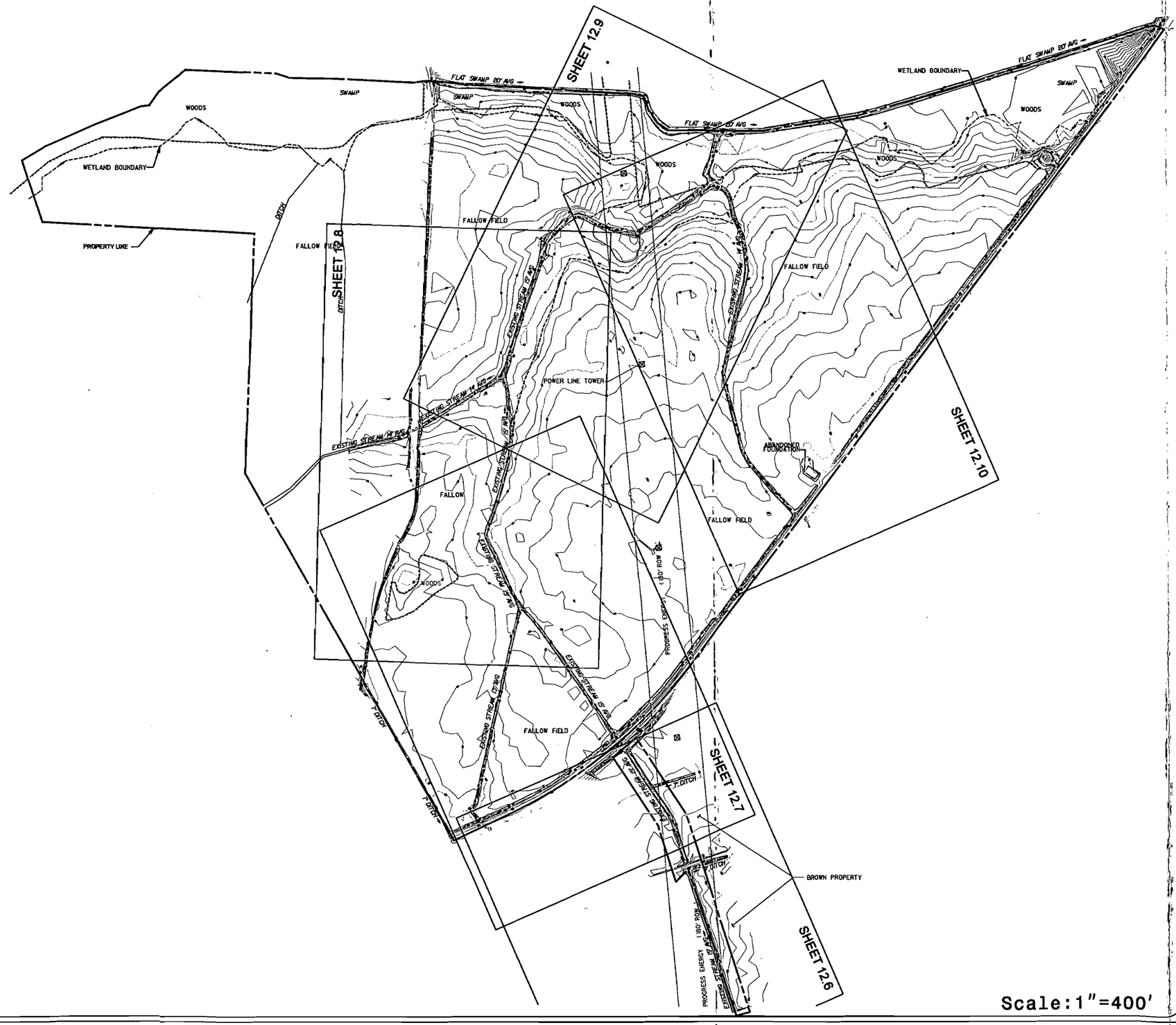
Stallings Site

Jones County, North Carolina

HEC-RAS Cross Sectional Layout

SHEET 12.4

PLAN VIEW OF PROPOSED STREAM RESTORATION



Scale: 1"=400'

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NOTE:
CONTOUR INTERVAL SHOWN IS 1/2 FOOT

Restoration Plan

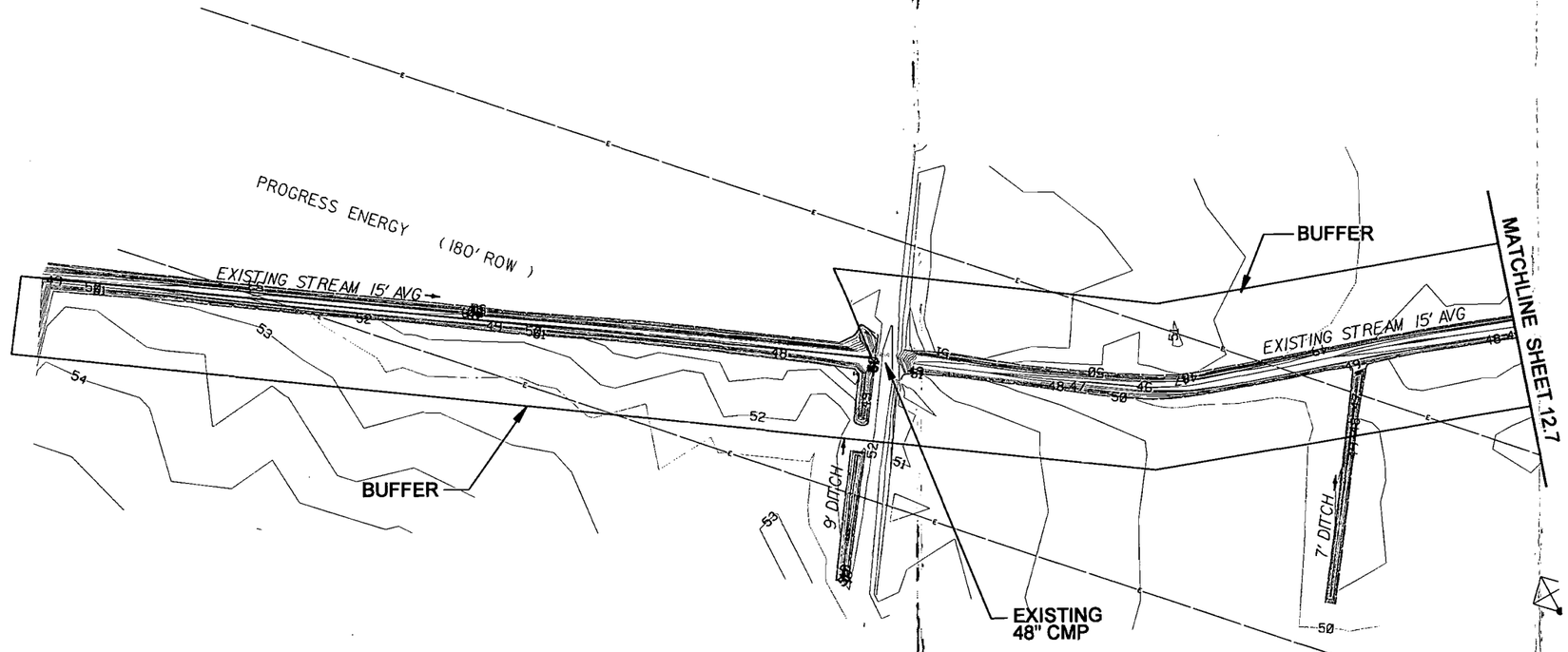
Stallings Site

Jones County, North Carolina

Plan View of Proposed
Stream Restoration

SHEET 12.5

PLAN VIEW OF BROWN PROPERTY BUFFER



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Fax. 9 [illegible]
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NOTE:
CONTOUR INTERVAL SHOWN IS 1/2 FOOT

Scale: 1" = 100'

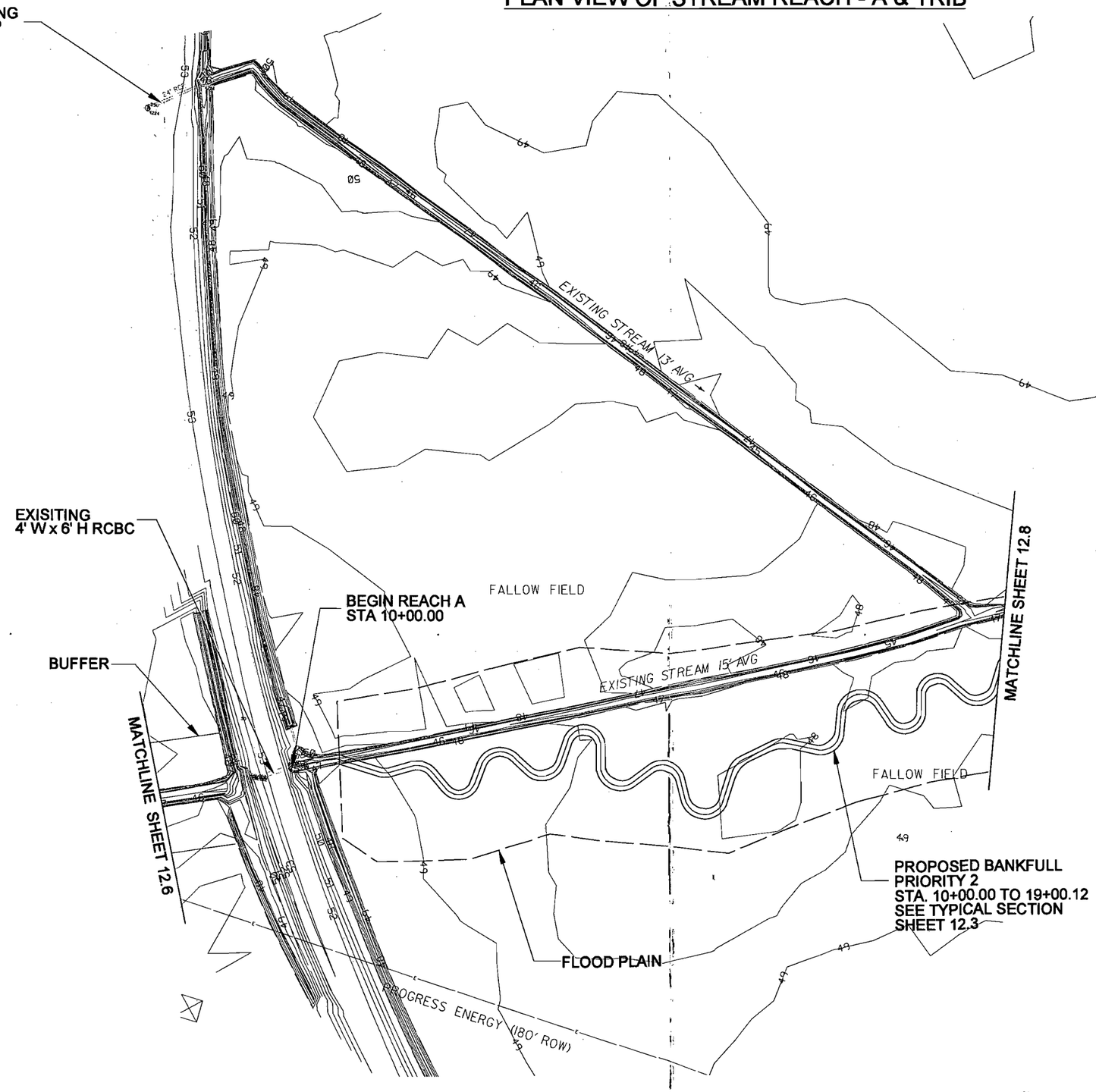
Restoration Plan

Stallings Site
Jones County, North Carolina

Plan View of Main Trib
Brown Property

SHEET 12.6

PLAN VIEW OF STREAM REACH - A & TRIB



Scale: 1" = 100'

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NOTE:
1. CONTOUR INTERVAL SHOWN IS 1/2 FOOT
2. RIPARIAN BUFFER ALONG CHANNEL WILL BE 200' FROM TOP OF BANK.

Restoration Plan

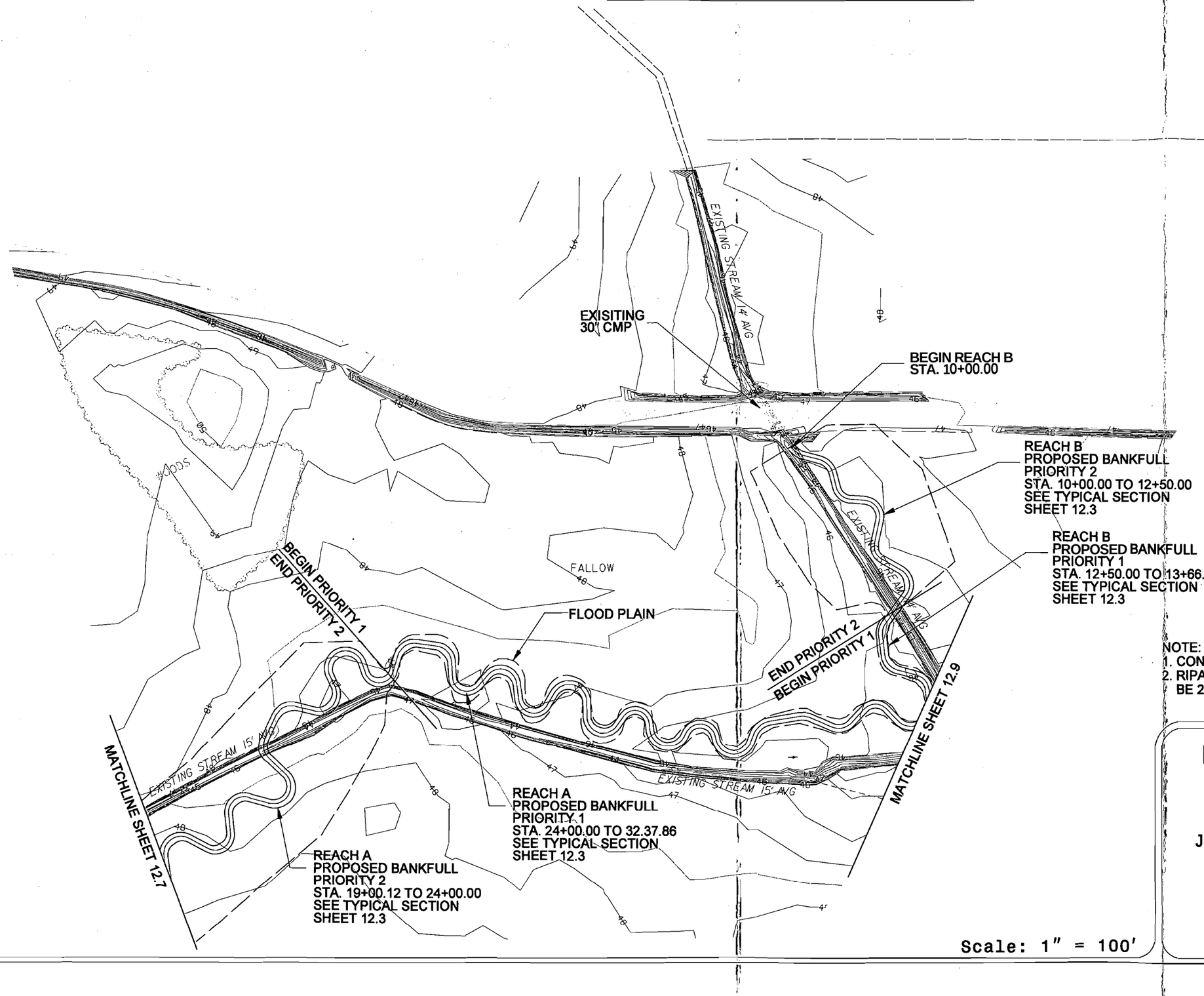
Stallings Site

Jones County, North Carolina

Plan View of
Stream Reach A & Trib

Sheet 12.7

PLAN VIEW OF STREAM REACH - A & B



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NOTE:
1. CONTOUR INTERVAL SHOWN IS 1/2 FOOT
2. RIPARIAN BUFFER ALONG CHANNEL WILL BE 200' FROM TOP OF BANK.

Scale: 1" = 100'

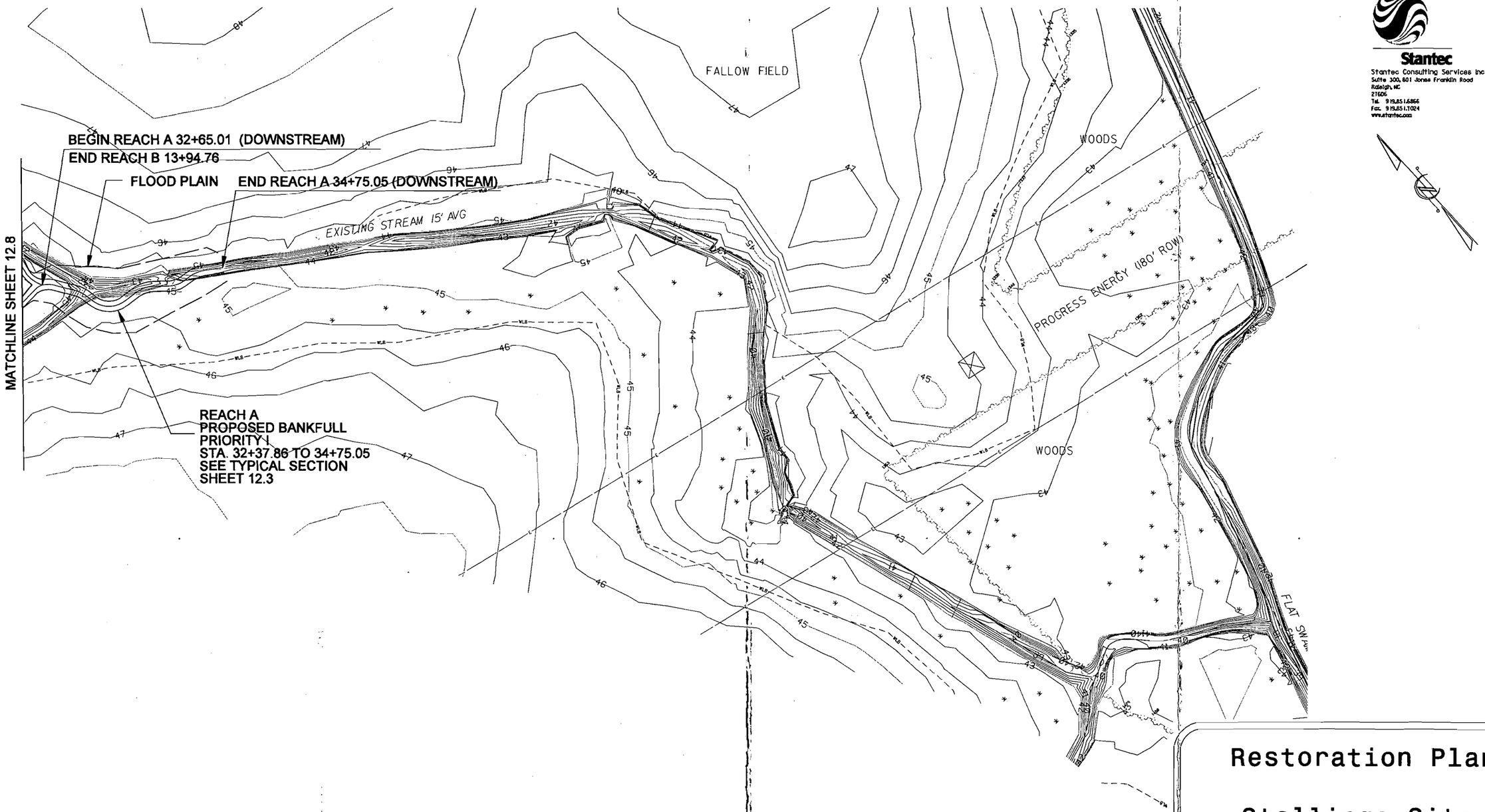
Restoration Plan

Stallings Site
Jones County, North Carolina

Plan View of
Stream Reach A & B

SHEET 12.8

PLAN VIEW OF STREAM REACH - A



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NOTE:
1. CONTOUR INTERVAL SHOWN IS 1/2 FOOT
2. RIPARIAN BUFFER ALONG CHANNEL WILL BE 200' FROM TOP OF BANK.

Scale: 1" = 100'

Restoration Plan

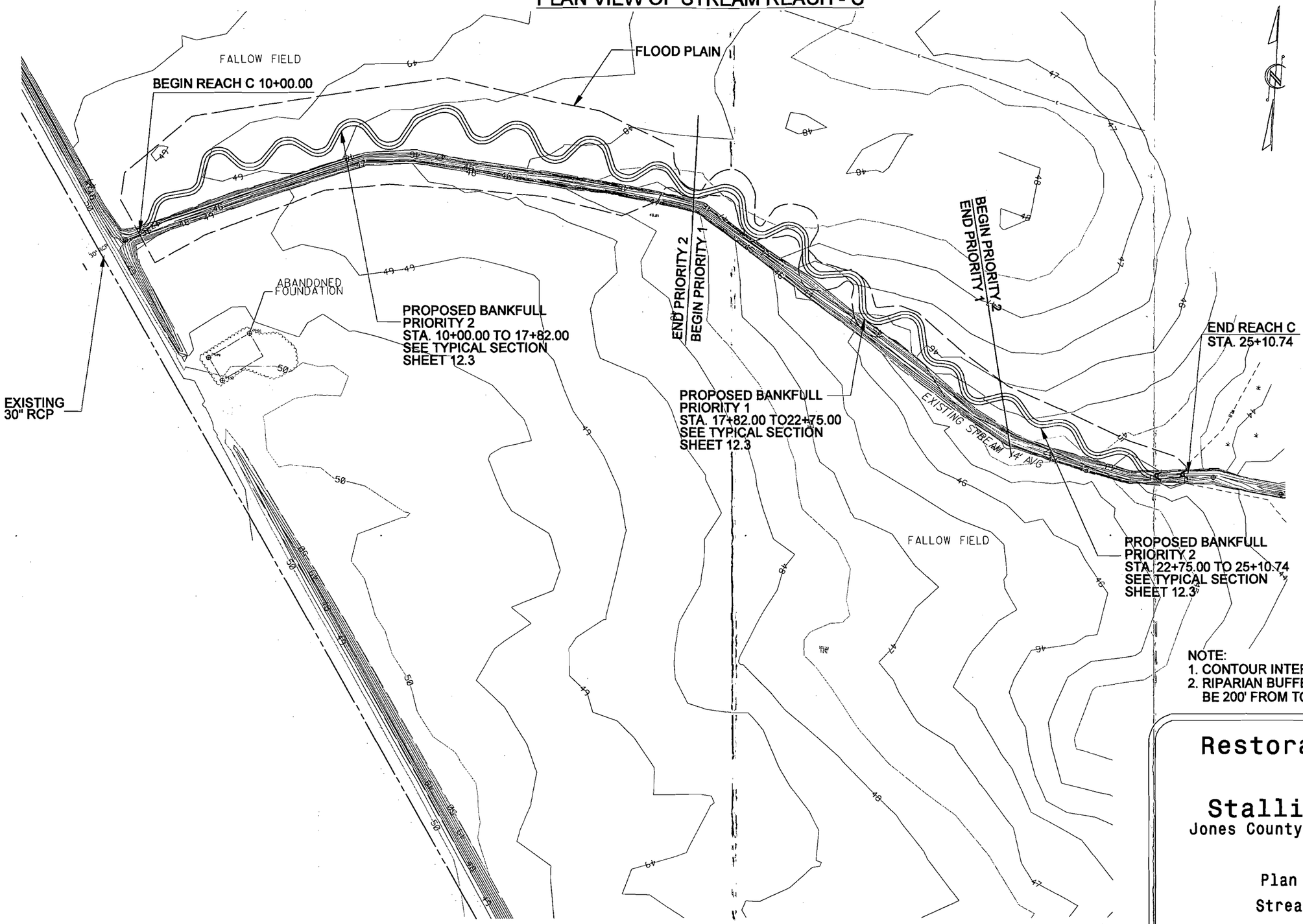
Stallings Site

Jones County, North Carolina

Plan View of
Stream Reach A

SHEET 12.9

PLAN VIEW OF STREAM REACH - C



Scale: 1"= 100'

NOTE:
1. CONTOUR INTERVAL SHOWN IS 1/2 FOOT
2. RIPARIAN BUFFER ALONG CHANNEL WILL BE 200' FROM TOP OF BANK.

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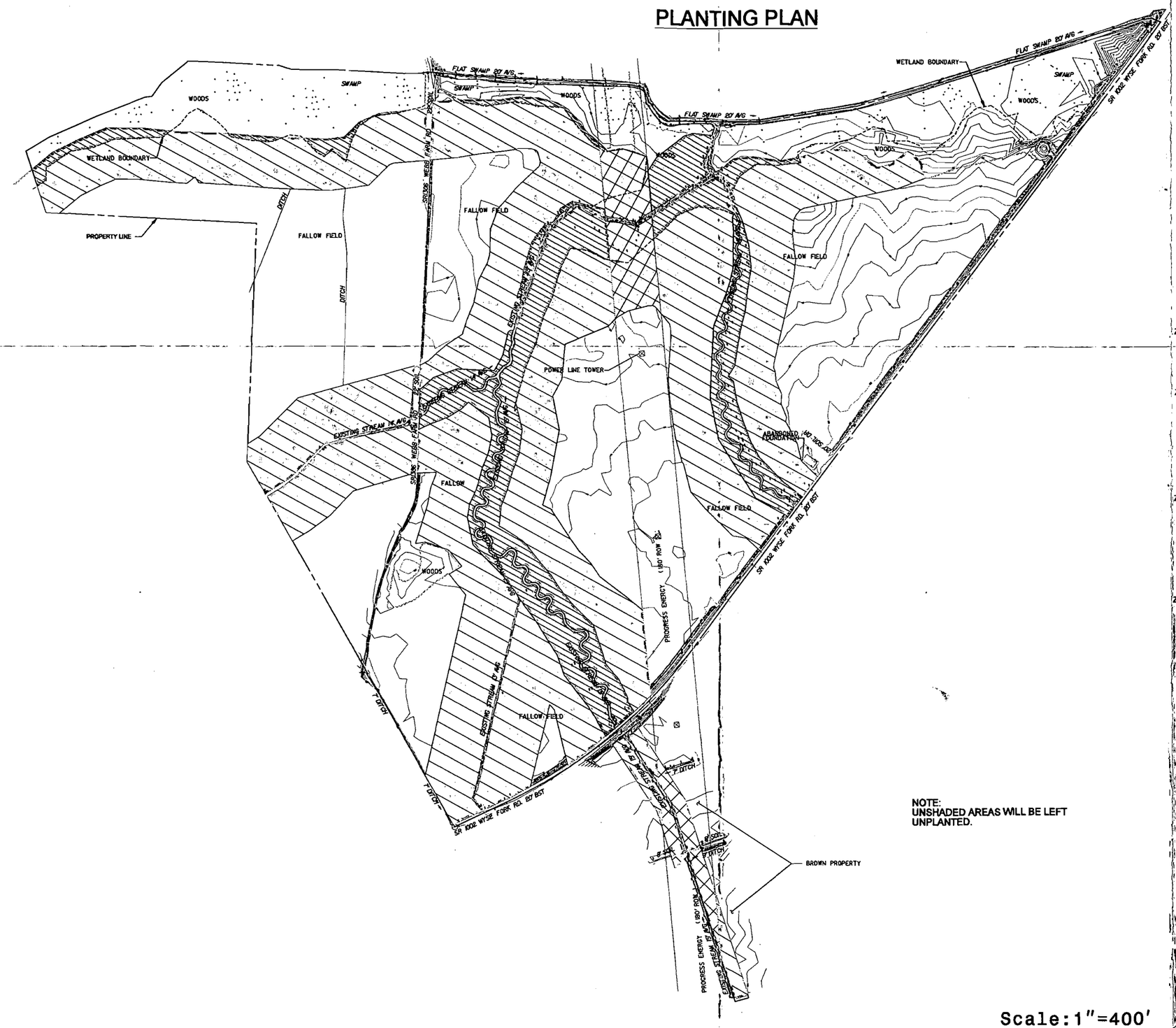
Restoration Plan

Stallings Site
Jones County, North Carolina

Plan View of
Stream Reach C

SHEET 12.10

PLANTING PLAN



NOTE:
UNSHADED AREAS WILL BE LEFT UNPLANTED.

Scale:1"=400'

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LEGEND

ZONE 1 — Streambank

Smooth Alder	*Alnus serrulta*
Swamp Dogwood	*Cornus stricta*
Elderberry	*Sambucus Canadensis*
Virginia Willow	*Itea virginica*

ZONE 2 — Riverine Bottomland Hardwood Forest

Overcup Oak	*Quercus lyrata*
Swamp Cottonwood	*Populus heterophylla*
Swamp Chestnut Oak	*Quercus michauxii*
Green Ash	*Fraxinus pennsylvanica*
Swamp Black Gum	*Nysse sylvetica var.biflora*
American Sycamore	*Platanus occidentalis*
Charrybark Oak	*Quercus falcata var. pagodaefolia*
Water Oak	*Quercus nigra*

ZONE 3 — Powerline Right-of-Way

Smooth Alder	*Alnus serrulata*
Swamp Dogwood	*Cornus stricta*
Buttonbush	*Cephalanthus occidentalis*
Sweet Pepperbush	*Clethra alnifolia*
Elderberry	*Sambucus Canadensis*
Sweet Bay	*Magnolia virginiana*
Redbay	*Persea borbonia*
Ironwood	*Carpinus caroliniana*

ZONE 4 — Extended Buffer

White Oak	*Quercus alba*
Willow Oak	*Quercus phellos*
Water Oak	*Quercus nigra*
Black Gum	*Nysse sylvatica*
Slippery Elm	*Ulmus rubra*
American Sycamore	*Platanus occidentalis*
Bitternut Hickory	*Carya cordiformis*
Wax Myrtle	*Myrica cerifera*
Red Cedar	*Juniperous virginiana*

Restoration Plan

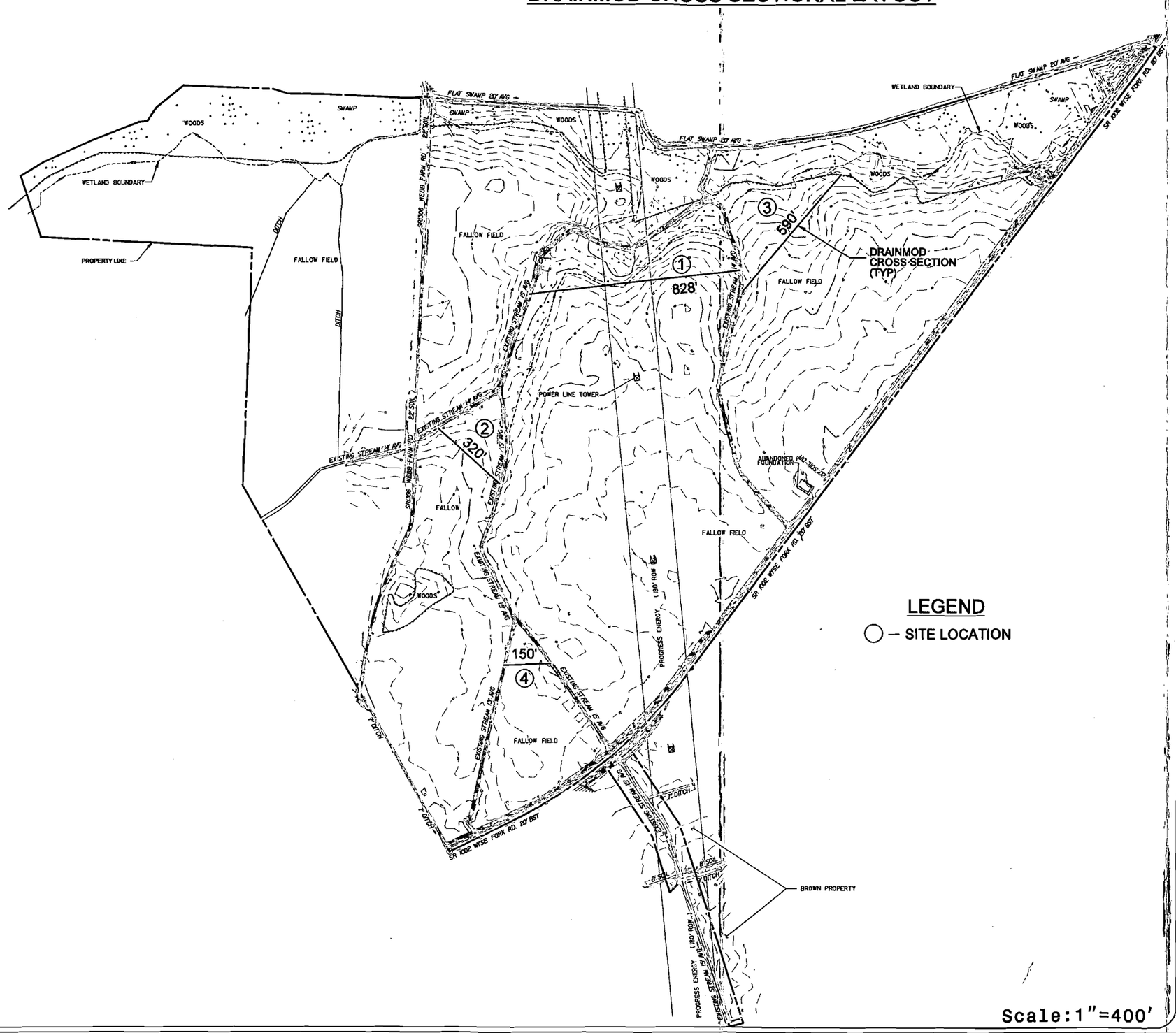
Stallings Site

Jones County, North Carolina

Planting Plan

SHEET 12.11

DRAINMOD CROSS SECTIONAL LAYOUT



LEGEND

○ – SITE LOCATION

NOTE:
CONTOUR INTERVAL SHOWN IS 1/2 FOOT

Scale:1"=400'

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Restoration Plan

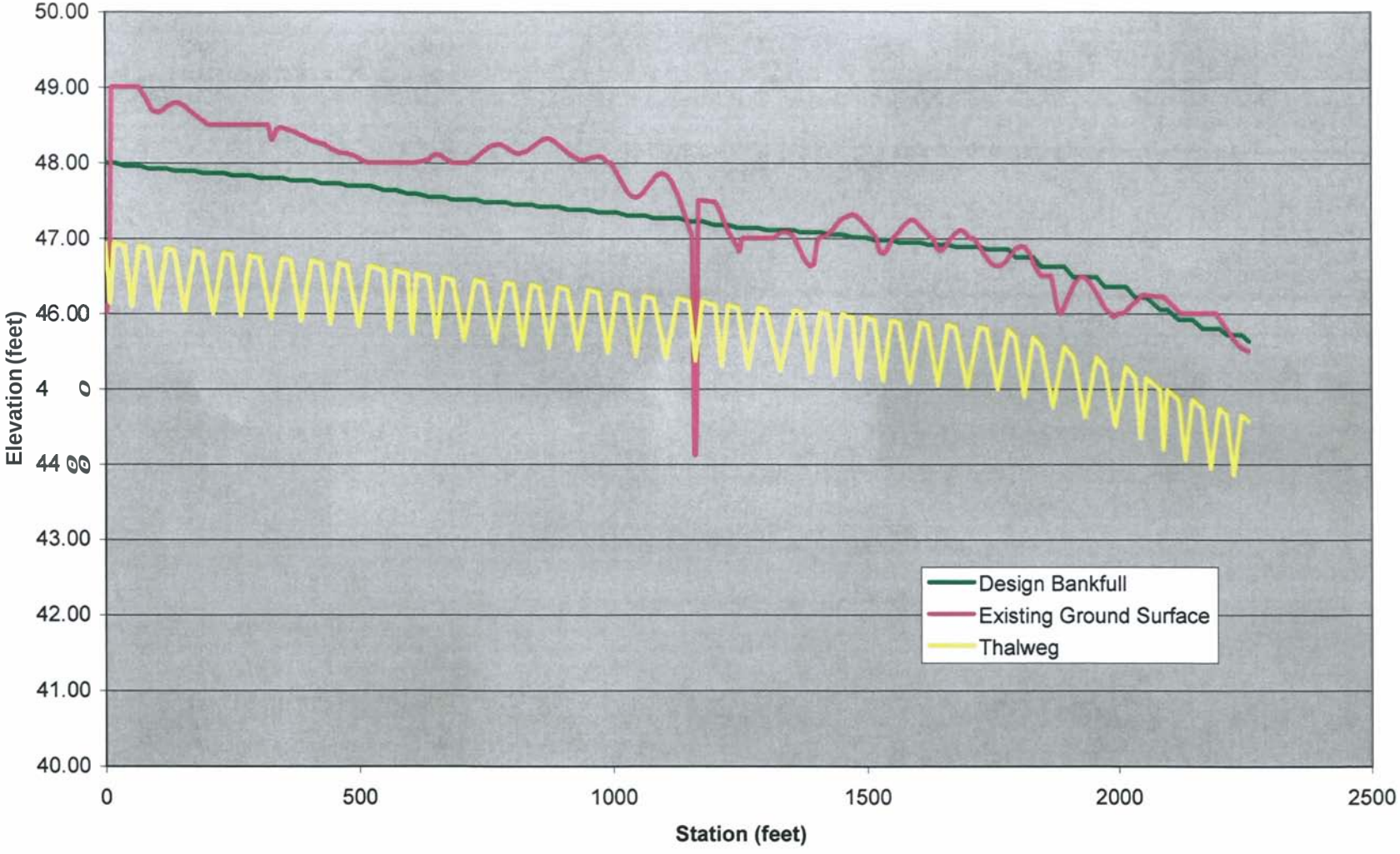
Stallings Site

Jones County, North Carolina

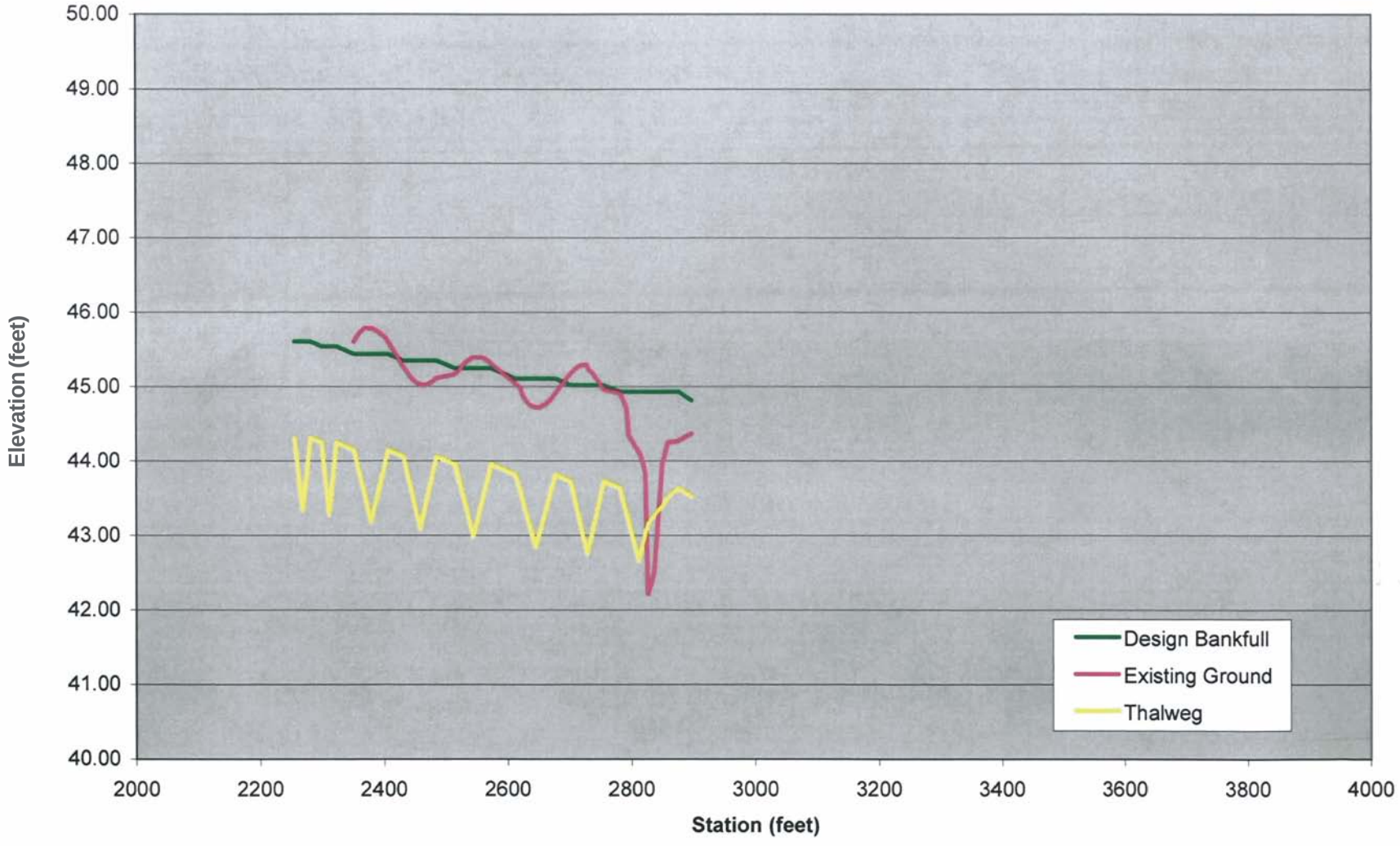
DRAINMOD Cross Sectional Layout

SHEET 12.12

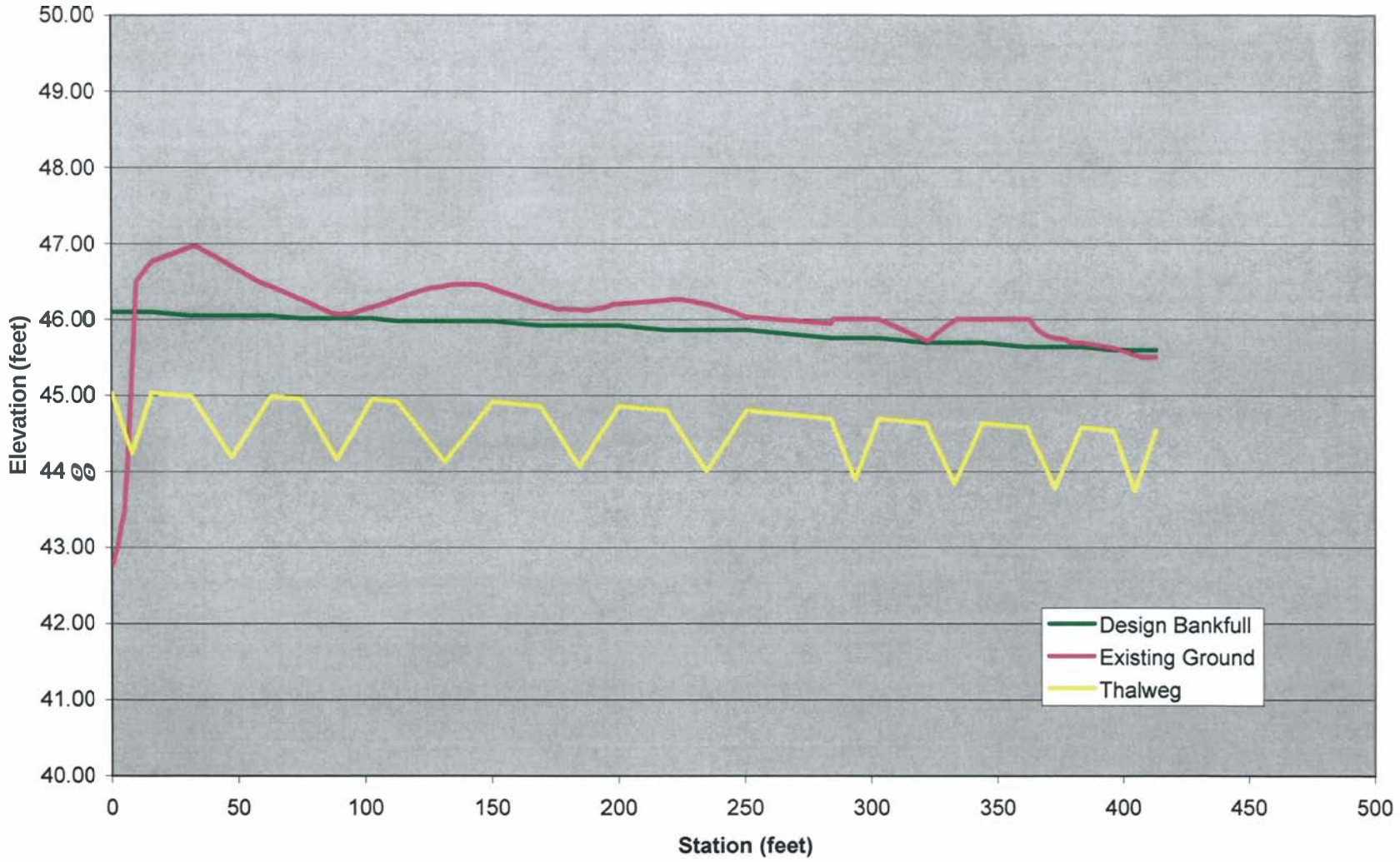
Sheet 12.13 - Longitudinal Profile - Upper Reach A



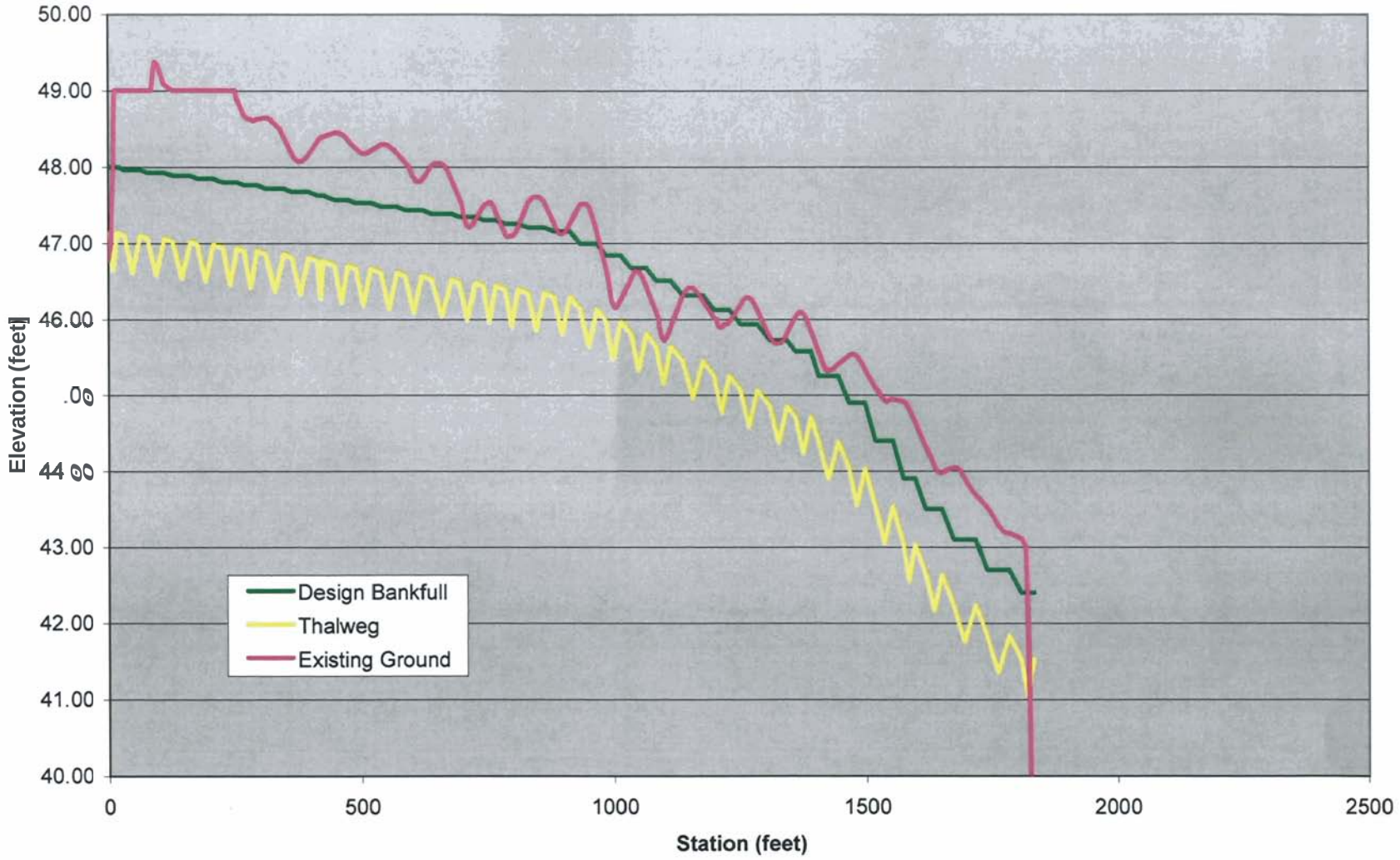
Sheet 12.14 - Longitudinal Profile - Lower Reach A



Sheet 12.15 - Longitudinal Profile - Reach B



Sheet 12.16 - Longitudinal Profile - Reach C



13.0 Appendices

Appendix 1. Project Site Photographs

Appendix 2. Project Site USACE Routine Wetland Determination Data Forms

Appendix 3. Project Site NCDWQ Stream Classification Forms

Appendix 4. Project Site Biological Reconnaissance Form

Appendix 5. Project and Reference Wetland Site Soils

Appendix 6. Reference Site Photographs

Appendix 7. References Site USACE Routine Wetland Determination Data Forms

Appendix 8. Reference Site Wetland Rating Form

Appendix 9. Reference Site NCDWQ Stream Classification Forms

Appendix 10. Hydrologic Gauge Data Summary, Groundwater and Rainfall Information

Appendix 11. HEC–RAS Analysis

Appendix 12. DRAINMOD Analysis

Appendix 13. Correspondence

Appendix 1. Project Site Photographs

Reach A at Wyse Fork Road culvert, facing downstream

Reach B, facing downstream
Note: Reach A runs horizontally in the background.

Confluence of Reaches A (left) and B (right),
Forming the lower end of Reach A (right foreground), facing upstream

Lower end of Reach A, facing upstream
Note: Reaches B and A confluence is at the willow trees in the background.

Confluence of Reach A and C, below project area, facing upstream

Reach C, downstream end, facing Flat Swamp

Beaver dam at lower end of Reach A.

Channel upstream of Reach B, north of Webb Farm Rd.

Intermittent channel north of and at upper end of Reach A.

Headwaters of UT to Flat Swamp on the Brown Property.

Power lines dissect the Stallings site from east to west

The Stallings site was cleared in the past for agricultural production

Appendix 2. Project Site USACE Routine Wetland Determination Data Forms

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Stallings Restoration Site			Date: 11/2/2005
Applicant / Owner: NC EEP			County: Jones
Investigator: P Colwell, M Ruiz, L Myott			State: NC
Do Normal Circumstances exist on the site?	**YES**	NO	Community ID: wetland
Is the site significantly disturbed (Atypical Situation)?	YES	**NO**	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	**NO**	Plot ID: near WN-10

VEGETATION

Dominant Plant Species	Scientific Name	Stratum	Indicator
1 ironwood	*Carpinus caroliniana*	Tree	FAC
2 boxelder	*Acer negundo*	Tree	FACW
3 red maple	*Acer rubrum*	Tree	FAC
4 boxelder	*Acer negundo*	Herb	FACW
5			
6			
7			
8			
9			
10			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 100%			
Remarks:			

HYDROLOGY

[ ] Recorded Data (Describe in Remarks)
- [ ] Stream, Lake, or Tide Gauge
- [ ] Aerial Photographs
- [ ] Other

[X] No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water		(in)
Depth of Free Water in Pit	2	(in)
Depth to Saturated Soil	2	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- [ ] Inundated
- [X] Saturated in Upper 12 Inches
- [ ] Water Marks
- [ ] Drift Lines
- [ ] Sediment Deposits
- [ ] Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required)
- [X] Oxidized Root Channels in Upper 12 inches
- [ ] Water-stained Leaves
- [X] Local Soil Survey Data
- [X] FAC-Neutral Test
- [ ] Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Meggett loam				Drainage Class: poorly drained	
Taxonomy (Subgroup): Typic Albaqualfs				Field Observations Confirm Mapped Type? YES NO	
PROFILE DESCRIPTION					
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	A1	10YR2/1			Sandy loam
4-8	A2	10YR3/1	5YR5/6	Few prominent	Loamy sand
8-12+	B	10YR5/2	5YR5/8	Many prominent	Sandy clay loam

HYDRIC SOIL INDICATORS:

[ ] Histosol
[ ] Histic Epipedon
[ ] Sulfidic Odor
[ ] Aquic Moisture Regime
[ ] Reducing Conditions
[X] Gleyed or Low-Chroma Colors
[ ] Concretions
[ ] High Organic Content in Surface Layer in Sandy Soils
[ ] Organic Streaking in Sandy Soils
[X] Listed on Local Hydric Soils List
[ ] Listed on National Hydric Soils List
[ ] Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	**YES** NO	Is this Sampling Point Within a Wetland? **YES** NO
Wetland Hydrology Present?	**YES** NO	
Hydric Soil Present?	**YES** NO	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Stallings Restoration Site			Date: 11/2/2005
Applicant / Owner: NC EEP			County: Jones
Investigator: P Colwell, M Ruiz, L Myott			State: NC
Do Normal Circumstances exist on the site?	**YES**	NO	Community ID: wetland
Is the site significantly disturbed (Atypical Situation)?	YES	**NO**	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	**NO**	Plot ID: near WS-7

VEGETATION

Dominant Plant Species	Scientific Name	Stratum	Indicator
1 ironwood	*Carpinus caroliniana*	Tree	FAC
2 boxelder	*Acer negundo*	Tree	FACW
3 red maple	*Acer rubrum*	Tree	FAC
4 willow	*Salix nigra*	Shrub	OBL
5 sweetgum	*Liquidambar styraciflua*	Tree	FAC+
6 common rush	*Juncus effusus*	Herb	FACW+
7 cattails	*Typha latifolia*	Herb	OBL
8			
9			
10			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 100%			
Remarks:			

HYDROLOGY

[ ] Recorded Data (Describe in Remarks)
- [ ] Stream, Lake, or Tide Gauge
- [ ] Aerial Photographs
- [ ] Other

[X] No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water		(in)
Depth of Free Water in Pit	7	(in)
Depth to Saturated Soil	0	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- [ ] Inundated
- [X] Saturated in Upper 12 Inches
- [ ] Water Marks
- [ ] Drift Lines
- [ ] Sediment Deposits
- [ ] Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required)
- [X] Oxidized Root Channels in Upper 12 inches
- [X] Water-stained Leaves
- [X] Local Soil Survey Data
- [X] FAC-Neutral Test
- [ ] Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Meggett loam				Drainage Class: poorly drained	
Taxonomy (Subgroup): Typic Albaqualfs				Field Observations Confirm Mapped Type? YES NO	
PROFILE DESCRIPTION					
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR4/1	5YR5/8	Few prominent	Sandy loam
6-8	B	10YR7/1	10YR6/8	Few faint	Sandy loam
8-20+	B	10YR7/1	10YR6/8	Few faint	Sand

HYDRIC SOIL INDICATORS:

[ ] Histosol	[ ] Concretions
[ ] Histic Epipedon	[ ] High Organic Content in Surface Layer in Sandy Soils
[ ] Sulfidic Odor	[ ] Organic Streaking in Sandy Soils
[ ] Aquic Moisture Regime	[X] Listed on Local Hydric Soils List
[ ] Reducing Conditions	[ ] Listed on National Hydric Soils List
[X] Gleyed or Low-Chroma Colors	[ ] Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	**YES** NO	Is this Sampling Point Within a Wetland? **YES** NO
Wetland Hydrology Present?	**YES** NO	
Hydric Soil Present?	**YES** NO	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Stallings Restoration Site			Date: 11/2/2005
Applicant / Owner: NC EEP			County: Jones
Investigator: P Colwell, M Ruiz, L Myott			State: NC
Do Normal Circumstances exist on the site?	**YES**	NO	Community ID: wetland
Is the site significantly disturbed (Atypical Situation)?	YES	**NO**	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	**NO**	Plot ID: near MF-12

VEGETATION

Dominant Plant Species	Scientific Name	Stratum	Indicator
1 willow	*Salix nigra*	Shrub	OBL
2 smartweed	*Polygonum pensylvanicum*	Herb	FACW
3 common rush	*Juncus effusus*	Herb	FACW+
4 cattails	*Typha latifolia*	Herb	OBL
5			
6			
7			
8			
9			
10			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 100%			
Remarks: Trees removed in past			

HYDROLOGY

[ ] Recorded Data (Describe in Remarks)
- [ ] Stream, Lake, or Tide Gauge
- [ ] Aerial Photographs
- [ ] Other

[X] No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water		(in)
Depth of Free Water in Pit	8	(in)
Depth to Saturated Soil	0	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- [ ] Inundated
- [X] Saturated in Upper 12 Inches
- [ ] Water Marks
- [X] Drift Lines
- [ ] Sediment Deposits
- [ ] Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required)
- [X] Oxidized Root Channels in Upper 12 inches
- [ ] Water-stained Leaves
- [X] Local Soil Survey Data
- [X] FAC-Neutral Test
- [ ] Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Meggett loam				Drainage Class: poorly drained	
Taxonomy (Subgroup): Typic Albaqualfs				Field Observations Confirm Mapped Type? YES NO	
PROFILE DESCRIPTION					
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	A	10YR3/2			Sandy loam
4-18+	B	10YR3/2	5YR5/8	Many prominent	Sandy clay loam

HYDRIC SOIL INDICATORS:

[ ] Histosol
[ ] Histic Epipedon
[ ] Sulfidic Odor
[ ] Aquic Moisture Regime
[ ] Reducing Conditions
[X] Gleyed or Low-Chroma Colors
[ ] Concretions
[ ] High Organic Content in Surface Layer in Sandy Soils
[ ] Organic Streaking in Sandy Soils
[X] Listed on Local Hydric Soils List
[ ] Listed on National Hydric Soils List
[ ] Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	**YES** NO	Is this Sampling Point Within a Wetland? **YES** NO
Wetland Hydrology Present?	**YES** NO	
Hydric Soil Present?	**YES** NO	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Stallings Restoration Site			Date: 11/2/2005
Applicant / Owner: NC EEP			County: Jones
Investigator: P Colwell, M Ruiz, L Myott			State: NC
Do Normal Circumstances exist on the site?	**YES**	NO	Community ID: upland
Is the site significantly disturbed (Atypical Situation)?	YES	**NO**	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	**NO**	Plot ID: near WN-10

VEGETATION

Dominant Plant Species	Scientific Name	Stratum	Indicator
1 ironwood	*Carpinus caroliniana*	Tree	FAC
2 loblolly pine	*Pinus taeda*	Tree	FAC
3 sweetgum	*Liquidambar styraciflua*	Tree	FAC+
4 poison ivy	*Toxicodendron radicans*	Herb	FAC
5 common greenbriar	*Smilax rotundifolia*	Herb	FAC
6			
7			
8			
9			
10			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 100%			
Remarks:			

HYDROLOGY

[ ] Recorded Data (Describe in Remarks)
- [ ] Stream, Lake, or Tide Gauge
- [ ] Aerial Photographs
- [ ] Other

[X] No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	N/A	(in)
Depth of Free Water in Pit	N/A	(in)
Depth to Saturated Soil	N/A	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- [ ] Inundated
- [ ] Saturated in Upper 12 Inches
- [ ] Water Marks
- [ ] Drift Lines
- [ ] Sediment Deposits
- [ ] Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required)
- [ ] Oxidized Root Channels in Upper 12 inches
- [ ] Water-stained Leaves
- [ ] Local Soil Survey Data
- [ ] FAC-Neutral Test
- [ ] Other (Explain in Remarks)

Remarks:
No water in hole, soils not saturated

SOILS

Map Unit Name (Series and Phase): Goldsboro sandy loam				Drainage Class: moderately well	
Taxonomy (Subgroup): Aquic Paleudult				Field Observations Confirm Mapped Type? YES NO	
PROFILE DESCRIPTION					
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	A	10YR3/2			Sandy loam
3-6	B	10YR4/3	10YR7/6	Many distinct	Loamy sand
6-10	B	10YR6/6			Loamy sand
10+	B	10YR5/8	10YR7/2	Many distinct	Sandy clay loam

HYDRIC SOIL INDICATORS:

[ ] Histosol
[ ] Histic Epipedon
[ ] Sulfidic Odor
[ ] Aquic Moisture Regime
[ ] Reducing Conditions
[ ] Gleyed or Low-Chroma Colors
[ ] Concretions
[ ] High Organic Content in Surface Layer in Sandy Soils
[ ] Organic Streaking in Sandy Soils
[ ] Listed on Local Hydric Soils List
[ ] Listed on National Hydric Soils List
[ ] Other (Explain in Remarks)

Remarks:
No hydric indicators

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	**YES** NO	Is this Sampling Point Within a Wetland? YES **NO**
Wetland Hydrology Present?	YES **NO**	
Hydric Soil Present?	YES **NO**	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Stallings Restoration Site			Date: 11/2/2005
Applicant / Owner: NC EEP			County: Jones
Investigator: P Colwell, M Ruiz, L Myott			State: NC
Do Normal Circumstances exist on the site?	**YES**	NO	Community ID: upland
Is the site significantly disturbed (Atypical Situation)?	YES	**NO**	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	**NO**	Plot ID: near WS-7

VEGETATION

Dominant Plant Species	Scientific Name	Stratum	Indicator
1 dog fennel	*Eupatorium capillifolium*	Herb	FACU
2 broom sedge	*Andropogon virginicus*	Herb	FAC-
3 common woodsorrel	*Oxalis stricta*	Herb	UPL
4			
5			
6			
7			
8			
9			
10			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 0%			
Remarks: Previously used for agriculture (cotton)			

HYDROLOGY

[ ] Recorded Data (Describe in Remarks) [ ] Stream, Lake, or Tide Gauge [ ] Aerial Photographs [ ] Other [X] No Recorded Data Available			WETLAND HYDROLOGY INDICATORS Primary Indicators: [ ] Inundated [ ] Saturated in Upper 12 Inches [ ] Water Marks [ ] Drift Lines [ ] Sediment Deposits [ ] Drainage Patterns in Wetlands Secondary Indicators (2 or more Required) [ ] Oxidized Root Channels in Upper 12 inches [ ] Water-stained Leaves [ ] Local Soil Survey Data [ ] FAC-Neutral Test [ ] Other (Explain in Remarks)
FIELD OBSERVATIONS			
Depth of Surface Water	N/A	(in)	
Depth of Free Water in Pit	N/A	(in)	
Depth to Saturated Soil	N/A	(in)	
Remarks: No water in hole, soils not saturated			

SOILS

Map Unit Name (Series and Phase): Goldsboro sandy loam					Drainage Class: moderately well
Taxonomy (Subgroup): Aquic Paleudult				Field Observations Confirm Mapped Type? YES NO	
PROFILE DESCRIPTION					
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-8	A	10YR4/4			Loamy sand
8-12	B	2.5YR5/4	10YR4/2	Few prominent	Sandy loam
12	B	2.5YR6/6			Sandy clay loam

HYDRIC SOIL INDICATORS:

[ ] Histosol
[ ] Histic Epipedon
[ ] Sulfidic Odor
[ ] Aquic Moisture Regime
[ ] Reducing Conditions
[ ] Gleyed or Low-Chroma Colors
[ ] Concretions
[ ] High Organic Content in Surface Layer in Sandy Soils
[ ] Organic Streaking in Sandy Soils
[ ] Listed on Local Hydric Soils List
[ ] Listed on National Hydric Soils List
[ ] Other (Explain in Remarks)

Remarks:
No hydric indicators

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	YES **NO**	Is this Sampling Point Within a Wetland? YES **NO**
Wetland Hydrology Present?	YES **NO**	
Hydric Soil Present?	YES **NO**	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Stallings Restoration Site			Date: 11/2/2005
Applicant / Owner: NC EEP			County: Jones
Investigator: P Colwell, M Ruiz, L Myott			State: NC
Do Normal Circumstances exist on the site?	**YES**	NO	Community ID: upland
Is the site significantly disturbed (Atypical Situation)?	YES	**NO**	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	**NO**	Plot ID: south of MF-12

VEGETATION

Dominant Plant Species	Scientific Name	Stratum	Indicator
1 dog fennel	*Eupatorium capillifolium*	Herb	FACU
2 panic grass	*Panicum virgatum*	Herb	FAC+
3 common woodsorrel	*Oxalis stricta*	Herb	UPL
4 poison ivy	*Toxicodendron radicans*	Herb	FACU
5 groundsel	*Baccharis halimifolia*	Herb	FACW
6			
7			
8			
9			
10			
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 30%			
Remarks: Previously used for agriculture (corn)			

HYDROLOGY

[ ] Recorded Data (Describe in Remarks)
- [ ] Stream, Lake, or Tide Gauge
- [ ] Aerial Photographs
- [ ] Other

[X] No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water	N/A	(in)
Depth of Free Water in Pit	N/A	(in)
Depth to Saturated Soil	N/A	(in)

WETLAND HYDROLOGY INDICATORS

Primary Indicators:
- [ ] Inundated
- [ ] Saturated in Upper 12 Inches
- [ ] Water Marks
- [ ] Drift Lines
- [ ] Sediment Deposits
- [ ] Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required)
- [ ] Oxidized Root Channels in Upper 12 inches
- [ ] Water-stained Leaves
- [ ] Local Soil Survey Data
- [ ] FAC-Neutral Test
- [ ] Other (Explain in Remarks)

Remarks:
No water in hole, soils not saturated

SOILS

Map Unit Name (Series and Phase): Goldsboro sandy loam				Drainage Class: moderately well	
Taxonomy (Subgroup): Aquic Paleudult				Field Observations Confirm Mapped Type? YES NO	
PROFILE DESCRIPTION					
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-8	A	10YR5/3			Loamy sand
8-15	B	10YR7/8	10YR5/3 & 5YR5/5	Few faint & Few prominent	Loamy sand

HYDRIC SOIL INDICATORS:

[ ] Histosol
[ ] Histic Epipedon
[ ] Sulfidic Odor
[ ] Aquic Moisture Regime
[ ] Reducing Conditions
[ ] Gleyed or Low-Chroma Colors
[ ] Concretions
[ ] High Organic Content in Surface Layer in Sandy Soils
[ ] Organic Streaking in Sandy Soils
[ ] Listed on Local Hydric Soils List
[ ] Listed on National Hydric Soils List
[ ] Other (Explain in Remarks)

Remarks:
No hydric indicators

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	YES **NO**	Is this Sampling Point Within a Wetland? YES **NO**
Wetland Hydrology Present?	YES **NO**	
Hydric Soil Present?	YES **NO**	

Remarks:

Appendix 3. Project Site NCDWQ Stream Classification Forms

NCDWQ Stream Classification Form

Project Name: Stallings River Basin: Neuse County: Jones Evaluator: PBC

DWQ Project Number: N/A Nearest Named Stream: Flat Swamp Latitude: Signature:

Date: 04/11/02 USGS QUAD: Dover Crossroads Longitude:

Location/Directions: Stallings Property – Off of State Road 1002, Stream Reach B

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgment of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	**0**	1	2	3
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	**1**	2	3
3) Are Natural Levees Present?	**0**	1	2	3
4) Is The Channel Sinuous?	**0**	1	2	3
5) Is There An Active (Or Relic) Floodplain Present?	0	**1**	2	3
6) Is The Channel Braided?	**0**	1	2	3
7) Are Recent Alluvial Deposits Present?	0	**1**	2	3
8) Is There A Bankfull Bench Present?	**0**	1	2	3
9) Is A Continuous Bed & Bank Present?	**0**	1	2	3
*(*NOTE: If Bed & Bank Caused By Ditching And WITHOUT Sinuosity Then Score=0*)*				
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map *And/Or* In Field) Present?	*Yes*=3	*No*=0	***1-Receives other "main ditches"***	

***PRIMARY GEOMORPHOLOGY INDICATOR POINTS*: 4**

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	0	**1**	2	3

***PRIMARY HYDROLOGY INDICATOR POINTS*: 1**

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	3	**2**	1	0
2) Are Rooted Plants Present In Streambed?	3	**2**	1	0
3) Is Periphyton Present?	0	**1**	2	3
4) Are Bivalves Present?	0	**1**	2	3

***PRIMARY BIOLOGY INDICATOR POINTS*: 6**

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	**0**	.5	1	1.5
2) Is There A Grade Control Point In Channel?	**0**	.5	1	1.5
3) Does Topography Indicate A Natural Drainage Way?	0	**.5**	1	1.5

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 0.5

II. Hydrology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Is This Year's (Or Last's) Leaf litter Present In Streambed?	1.5	**1**	.5	0
2) Is Sediment On Plants (Or Debris) Present?	0	**.5**	1	1.5
3) Are Wrack Lines Present?	0	.5	1	**1.5**
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	.5	1	**1.5**
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	0	.5	1	**1.5**
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)?	*Yes=1.5*			***No*=0**

SECONDARY HYDROLOGY INDICATOR POINTS: 6

III. Biology	**Absent**	**Weak**	**Moderate**	**Strong**		
1) Are Fish Present?	0	**.5**	1	1.5		
2) Are Amphibians Present?	0	**.5**	1	1.5		
3) Are AquaticTurtles Present?	**0**	.5	1	1.5		
4) Are Crayfish Present?	0	.5	**1**	1.5		
5) Are Macrobenthos Present?	0	**.5**	1	1.5		
6) Are Iron Oxidizing Bacteria/Fungus Present?	**0**	.5	1	1.5		
7) Is Filamentous Algae Present?	0	**.5**	1	1.5		
8) Are Wetland Plants In Streambed? N/A	**SAV**	**Mostly OBL**	**Mostly FACW**	**Mostly FAC**	**Mostly FACU**	**Mostly UPL**
(**NOTE:** If Total Absence Of All Plants In Streambed As Noted Above Skip This Step **UNLESS** SAV Present*).*	2	**1**	.75	.5	0	0

SECONDARY BIOLOGY INDICATOR POINTS: 4

TOTAL POINTS (Primary + Secondary)= 21.5 (If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)

NCDWQ Stream Classification Form

Project Name: Stallings River Basin: Neuse County: Jones Evaluator: PBC

DWQ Project Number: N/A Nearest Named Stream: Flat Swamp Latitude: Signature:

Date: 04/11/02 USGS QUAD: Dover Crossroads Longitude:

Location/Directions: Stallings Property – Off of State Road 1002, Stream Reach C

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgment of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	**0**	1	2	3
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	**1**	2	3
3) Are Natural Levees Present?	**0**	1	2	3
4) Is The Channel Sinuous?	**0**	1	2	3
5) Is There An Active (Or Relic) Floodplain Present?	0	**1**	2	3
6) Is The Channel Braided?	**0**	1	2	3
7) Are Recent Alluvial Deposits Present?	0	**1**	2	3
8) Is There A Bankfull Bench Present?	**0**	1	2	3
9) Is A Continuous Bed & Bank Present? *(*NOTE: If Bed & Bank Caused By Ditching And WITHOUT Sinuosity Then Score=0*)*	**0**	1	2	3
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map *And/Or* In Field) Present?	*Yes*=3	*No*=0		

***PRIMARY GEOMORPHOLOGY INDICATOR POINTS*: 3**

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	0	**1**	2	3

***PRIMARY HYDROLOGY INDICATOR POINTS*: 1**

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	3	**2**	1	0
2) Are Rooted Plants Present In Streambed?	3	**2**	1	0
3) Is Periphyton Present?	0	**1**	2	3
4) Are Bivalves Present?	**0**	1	2	3

***PRIMARY BIOLOGY INDICATOR POINTS*: 5**

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	**0**	.5	1	1.5
2) Is There A Grade Control Point In Channel?	**0**	.5	1	1.5
3) Does Topography Indicate A Natural Drainage Way?	0	**.5**	1	1.5

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 0.5

II. Hydrology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Is This Year's (Or Last's) Leaf litter Present In Streambed?	1.5	**1**	.5	0
2) Is Sediment On Plants (Or Debris) Present?	0	**.5**	1	1.5
3) Are Wrack Lines Present?	0	.5	**1**	1.5
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	.5	1	**1.5**
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	0	.5	1	**1.5**
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)?	***Yes=1.5***			*No*=0

SECONDARY HYDROLOGY INDICATOR POINTS: 5.5

III. Biology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Are Fish Present?	0	**.5**	1	1.5
2) Are Amphibians Present?	0	**.5**	1	1.5
3) Are AquaticTurtles Present?	**0**	.5	1	1.5
4) Are Crayfish Present?	0	.5	**1**	1.5
5) Are Macrobenthos Present?	0	**.5**	1	1.5
6) Are Iron Oxidizing Bacteria/Fungus Present?	**0**	.5	1	1.5
7) Is Filamentous Algae Present?	0	**.5**	1	1.5

8) Are Wetland Plants In Streambed? N/A	**SAV**	**Mostly OBL**	**Mostly FACW**	**Mostly FAC**	**Mostly FACU**	**Mostly UPL**
(**NOTE:** If Total Absence Of All Plants In Streambed As Noted Above Skip This Step **UNLESS** SAV Present*).*	2	**1**	.75	.5	0	0

SECONDARY BIOLOGY INDICATOR POINTS: 4

TOTAL POINTS (Primary + Secondary)= 19 (If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)

Appendix 4. Project Site Biological Reconnaissance Form

BIOLOGICAL RECONNAISANCE FORM
Perennial/Intermittent Point

Send to Dave Penrose
401/Wetlands Unit, Division of Water Quality
1650 Mail Services Center
Raleigh, North Carolina 27699-1621
e-mail Dave.Penrose@NCmail.net, FAX 919/715-5637

a) Location Stallings Site, DOT project

Stream Name: UT Flat Swamp		Receiving Waterbody: Rattlesnake Branch, Trent River	
Location/Road: nr SR 1002	County: Jones	Date: 21Feb02	Regional Office: Washington RO
Basin: Neuse	Subbasin: 030411	Latitude/Longitude: Three locations (see below)	
Ecoregion: Coastal Plain	Rosgen Class: ?	Observers: DP, LeiLani, Lia Myott	USGS Quad Sheet: Dover
Notes (attach photograph or drawing on the back of this form): We collected samples at three locations (see attached map): Marker 20 is a UT at SR 1306 north of the mainstem (approximately 72AC drainage at 351020/772958), Marker 21 at SR 1002 (351015/772917) and an upstream reference site above site at Marker 22 (351014/772930). These were all difficult I/P calls, presence of a Sphaerium (fingernail clams) were used to make calls as crayfish were collected at all sites. Flow was eliminated at all downstream sites because of recent beaver activity.			

b) Habitat

Primary Adjacent Land Use: Agriculture, cotton	Riparian Zone Characteristics: riparian canopy eliminated at all but site at Marker 22.	
Stream Width: <1 meter	Flow Conditions: flowing at all upstream locations, beaver activity eliminated flow at downstream locations.	Stream Order: first
Stream Permanence Characteristics, Rating (if relevant): bed and bank characteristics, degree of incision and catchment size (370 AC at confluence with Flat Swamp)		

c) Biology

Benthic Macroinvertebrate Taxa: Amphipoda: X Isopoda: X Decapoda: X Chironomidae: X Oligochaeta: X Mollusca: X Ephemeroptera: ☐ Plecoptera: ☐ Trichoptera: ☐ Coleoptera: ☐ Other Diptera: X (blackflies)
Fish and Salamander Taxa: Gambusia in pools
I/P Results: Based on these collections an I/P point was sited at the bridge at SR 1306 (perennial below the bridge) on the UT of the mainstem, and for the entire reach of the mainstem of the UT below Marker 22. There was a distinct change in the composition of benthic fauna between Marker 22 and 21 perhaps due to landuse activities. The fauna at the upstream site was dominated by midges, blackflies and Sphaerium, while very little benthos was collected at Marker 21.

Appendix 5. Project and Reference Wetland Site Soils

Soil Profile 1

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: proposed nonriverine wetland	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field (corn remnants)
Moisture Status: moist	**Landscape Position**: interstream divide
Aspect: n/a	**Depth to water**: water in the hole at 36"
Mapped Soil Series: Meggett	**Depth to Redox**: 7"
Weather: sunny **Hole Depth**: 48"	**Depth to CH≤2 Matrix**: 24"
Notes:	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-7	10YR4/2		loamy sand	Weak	Med	Granular	friable	Abrupt	
E	7-18	10YR6/3	10YR5/8 c2d 7.5YR5/8 f2d	sandy loam	Weak	Med	Granular	friable	Gradual	7.5YR4/6 oxidized root channels
E2	18-24	10YR5/4	10YR5/8 f2d	loamy sand	Weak	Med	Granular	friable	Gradual	Few small pebbles
Btg1	24-30	10YR5/1	10YR5/6 c2d 7.5YR5/8 c2d	sandy clay loam	Weak	Med	Subangular blocky	sticky, plastic	Gradual	
Btg2	30-34	N 7/	7.5YR5/8 c2d 7.5YR8/1 f1d	sandy clay to sandy clay loam			Massive	very sticky, very plastic	Gradual	
Btg3	34-43	N 5/	7.5YR5/8 c2d 7.5YR6/8 c2d	clay			Massive	very sticky, very plastic	Gradual	
Btg4	43-48+	10YR6/8 N 5/	5PB/5 c2d	clay			Massive	sticky, plastic		

Soil Profile 2

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: proposed nonriverine wetland	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field (corn remnants), a few tufts of *juncus*
Moisture Status: moist	**Landscape Position**: interstream divide
Aspect: n/a	**Depth to water**: see note
Mapped Soil Series: Meggett	**Depth to Redox**: 8"
Weather: cloudy **Hole Depth**: 56"	**Depth to CH≤2 Matrix**: 24"
Notes: Water perched at surface but does not continue throughout soil profile. Green mottles in Btg5 are a little yellower than what was in the color book (no suitable color).	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-8	10YR3/2		loam	Weak	Med	Granular	friable	Abrupt	saturated
Btg1	8-12	10YR6/2	10YR3/2 m2d 10YR5/8 c2d	sandy clay loam	Weak	Med	SBK	sticky, plastic	Gradual	
Btg2	12-27	10YR5/1	10YR5/8 m2d	clay	Weak	Med	SBK	sticky, plastic	Gradual	fine common roots
Btg3	27-36	10YR6/1	10YR6/8 c2p 2.5Y7/6 f2p	clay			Massive	very sticky, very plastic	Gradual	
Btg4	36-50	10Y6/1	10YR6/8 m2d 10YR5/8 c2d	clay			Massive	very sticky, very plastic	Gradual	Found a 2.5" rounded rock around 45"
Btg5	50-56+	10Y6/1	10YR6/8 m3d 7.5YR8/1 f1d 5PB5/1 c2d 5G5/2 c3d	clay			Massive	sticky, plastic	Gradual	Few Mn concretions; starting to transition to C horizon

Soil Profile 3

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: edge of proposed nonriverine wetland	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field
Moisture Status: moist	**Landscape Position**: interstream divide/shoulder
Aspect: n/a	**Depth to water**:
Mapped Soil Series: Meggett	**Depth to Redox**: 10"
Weather: sunny **Hole Depth**: 48"	**Depth to CH≤2 Matrix**: 10"
Notes:	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-6	10YR4/2		loam	Weak	Med	Granular	friable	Abrupt	
E	6-10	2.5Y6/3		sandy loam	Weak	Med	SBK	friable	Gradual	
Btg1	10-22	10YR5/1	10YR5/6 f2d 2.5Y4/6 m2p	clay loam to clay			Massive	sticky, plastic	Gradual	
Btg2	22-30	10Y6/1	10YR5/6 c2d 2.5YR4/6 m2p	clay			Massive	very sticky, very plastic	Gradual	
Btg3	30-40	10YR6/1	10YR6/8 m2d	clay			Massive	very sticky, very plastic	Gradual	
Btg4	40-44	10YR6/8	10YR6/1 m3d	clay			Massive	very sticky, very plastic	Gradual	few Fe concretions
Btg5	44-48+	10Y6/1	5PB/5 c2d 10GY5/1 c2d 10YR5/8 c2p 7.5YR8/1 f1d	clay			Massive	very sticky, very plastic		Starting to transition to C horizon

Soil Profile 4

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: south side of stream reach B	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field
Moisture Status: wet	**Landscape Position**: toeslope
Aspect: n/a	**Depth to water**: 10"
Mapped Soil Series: Meggett	**Depth to Redox**: mottles at surface
Weather: sunny **Hole Depth**: 64"	**Depth to CH≤2 Matrix**: 10"
Notes: Water was present at 10" (perching?) but was really saturated at 20" Few clay films present in Btg4 seem to be from more than just auger effects	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-6	10YR4/2	5YR4/6 f1f	loamy sand	Weak	Med	Granular	friable	Abrupt	
E	6-10	2.5Y6/3		loamy sand	Weak	Med	Granular	friable	Gradual	
Btg1	10-20	10YR5/2	10YR6/8 c2d	sandy clay loam and clay			Massive	sticky, plastic	Gradual	
Btg2	20-26	10YR5/2	10YR6/8 m3d	clay			Massive	very sticky, very plastic	Gradual	
Btg3	26-42	10Y6/1	10YR6/8 m3d 5PB5/1 c2d 7.5YR8/1 f1d	clay			Massive	very sticky, very plastic	Gradual	few Mn concretions
Btg4	42-64+	10Y6/1	10YR5/8 m2d 5PB5/1 c2d	sandy clay loam and sandy loam			Massive	sticky, plastic	Gradual	few clay films; starting to transition to C horizon

Soil Profile 5

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: small proposed nonriverine wetland south of powerline	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field (corn remnants, fennel)
Moisture Status: moist	**Landscape Position**: interstream divide
Aspect: n/a	**Depth to water**: 40"
Mapped Soil Series: Meggett	**Depth to Redox**: 21"
Weather: sunny **Hole Depth**: 48"	**Depth to CH≤2 Matrix**: 36"
Notes:	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-6	10YR4/3		loam	Weak	Med	Granular	friable	Abrupt	
E	6-21	10YR5/6		sandy loam	Weak	Med	Granular	friable	Gradual	
E2	21-26	10YR6/3	7.5YR5/6 c2f	loamy sand	Weak	Med	Granular	friable	Gradual	
Bt1	26-30	10YR5/6	7.5YR5/8 c2d	sandy clay loam	Weak	Med	SBK	sticky, plastic	Gradual	
Bt2	30-36	10YR5/6	10YR4/6 c2d 10YR6/3 c2d	clay	Weak	Med	SBK	sticky, plastic	Gradual	
Btg3	36-42	10YR6/1	7.5YR5/8 c2p 2.5YR4/8 c2p	sandy clay loam	Weak	Med	SBK	sticky, plastic	Gradual	
Bt4	42-48+	7.5YR5/8	10YR6/1 c2p 2.5YR4/8 c2d	clay loam	Weak	Med	SBK	sticky, plastic		

Soil Profile 6

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: proposed nonriverine wetland	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field (fennel)
Moisture Status: moist	**Landscape Position**: interstream divide
Aspect: n/a	**Depth to water**: 36"
Mapped Soil Series: Meggett	**Depth to Redox**: a few oxidized root channels at surface
Weather: sunny **Hole Depth**: 51"	**Depth to CH≤2 Matrix**: 15"
Notes: Green mottles in Btg4 are a little yellower than what was in the color book (no suitable color). Bluish clay near bottom of hole is homogeneous clay while the redder clay has sand/other particles in it.	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-8	10YR3/2		loamy sand	Weak	Med	Granular	friable	Abrupt	
E	8-11	10YR6/3	10YR5/6 m2d	sandy loam	Weak	Med	Granular	friable	Gradual	
Btg1	11-15	10YR5/3	10YR5/6 m3f 5YR3/4 f2d	sandy clay	Weak	Med	Granular	friable	Gradual	
Btg2	15-38	10YR5/1	10YR5/6 m2d	clay	Weak	Med	SBK	sticky, plastic	Gradual	
Btg3	38-44	N 6/	10YR5/8 m3d 7.5YR8/1 f1d	clay			Massive	very sticky, very plastic	Gradual	
Btg4	44-51+	N 6/	10YR5/8 m3d 5PB5/1 c2d 5G5/2 c3d	clay			Massive	very sticky, very plastic	Gradual	Starting to transition to C horizon

Soil Profile 7

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: proposed nonriverine wetland	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field (fennel)
Moisture Status: moist	**Landscape Position**: interstream divide
Aspect: n/a	**Depth to water**: water in hole at 43"
Mapped Soil Series: Meggett	**Depth to Redox**: 10"
Weather: sunny **Hole Depth**: 48"	**Depth to CH≤2 Matrix**: 33"
Notes:	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-7	10YR4/2		sandy loam	Weak	Med	Granular	friable	Abrupt	
B1	7-10	10YR6/6		sandy loam	Weak	Med	Granular	friable	Gradual	More clayey than Ap but still a SL
Btg2	10-20	2.5Y5/4	7.5YR5/8 m3d 5YR4/6 c2d	clay loam	Weak	Med	SBK	sticky, plastic	Gradual	More red as you go deeper
Btg3	20-33	10YR5/6	2.5YR4/6 c2d 7.5YR5/8 m3d	clay			Massive	very sticky, very plastic	Gradual	
Btg4	33-48+	10Y6/1	2.5YR4/6 c2d 7.5YR5/8 m3d	clay/sandy clay			Massive	very sticky, very plastic	Gradual	Few 1cm rounded quartz pebbles

Soil Profile 8

Described by: ALC/LEM	**Date**: Feb 9, 2006
Location: upland near Webb Farm Road	**Project**: Stallings
County: Jones	**Slope**: A
Parent Material: marine sediment	**Vegetative Cover**: ag field (fennel/cotton remnants)
Moisture Status: moist	**Landscape Position**: interstream divide
Aspect: n/a	**Depth to water**: some perched water, B2 saturated
Mapped Soil Series: Goldsboro	**Depth to Redox**: 10"
Weather: cloudy **Hole Depth**: 54"	**Depth to CH≤2 Matrix**: 33"
Notes: Water seems to be perched above thick clay layer	

Horizon	Depth (inches)	Matrix Color	Mottles	Texture	Structure			Consistence	Boundary	Other
					Grade	Class	Type			
Ap	0-8	2.5Y4/3		sandy loam	Weak	Med	Granular	friable	Abrupt	
B1	8-16	2.5Y5/6	10YR4/3 f2d 7.5YR4/6 f2d	sandy loam	Weak	Med	Granular	friable	Gradual	More clay than Ap
B2	16-24	2.5Y6/4		sandy loam	Weak	Med	Granular	friable	Gradual	saturated
Bt3	24-30	10YR5/6	7.5YR5/8 m3d	sandy clay loam	Weak	Med	SBK	sticky, plastic	Gradual	
Bt4	30-33	7.5YR5/8	10YR5/6 m3d	clay	Weak	Med	SBK	sticky, plastic	Gradual	
Btg5	33-42	10YR6/2 2.5Y5/6	7.5YR4/6 c2d	clay			Massive	very sticky, very plastic	Gradual	
Btg6	42-54+	10YR6/2	5YR5/6 c2d 5YR4/6 c2d	clay			Massive	very sticky, very plastic		Some clay films, a few Fe concretions, a few small rocks

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Soil Profile 9

Soil Series MEGGET — **Date** AUGUST 17, 2004

Location N 35° 10' 3.3" W 77° 28' 53.3" — **Drainage (wetness) Class** Poorly Drained

County JONES — **Slope Percent** < 2

Parent Material Fine textured sediment & soft marl — **Vegetative Cover** edge of cotton field - between field and swamp forest

Moisture Status

Classification Typic Albaqualfs

Aspect

Landscape Position terrace / floodplain of swamp — **Described by** S SHEUNGOSKI

Horiz.	Depth	Main Colors (moist)	Mottles	Texture	Structure			Moist & Wet Consist.	Ped. Coatings	Horiz. Boundary	Other Remarks
					Grade	Class	Type				
Ap	0-10	10YR 4/2		fine sandy loam	weak	fine	gran	friable		gradual	oxidized rhizospheres
B1	10-16	10YR 3/2	faint 10YR 4/3	loamy sand	weak	fine	gran	friable		gradual	wet / saturated layer
B2	16+	10YR 3/1	faint (streaking) 10YR 4/4 10YR 5/8 ↑ concentrations	clay	mod	med	sub-angl. blocky	firm			

Soil Profile 9

SOIL PROFILE INTERPRETATION

INFILTRATION RATE
___ High
___ Moderate
X Low

HYDRAULIC CONDUCTIVITY
___ High
___ Moderate
X Low

AVAILABLE WATER
___ High
X Moderate
___ Low
___ Very Low

SOIL WETNESS CLASS
___ 1. >150cm
___ 2. 100-150cm
X 3. 50-100cm
___ 4. 25-50cm
___ 5. < 25cm

SITE CHARACTERISTICS

POSITION OF SITE
X Flood Plain
___ Stream terrace
___ Upland
___ Footslope
___ Depression
___ Drainageway

PARENT MATERIAL
___ Alluvium
___ Residuum
___ Colluvium
X Unconsolidated Coastal Plain Sediment

SOIL SLOPE
X Nearly level (0-2%)
___ Gently sloping (2-6%)
___ Sloping (6-12%)
___ Strongly sloping (12-20%)
___ Moderately steep (20-30%)
___ Steep (>30%)

SOIL CLASSIFICATION

EPIPEDONS
___ Mollic
___ Ochric
___ Umbric
___ Histic

SUBSURFACE HORIZONS
___ Albic
___ Argillic
___ Cambic
___ Kandic
___ Spodic
___ None

ORDER
___ Alfisols
___ Entisols
___ Inceptisols
___ Mollisols
___ Spodosols
___ Ultisols
___ Histosols

EROSION
X Overwash
___ None to slight
___ Moderate
___ Severe

SURFACE RUNOFF
X Ponded
___ Very slow
___ Slow
___ Medium
___ Rapid
___ Very Rapid

(8)

Soil Profile 10 - Reference Wetland

Soil Series Stockade | **Date** AUGUST 17, 2004

Location N 35° 9' 54.2" W 77° 28' 52.7" | **Drainage (wetness) Class** Very Poorly Drained

County JONES | **Slope Percent**

Parent Material Fine textured sediment mixed in soft marl | **Vegetative Cover** Swamp forest

Moisture Status

Classification Typic Umbraqualfs

Aspect

Landscape Position floodplain of swamp | **Described by** S SHELINGOSKI

Horiz.	Depth	Main Colors (moist)	Mottles	Texture	Structure			Moist & Wet Consist.	Ped. Coatings	Horiz. Boundary	Other Remarks
					Grade	Class	Type				
Ap	0-16	10YR 2/1		clay loam	weak	med	gran	friable		abrupt	
A1	10-16	10YR 3/1		clay	weak	med	subang blocky	firm sticky		gradual	
B1	16-20	10YR 3/1	2.5Y 4/3 Concentrations	clay	weak	med	subang. blocky	firm sticky		gradual	
B1g	20+	2.5Y 4/1	7.5 YR 5/8 10 YR 5/6 Concentrations fine, common	clay	weak	med	subang. blocky	firm sticky		gradual	

Soil Profile 10

SOIL PROFILE INTERPRETATION

INFILTRATION RATE
- ___ High
- ___ Moderate
- X Low

HYDRAULIC CONDUCTIVITY
- ___ High
- ___ Moderate
- X Low

AVAILABLE WATER
- X High
- ___ Moderate
- ___ Low
- ___ Very Low

SOIL WETNESS CLASS
- ___ 1. >150cm
- ___ 2. 100-150cm
- ___ 3. 50-100cm
- ___ 4. 25-50cm
- X 5. < 25cm

SITE CHARACTERISTICS

POSITION OF SITE
- X Flood Plain
- ___ Stream terrace
- ___ Upland
- ___ Footslope
- ___ Depression
- ___ Drainageway

PARENT MATERIAL
- ___ Alluvium
- ___ Residuum
- ___ Colluvium
- X Unconsolidated Coastal Plain Sediment

SOIL SLOPE
- X Nearly level (0-2%)
- ___ Gently sloping (2-6%)
- ___ Sloping (6-12%)
- ___ Strongly sloping (12-20%)
- ___ Moderately steep (20-30%)
- ___ Steep (>30%)

SOIL CLASSIFICATION

EPIPEDONS
- ___ Mollic
- ___ Ochric
- ___ Umbric
- ___ Histic

SUBSURFACE HORIZONS
- ___ Albic
- ___ Argillic
- ___ Cambic
- ___ Kandic
- ___ Spodic
- ___ None

ORDER
- ___ Alfisols
- ___ Entisols
- ___ Inceptisols
- ___ Mollisols
- ___ Spodosols
- ___ Ultisols
- ___ Histosols

EROSION
- X Overwash
- ___ None to slight
- ___ Moderate
- ___ Severe

SURFACE RUNOFF
- X Ponded
- ___ Very slow
- ___ Slow
- ___ Medium
- ___ Rapid
- ___ Very Rapid

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Soil Profile 11

Soil Series GOLDSBORO / WEGGETT

Location N 35° 10' 12.0" W 77° 28' 45.8"

County JONES

Parent Material Fine textured sediment

Moisture Status

Classification Aquic Paleudult

Aspect

Landscape Position terrace

Date AUGUST 17, 2004

Drainage (wetness) Class Moderately well Drained

Slope Percent 0-2

Vegetative Cover Cotton field

Described by S. SHELNGOSKI

Horiz.	Depth	Main Colors (moist)	Mottles	Texture	Structure			Moist & Wet Consist.	Ped. Coatings	Horiz. Boundary	Other Remarks
					Grade	Class	Type				
Ap	0-14	10YR 4/2		Sandy loam	weak	med	gran	v. friable		clear/ distinct	Standing water on surface wet
B1	14-24	10YR 4/2 10YR 6/6		loamy sand	weak	fine	subang blocky	v. friable		gradual	
B2	24-30	10YR 5/4		coarse sandy clay	weak	fine	subang blocky	friable, sl. sticky		clear	dry soil
B3	30-34	10YR 5/8 10YR 5/4		clay	weak	fine	subang blocky	friable sl sticky		gradual	dry soil
B4	34+	10YR 5/8		clay	weak	med	subang blocky	firm friable sticky plastic			

Soil Profile 11

SOIL PROFILE INTERPRETATION

INFILTRATION RATE
- ___ High
- ___ Moderate
- X Low

HYDRAULIC CONDUCTIVITY
- ___ High
- ___ Moderate
- X Low

AVAILABLE WATER
- ___ High
- ___ Moderate
- X Low
- ___ Very Low

SOIL WETNESS CLASS
- X 1. >150cm
- ___ 2. 100-150cm
- ___ 3. 50-100cm
- ___ 4. 25-50cm
- ___ 5. < 25cm

SITE CHARACTERISTICS

POSITION OF SITE
- ___ Flood Plain
- X Stream terrace
- ___ Upland
- ___ Footslope
- ___ Depression
- ___ Drainageway

PARENT MATERIAL
- ___ Alluvium
- ___ Residuum
- ___ Colluvium
- X Unconsolidated Coastal Plain Sediment

SOIL SLOPE
- X Nearly level (0-2%)
- ___ Gently sloping (2-6%)
- ___ Sloping (6-12%)
- ___ Strongly sloping (12-20%)
- ___ Moderately steep (20-30%)
- ___ Steep (>30%)

SOIL CLASSIFICATION

EPIPEDONS
- ___ Mollic
- ___ Ochric
- ___ Umbric
- ___ Histic

SUBSURFACE HORIZONS
- ___ Albic
- ___ Argillic
- ___ Cambic
- ___ Kandic
- ___ Spodic
- ___ None

ORDER
- ___ Alfisols
- ___ Entisols
- ___ Inceptisols
- ___ Mollisols
- ___ Spodosols
- X Ultisols
- ___ Histosols

EROSION
- ___ Overwash
- X None to slight
- ___ Moderate
- ___ Severe

SURFACE RUNOFF
- X Ponded
- ___ Very slow
- ___ Slow
- ___ Medium
- ___ Rapid
- ___ Very Rapid

Appendix 6. Reference Site Photographs

Riverine wet hardwood flat reference wetland.

Jack Cabin Branch facing upstream from bottom of reach

Jack Cabin Branch facing downstream from middle of reach

Beaverdam Branch riffle cross-section facing downstream

Beaverdam Branch meander and point bar

Bullard Branch meander facing downstream

Bullard Branch meander facing upstream

Appendix 7. References Site USACE Routine Wetland Determination Data Forms

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Stallings Restoration Site Riverine Reference			Date: 5/9/2002
Applicant / Owner: NC EEP			County: Jones
Investigator: L Myott			State: NC
Do Normal Circumstances exist on the site?	**YES**	NO	Community ID: wetland
Is the site significantly disturbed (Atypical Situation)?	YES	**NO**	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse)	YES	**NO**	Plot ID: by well J

VEGETATION

Dominant Plant Species	Scientific Name	Stratum	Indicator
1. ironwood	*Carpinus caroliniana*	Tree	FAC
2. sweetgum	*Liquidambar styraciflua*	Tree	FAC+
3. red maple	*Acer rubrum*	Tree	FAC
4. elm	*Ulmus Americana*	Tree	FACW
5. Southern red oak	*Quercus falcata*	Tree	FACU-
6. willow oak	*Quercus phellos*	Tree	FACW-
7. black willow	*Salix nigra*	Tree	FACW-
8. jewelweed	*Impatiens capensis*	Tree	OBL
9. cattail	*Typha* spp	Herb	FACW
10. giant cane	*Arundinaria gigantea*	Herb	FACW
11. boxelder	*Acer negundo*	Shrub	FACW
12. greenbrier	*Smilax rotundifolia*	Vine	FAC
13. saw greenbrier	*Smilax bona-nox*	Vine	FAC
14. poison ivy	*Toxicodendron radicans*	Vine	FAC
Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): >50%			
Remarks:			

HYDROLOGY

[ ] Recorded Data (Describe in Remarks)
- [ ] Stream, Lake, or Tide Gauge
- [ ] Aerial Photographs
- [ ] Other

[X] No Recorded Data Available

FIELD OBSERVATIONS

Depth of Surface Water		(in)
Depth of Free Water in Pit	9	(in)
Depth to Saturated Soil	4	(in)

WETLAND HYDROLOGY INDICATORS
Primary Indicators:
- [ ] Inundated
- [X] Saturated in Upper 12 Inches
- [X] Water Marks
- [X] Drift Lines
- [ ] Sediment Deposits
- [X] Drainage Patterns in Wetlands

Secondary Indicators (2 or more Required)
- [X] Oxidized Root Channels in Upper 12 inches
- [ ] Water-stained Leaves
- [X] Local Soil Survey Data
- [X] FAC-Neutral Test
- [ ] Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Meggett loam				Drainage Class: poorly drained	
Taxonomy (Subgroup): Typic Albaqualfs				Field Observations Confirm Mapped Type? YES NO	
PROFILE DESCRIPTION					
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A1	10YR2/1			Loam
6-12	A2	10YR3/1			Loam
12-18+	B	10YR3/1	10YR4/3	few	Loamy clay

HYDRIC SOIL INDICATORS:

[ ] Histosol	[ ] Concretions
[ ] Histic Epipedon	[ ] High Organic Content in Surface Layer in Sandy Soils
[ ] Sulfidic Odor	[ ] Organic Streaking in Sandy Soils
[ ] Aquic Moisture Regime	[X] Listed on Local Hydric Soils List
[ ] Reducing Conditions	[X] Listed on National Hydric Soils List
[X] Gleyed or Low-Chroma Colors	[ ] Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	**YES** NO	Is this Sampling Point Within a Wetland? **YES** NO
Wetland Hydrology Present?	**YES** NO	
Hydric Soil Present?	**YES** NO	

Remarks:

Appendix 8. Reference Site Wetland Rating Form

1 WETLAND RATING WORKSHEET Fourth Version

Project Name: Stallings Mitigation, Flat Swamp Reference Wetland
Nearest Road: Wyse Fork Rd. County: Jones
Wetland Area: 5 acres Wetland Width 200 feet
Name of evaluator P. Colwell **Date:** 4/18/02

Wetland Location

_____on pond or lake
_____on perennial stream
_____on intermittent stream
_____within interstream divide
_____other

Soil Series Meggett

_____predominantly organic-humus, muck, or peat
_____predominantly mineral – non-sandy
_____predominantly sandy

Hydraulic factors

_____steep topography
_____ditched or channelized
_____total wetland width >= 100 feet

Adjacent land use
(within ½ mile upstream, upslope, or radius)

_____forested/natural vegetation 40 %
_____agriculture, urban/suburban 60 %
_____impervious surface ≤1 %

Dominant Vegetation
(1) Green Ash
(2) Red Maple
(3) Lizards Tail

Flooding and wetness

_____semipermanently to permanently flooded or inundated
_____seasonally flooded or inundated
_____intermittently flooded or temporary surface water
_____No evidence of flooding or surface water

Wetland type (select one)*

_____Bottomland hardwood forest
_____Headwater forest
_____Swamp forest
_____Wet flat
_____Pocasin
_____Bog forest
_____Pine savanna
_____Freshwater marsh
_____Bog/fen
_____Ephemeral wetland
_____Carolina Bay
_____Other_____

*the rating system cannot be applied to salt or brackish marshes or stream channels

Water storage	4	x 4.00 =	16
Bank/Shoreline stabilization	1	x 4.00 =	4
Pollutant removal	5 *	x 5.00 =	25
Wildlife Habitat	3	x 2.00 =	6
Aquatic life value	3	x 4.00 =	12
Recreation/Education	3	x 1.00 =	3

2.0 Wetland Rating
66

Add 1 point if in sensitive watershed and >10% nonpoint disturbance within ½ mile upstream, upslope, or radius

Appendix 9. Reference Site NCDWQ Stream Classification Forms

NCDWQ Stream Classification Form

Project Name: Stallings | River Basin: Neuse | County: Jones | Evaluator: PKoch

DWQ Project Number: N/A | Nearest Named Stream: Jack Cabin Branch | Latitude: | Signature:

Date: 10/11/01 | USGS QUAD: Phillips Crossroads | Longitude:

Location/Directions: Southeast corner of intersection of Old Comfort Rd and SR41

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgment of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	0	1	**2**	3
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	1	**2**	3
3) Are Natural Levees Present?	0	1	**2**	3
4) Is The Channel Sinuous?	0	1	**2**	3
5) Is There An Active (Or Relic) Floodplain Present?	0	1	2	**3**
6) Is The Channel Braided?	**0**	1	2	3
7) Are Recent Alluvial Deposits Present?	0	**1**	2	3
8) Is There A Bankfull Bench Present?	0	1	**2**	3
9) Is A Continuous Bed & Bank Present?	0	**1**	2	3
*(*NOTE: If Bed & Bank Caused By Ditching And WITHOUT Sinuosity Then Score=0*)*				
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map *And/Or* In Field) Present?	*Yes*=3	***No*=0**		

***PRIMARY GEOMORPHOLOGY INDICATOR POINTS*: 15**

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	**0**	1	2	3

***PRIMARY HYDROLOGY INDICATOR POINTS*: 0**

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	3	**2**	1	0
2) Are Rooted Plants Present In Streambed?	3	**2**	1	0
3) Is Periphyton Present?	**0**	1	2	3
4) Are Bivalves Present?	**0**	1	2	3

***PRIMARY BIOLOGY INDICATOR POINTS*: 4**

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	**0**	.5	1	1.5
2) Is There A Grade Control Point In Channel?	0	.5	**1**	1.5
3) Does Topography Indicate A Natural Drainage Way?	0	.5	1	**1.5**

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 2.5

II. Hydrology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Is This Year's (Or Last's) Leaf litter Present In Streambed?	1.5	1	.5	**0**
2) Is Sediment On Plants (Or Debris) Present?	0	.5	**1**	1.5
3) Are Wrack Lines Present?	0	.5	**1**	1.5
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	**0**	.5	1	1.5
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	**0**	.5	1	1.5

6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)? ***Yes=1.5*** *No*=0

SECONDARY HYDROLOGY INDICATOR POINTS: 3.5

III. Biology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Are Fish Present?	**0**	.5	1	1.5
2) Are Amphibians Present?	0	**.5**	1	1.5
3) Are AquaticTurtles Present?	**0**	.5	1	1.5
4) Are Crayfish Present?	0	**.5**	**1**	1.5
5) Are Macrobenthos Present?	**0**	.5	1	1.5
6) Are Iron Oxidizing Bacteria/Fungus Present?	**0**	.5	1	1.5
7) Is Filamentous Algae Present?	**0**	.5	1	1.5

8) Are Wetland Plants In Streambed? N/A	**SAV**	**Mostly OBL**	**Mostly FACW**	**Mostly FAC**	**Mostly FACU**	**Mostly UPL**
(**NOTE:** If Total Absence Of All Plants In Streambed As Noted Above Skip This Step **UNLESS** SAV Present*).*	2	1	.75	.5	0	0

SECONDARY BIOLOGY INDICATOR POINTS: 1

TOTAL POINTS (Primary + Secondary)= 26 (If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)

NCDWQ Stream Classification Form

Project Name: Stallings | River Basin: Neuse | County: Jones | Evaluator: KM

DWQ Project Number: N/A | Nearest Named Stream: Beaverdam Branch | Latitude: | Signature:

Date: 10/11/01 | USGS QUAD: Jacksonville NE | Longitude:

Location/Directions: Southwest corner of intersection of Davis Field Rd and Pole-Pocosin Rd

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgment of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	0	1	2	**3**
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	1	**2**	3
3) Are Natural Levees Present?	0	**1**	2	3
4) Is The Channel Sinuous?	0	1	2	**3**
5) Is There An Active (Or Relic) Floodplain Present?	0	1	2	**3**
6) Is The Channel Braided?	**0**	1	2	3
7) Are Recent Alluvial Deposits Present?	0	**1**	2	3
8) Is There A Bankfull Bench Present?	0	1	**2**	3
9) Is A Continuous Bed & Bank Present?	0	1	**2**	3
*(*NOTE: If Bed & Bank Caused By Ditching And WITHOUT Sinuosity Then Score=0*)*				
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map *And/Or* In Field) Present?	*Yes*=3	***No*=0**		

***PRIMARY GEOMORPHOLOGY INDICATOR POINTS*: 17**

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	0	1	**2**	3

***PRIMARY HYDROLOGY INDICATOR POINTS*: 2**

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	**3**	2	1	0
2) Are Rooted Plants Present In Streambed?	3	2	**1**	0
3) Is Periphyton Present?	**0**	1	2	3
4) Are Bivalves Present?	**0**	1	2	3

***PRIMARY BIOLOGY INDICATOR POINTS*: 4**

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	**0**	.5	1	1.5
2) Is There A Grade Control Point In Channel?	0	.5	**1**	1.5
3) Does Topography Indicate A Natural Drainage Way?	0	.5	1	**1.5**

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 2.5

II. Hydrology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Is This Year's (Or Last's) Leaf litter Present In Streambed?	**1.5**	1	.5	0
2) Is Sediment On Plants (Or Debris) Present?	0	.5	**1**	1.5
3) Are Wrack Lines Present?	0	.5	**1**	1.5
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	.5	1	**1.5**
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	0	.5	1	**1.5**
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)?	***Yes=1.5***			*No=0*

SECONDARY HYDROLOGY INDICATOR POINTS: 6.5

III. Biology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Are Fish Present?	0	.5	**1**	1.5
2) Are Amphibians Present?	0	.5	**1**	1.5
3) Are AquaticTurtles Present?	**0**	.5	1	1.5
4) Are Crayfish Present?	0	**.5**	1	1.5
5) Are Macrobenthos Present?	0	.5	**1**	1.5
6) Are Iron Oxidizing Bacteria/Fungus Present?	**0**	.5	1	1.5
7) Is Filamentous Algae Present?	0	**.5**	1	1.5

8) Are Wetland Plants In Streambed? N/A **SAV**	**Mostly OBL**	**Mostly FACW**	**Mostly FAC**	**Mostly FACU**	**Mostly UPL**
(**NOTE:** If Total Absence Of All Plants In Streambed As Noted Above Skip This Step **UNLESS** SAV Present*).* 2	1	.75	.5	0	0

SECONDARY BIOLOGY INDICATOR POINTS: 4

TOTAL POINTS (Primary + Secondary)= 36 (If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)

NCDWQ Stream Classification Form

Project Name: Stallings | River Basin: Cape Fear | County: Duplin | Evaluator: L.Myott

DWQ Project Number: N/A | Nearest Named Stream: Bullard Branch | Latitude: | Signature:

Date: 03/14/02 | USGS QUAD: Summerlins Crossroads | Longitude:

Location/Directions: Northeast corner of intersection of Kelly Rd and Summerlins Crossroads Rd

PLEASE NOTE:** ***If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgment of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	0	1	2	**3**
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	**1**	2	3
3) Are Natural Levees Present?	**0**	1	2	3
4) Is The Channel Sinuous?	0	1	2	**3**
5) Is There An Active (Or Relic) Floodplain Present?	0	1	2	**3**
6) Is The Channel Braided?	0	**1**	2	3
7) Are Recent Alluvial Deposits Present?	0	1	2	**3**
8) Is There A Bankfull Bench Present?	0	1	2	**3**
9) Is A Continuous Bed & Bank Present?	0	1	2	**3**
*(*NOTE: If Bed & Bank Caused By Ditching And WITHOUT Sinuosity Then Score=0*)*				
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map *And/Or* In Field) Present?	***Yes*=3**	*No*=0		

***PRIMARY GEOMORPHOLOGY INDICATOR POINTS*: 23**

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	**0**	1	2	3

***PRIMARY HYDROLOGY INDICATOR POINTS*: 0**

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	3	**2**	1	0
2) Are Rooted Plants Present In Streambed?	**3**	2	1	0
3) Is Periphyton Present?	0	1	**2**	3
4) Are Bivalves Present?	**0**	1	2	3

***PRIMARY BIOLOGY INDICATOR POINTS*: 7**

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	0	**.5**	1	1.5
2) Is There A Grade Control Point In Channel?	0	.5	1	**1.5**
3) Does Topography Indicate A Natural Drainage Way?	0	.5	1	**1.5**

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: 3.5

II. Hydrology	**Absent**	**Weak**	**Moderate**	**Strong**
1) Is This Year's (Or Last's) Leaf litter Present In Streambed?	1.5	**1**	.5	0
2) Is Sediment On Plants (Or Debris) Present?	**0**	.5	1	1.5
3) Are Wrack Lines Present?	0	.5	1	**1.5**
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	.5	1	**1.5**
5) Is There Water In Channel During Dry Conditions ***Or*** In Growing Season)?	0	.5	1	**1.5**
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)?	***Yes=1.5***			*No*=0

SECONDARY HYDROLOGY INDICATOR POINTS: 7

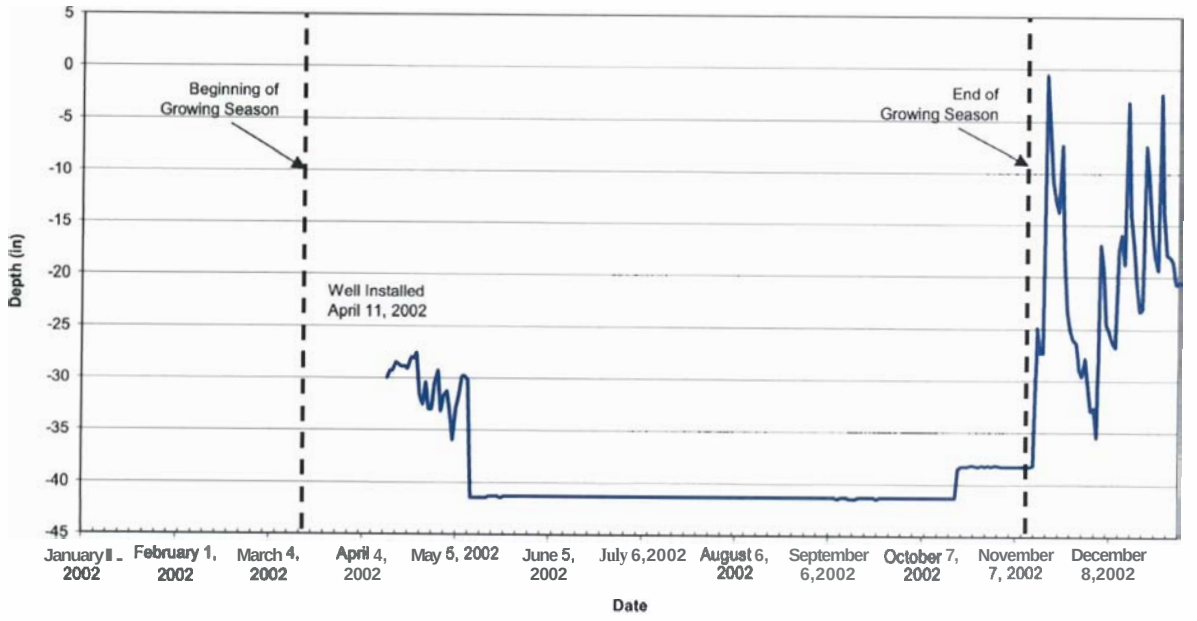
III. Biology	**Absent**	**Weak**	**Moderate**	**Strong**		
1) Are Fish Present?	0	**.5**	1	1.5		
2) Are Amphibians Present?	0	.5	1	**1.5**		
3) Are AquaticTurtles Present?	**0**	.5	1	1.5		
4) Are Crayfish Present?	**0**	.5	1	1.5		
5) Are Macrobenthos Present?	0	.5	1	**1.5**		
6) Are Iron Oxidizing Bacteria/Fungus Present?	**0**	.5	1	1.5		
7) Is Filamentous Algae Present?	**0**	.5	1	1.5		
8) Are Wetland Plants In Streambed? N/A	**SAV**	**Mostly OBL**	**Mostly FACW**	**Mostly FAC**	**Mostly FACU**	**Mostly UPL**
(**NOTE:** If Total Absence Of All Plants In Streambed As Noted Above Skip This Step **UNLESS** SAV Present*).*	2	1	.75	.5	0	0

SECONDARY BIOLOGY INDICATOR POINTS: 3.5

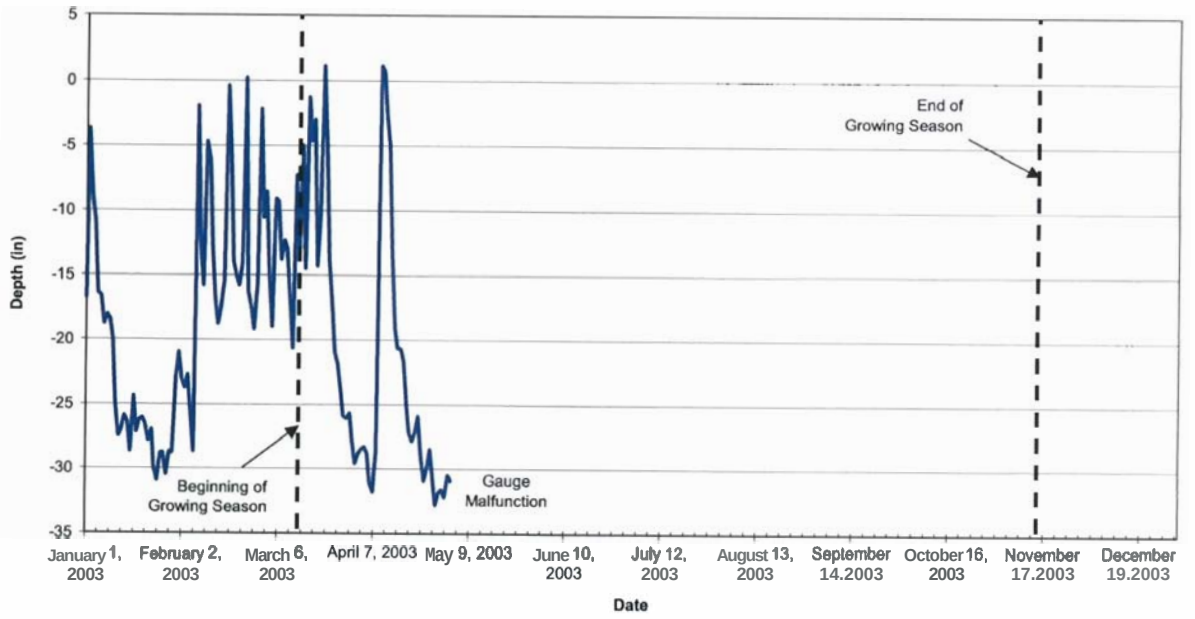
TOTAL POINTS (Primary + Secondary)= 40.5 (If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)

Appendix 10. Hydrologic Gauge Data Summary

2002 Groundwater Data
Well A



2003 Groundwater Data
Well A



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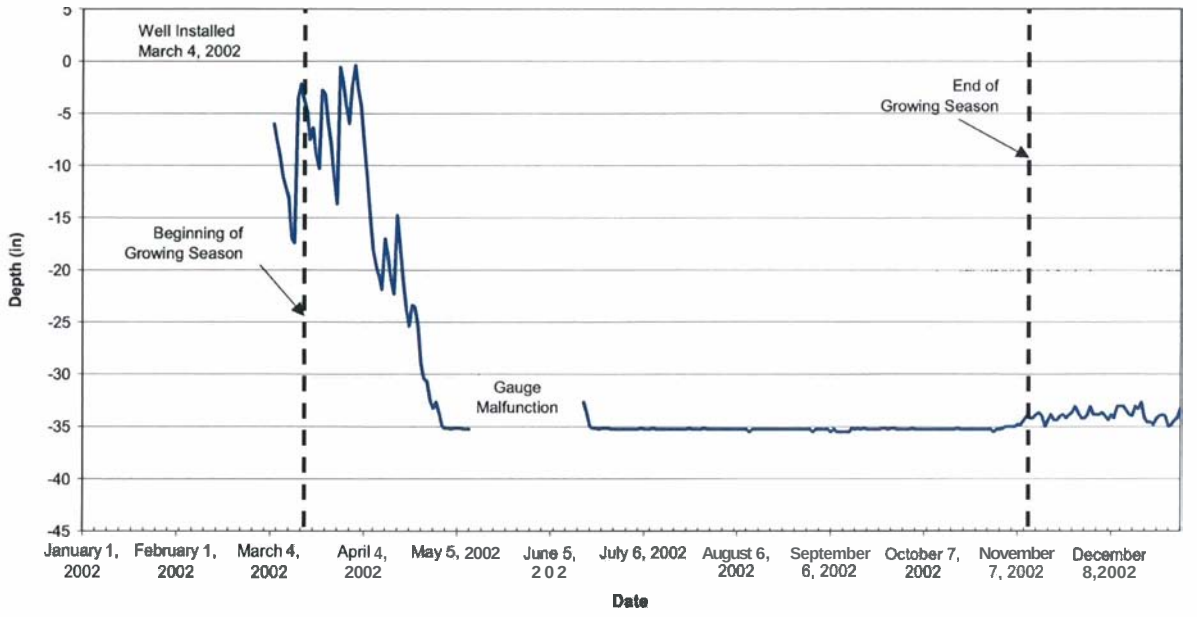

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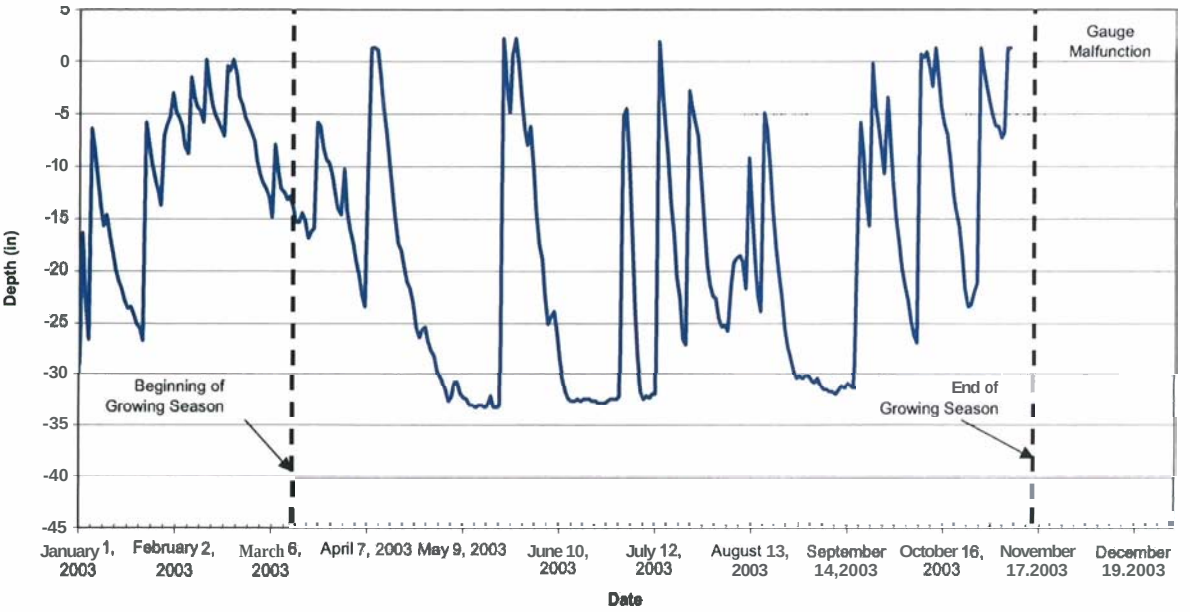

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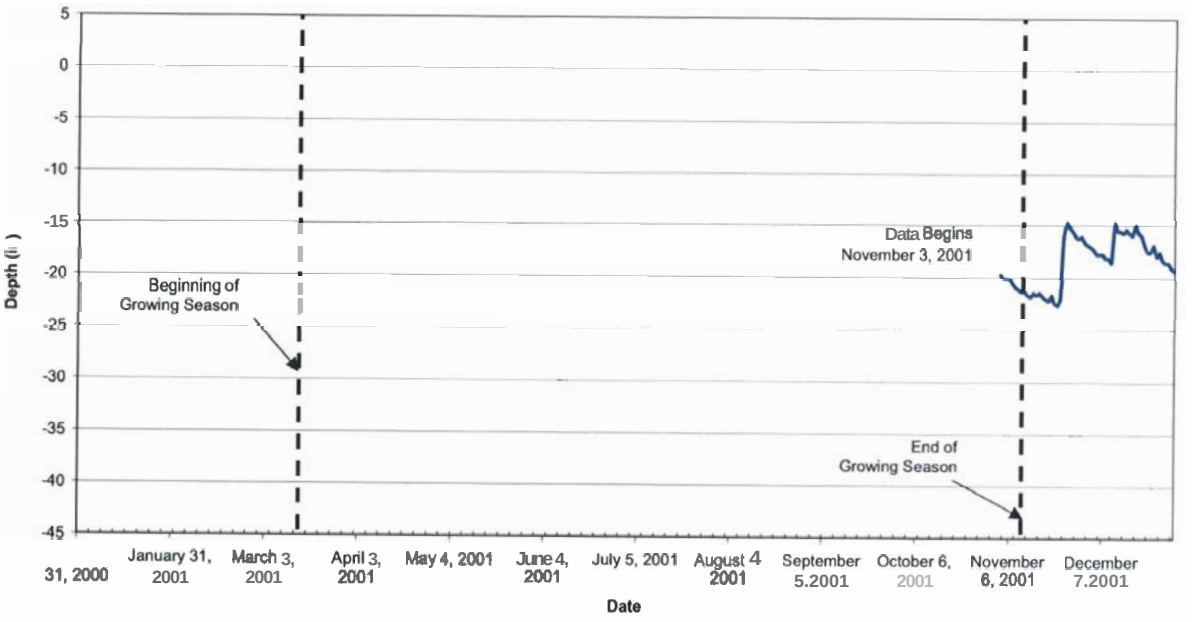

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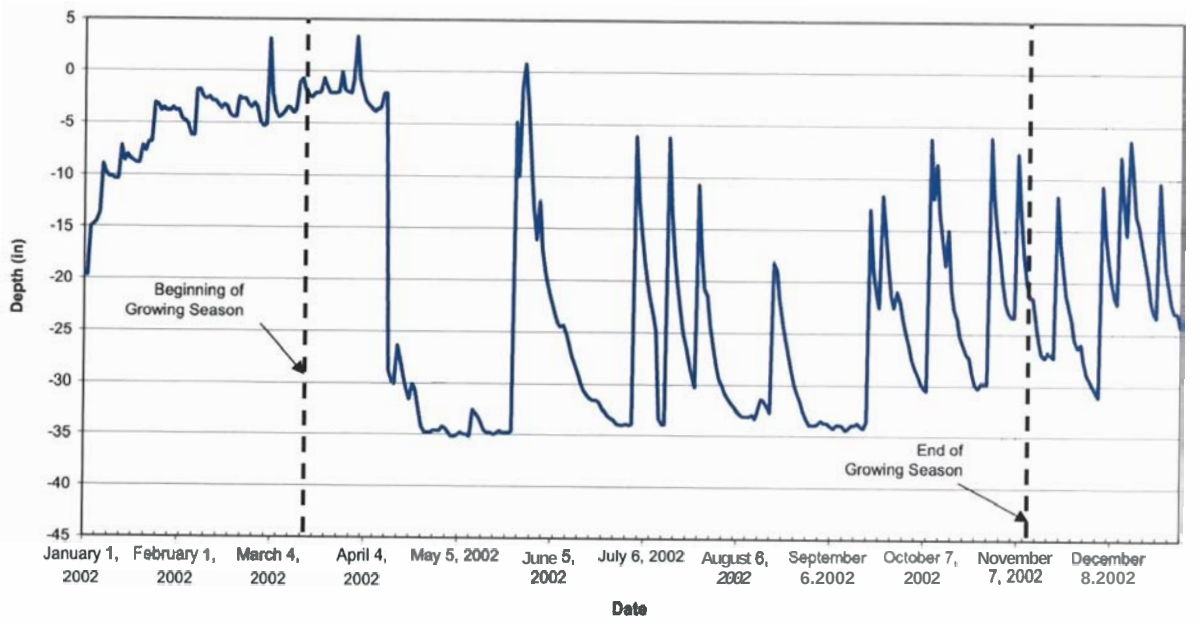

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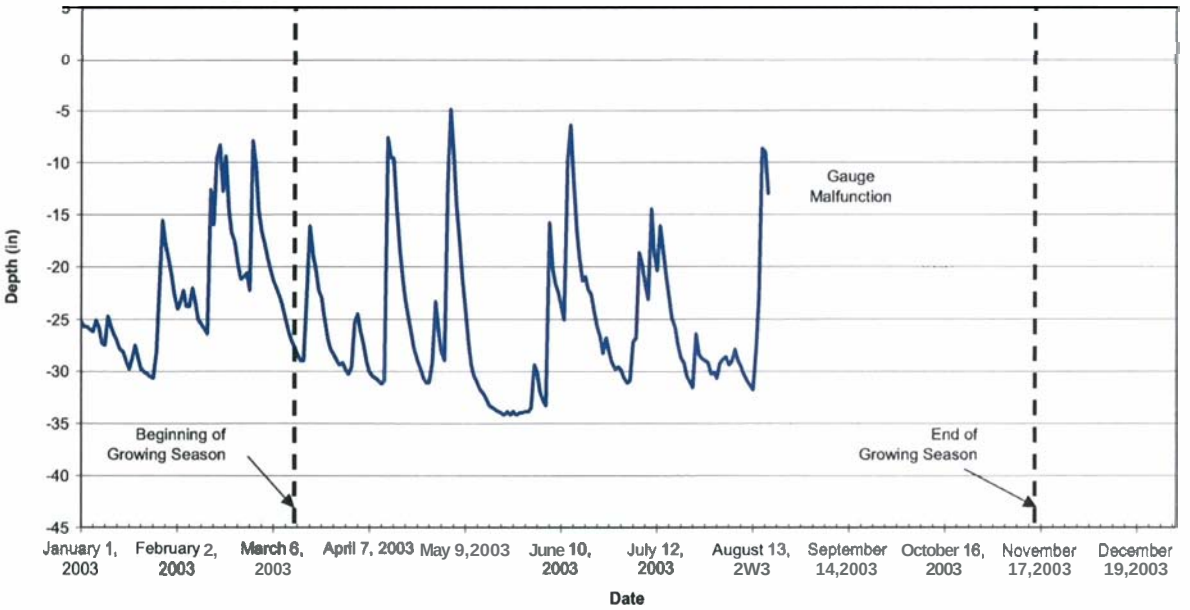

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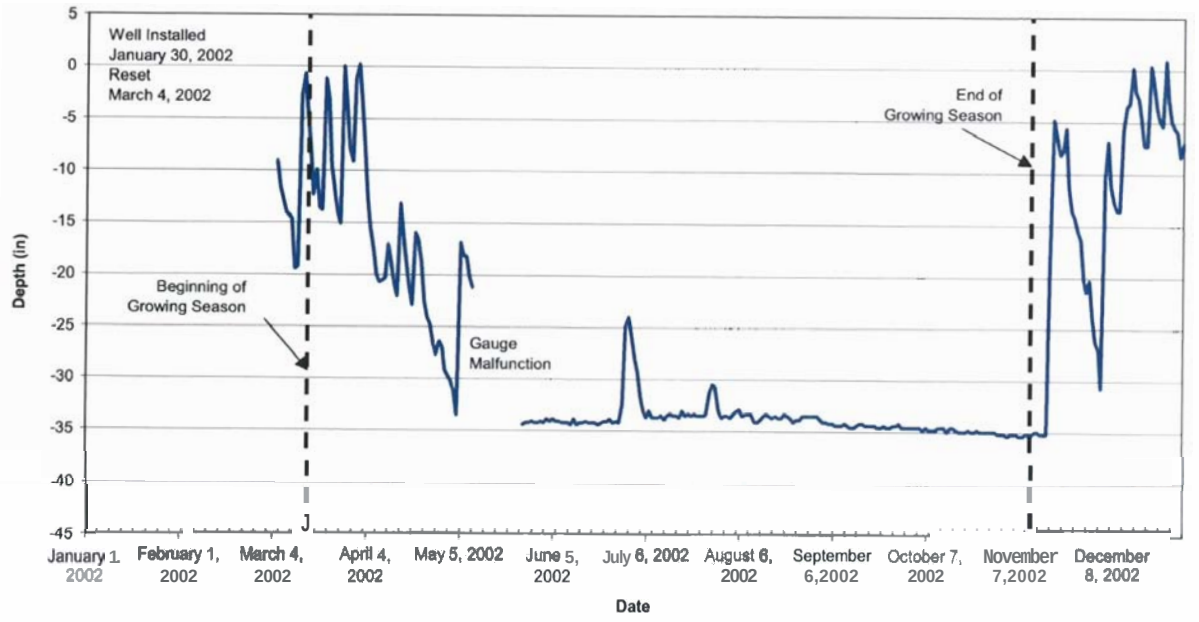

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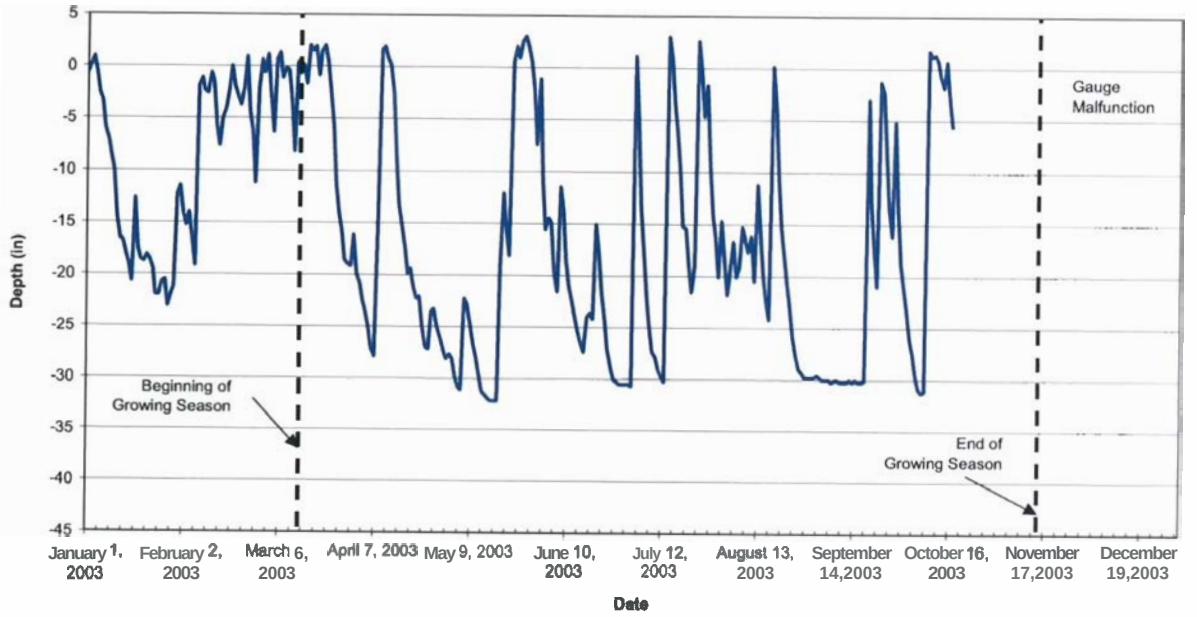

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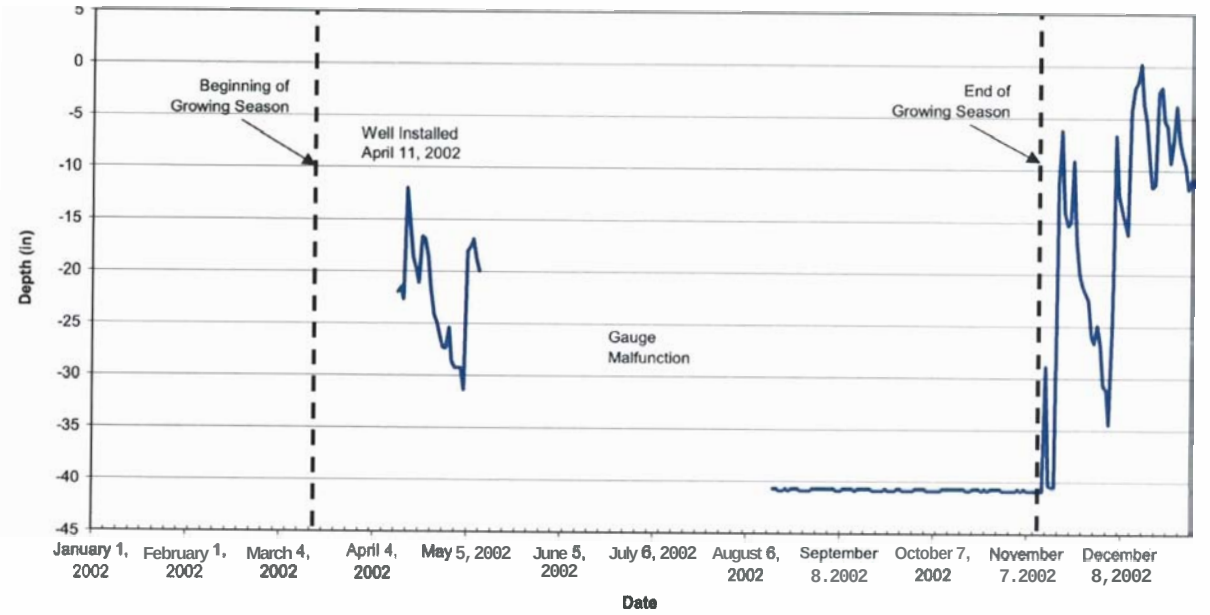

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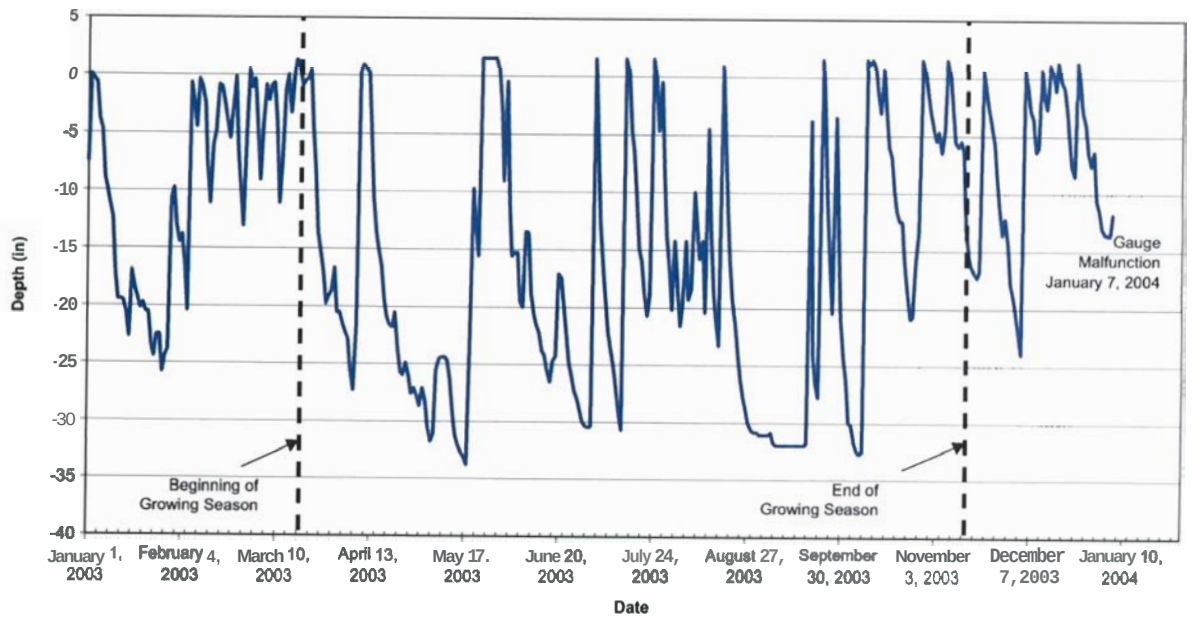
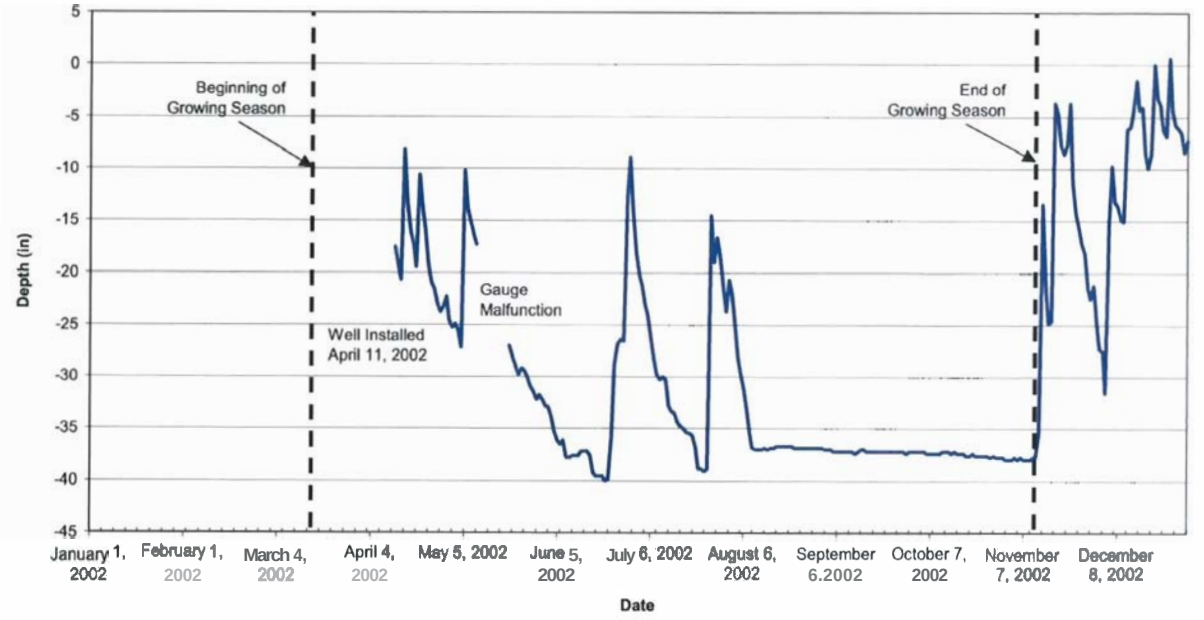


2002 Groundwater Data
Well F



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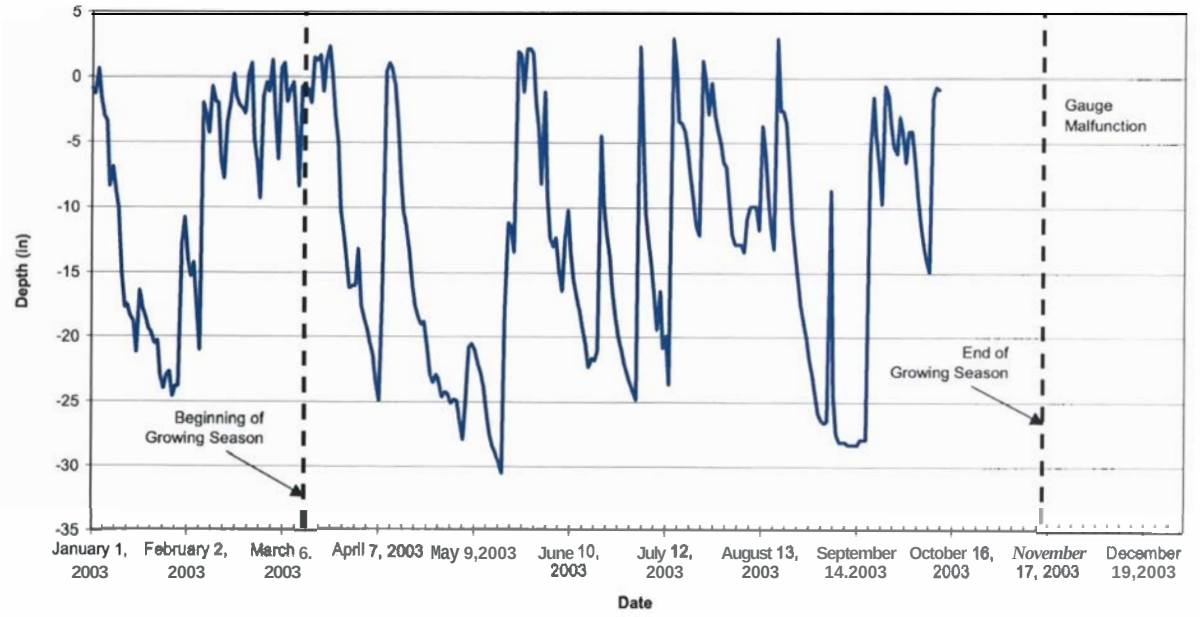

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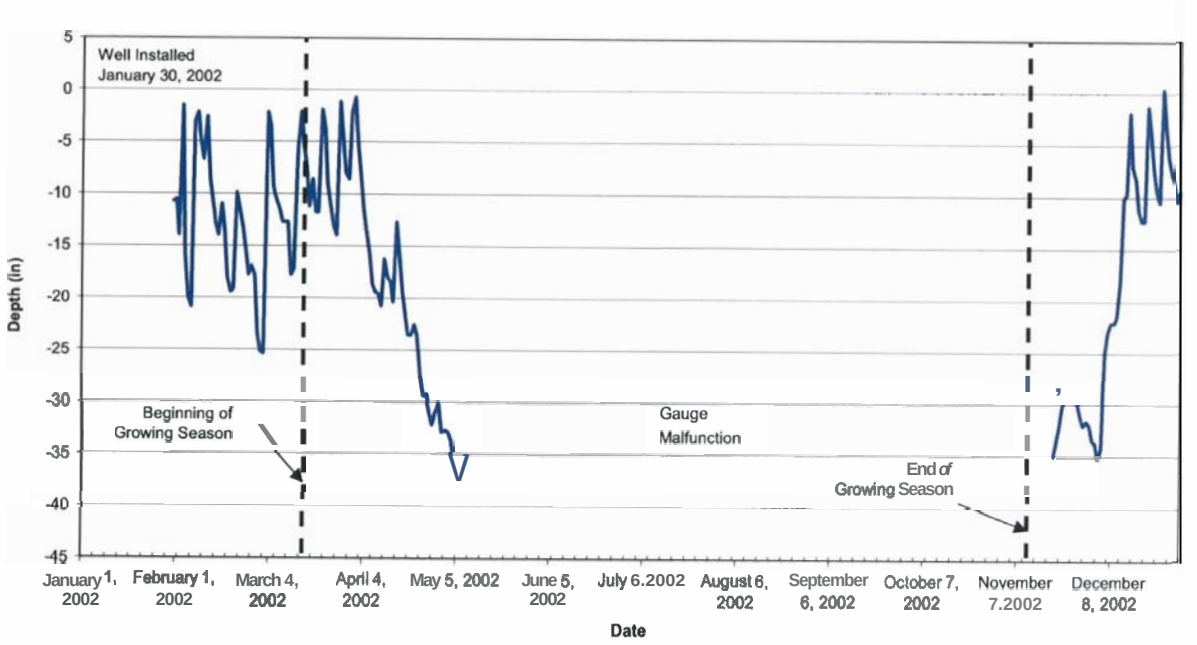

2003 Groundwater Data
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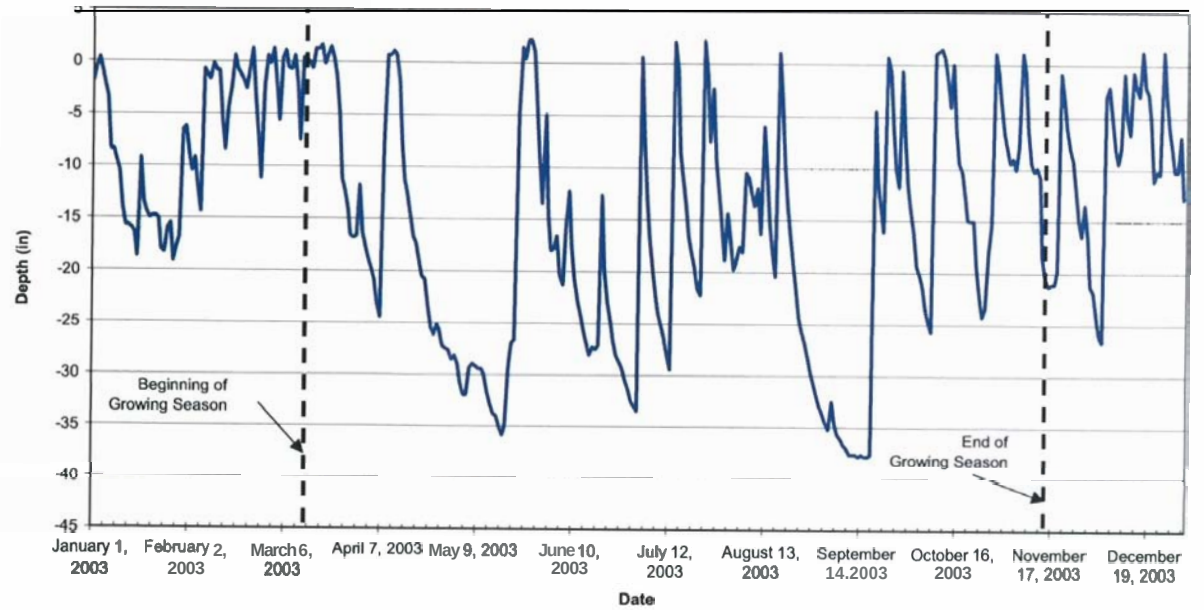
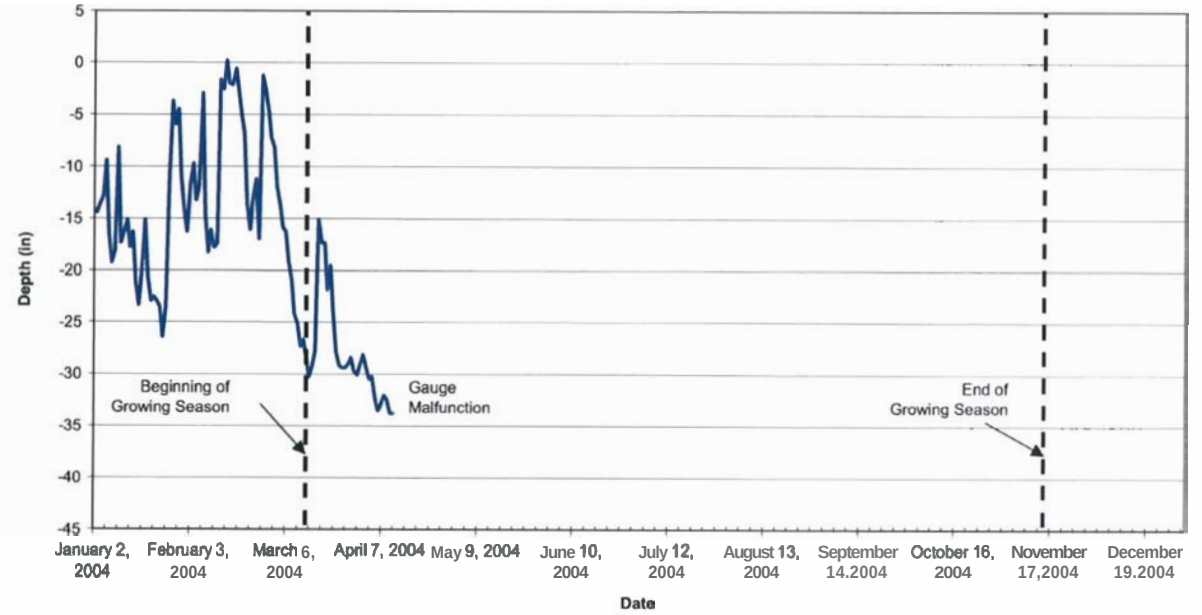


2004 Groundwater Data
Well G



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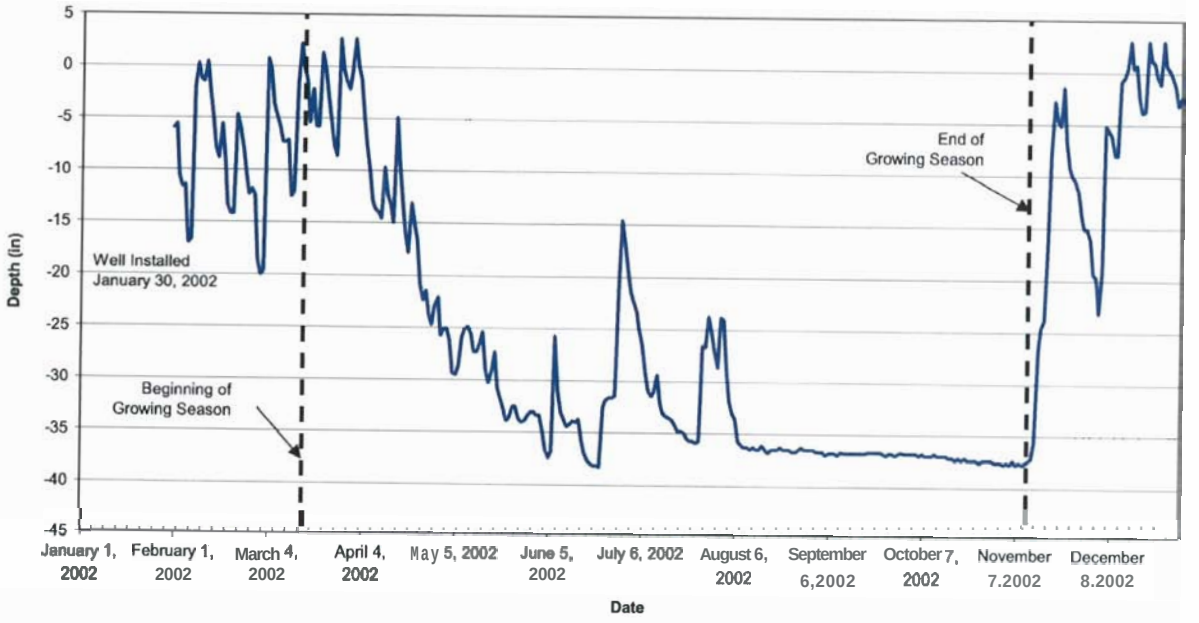

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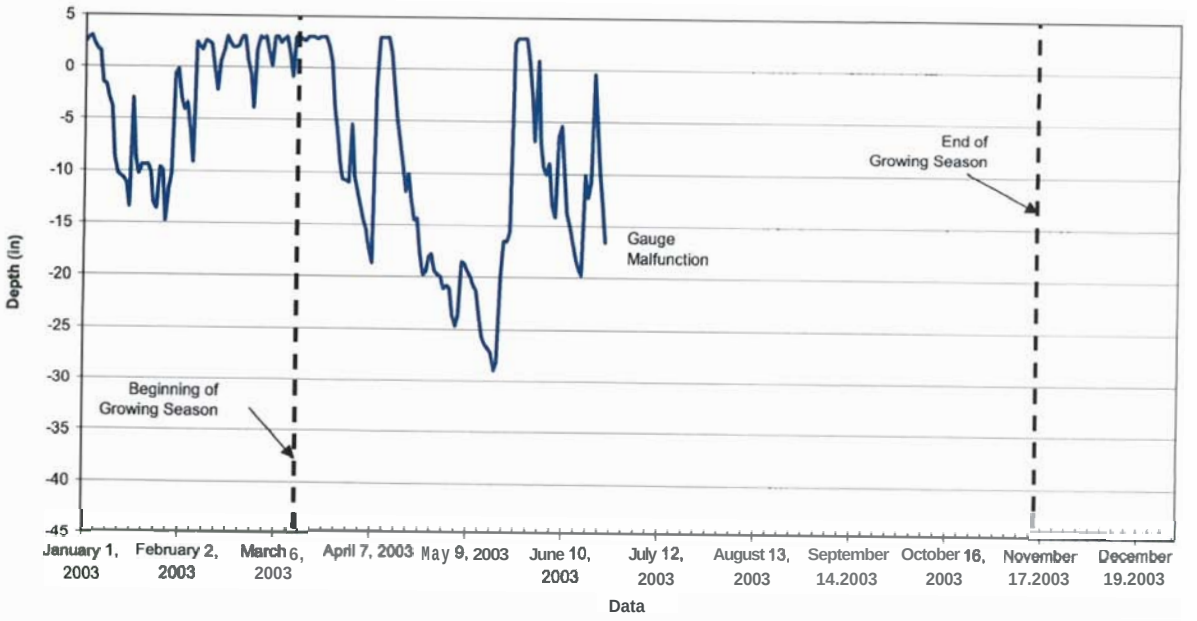
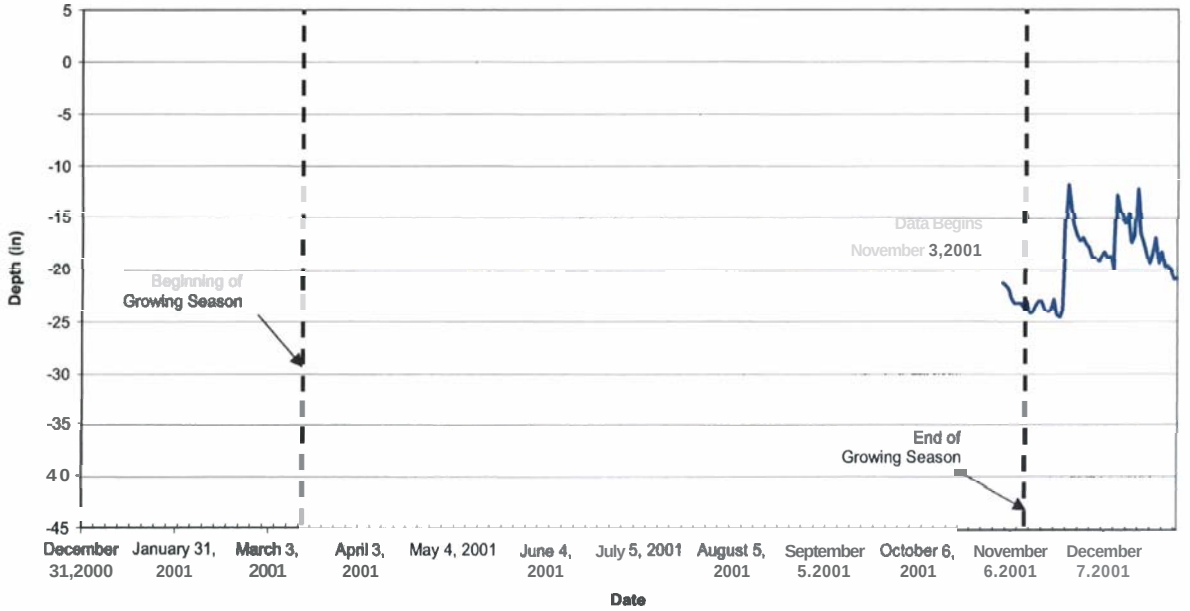


2001 Groundwater Data
Well I



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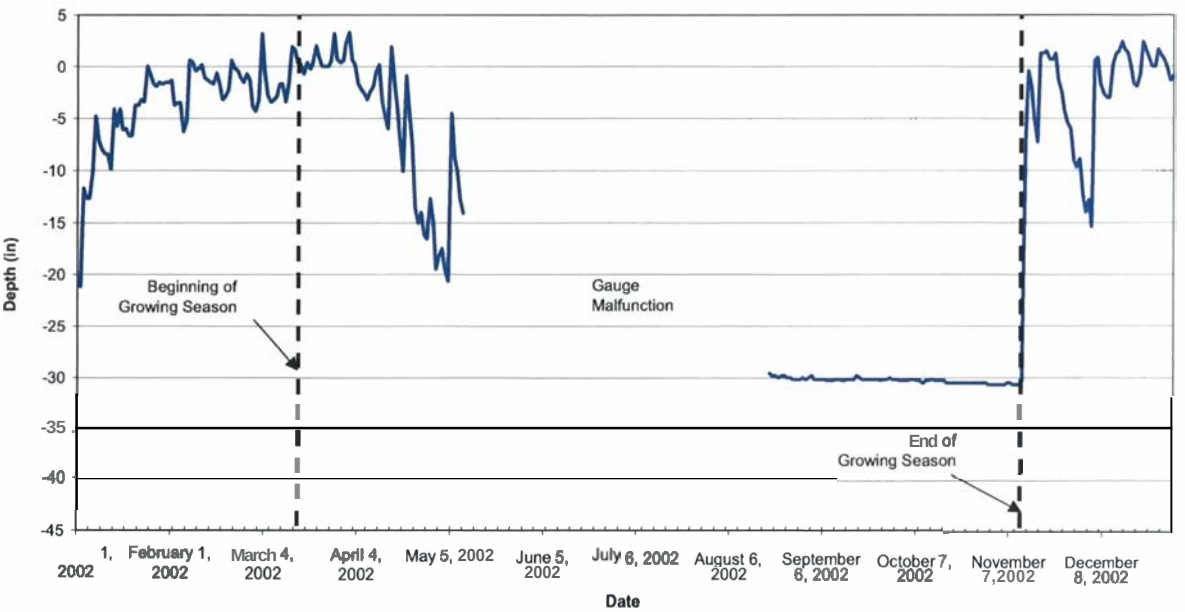
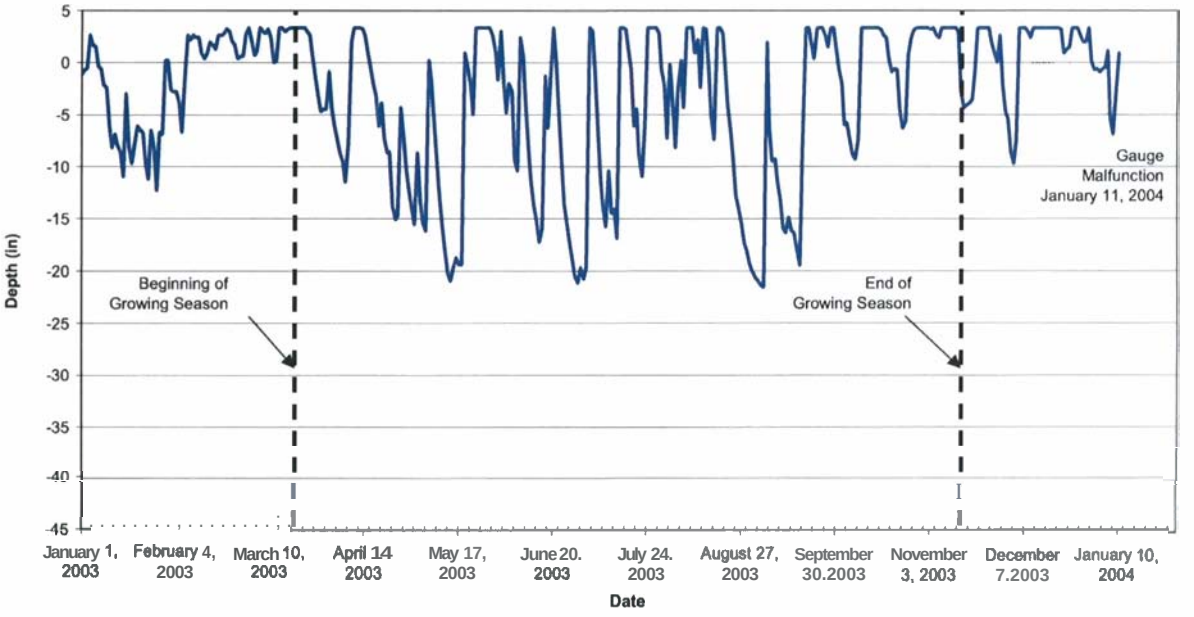
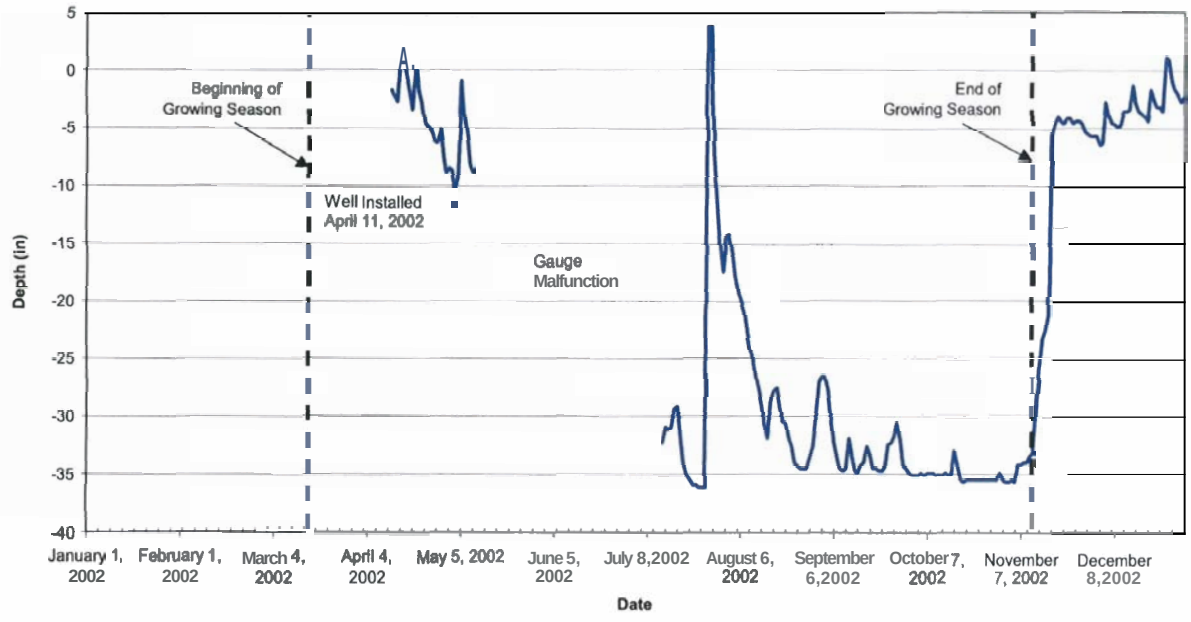


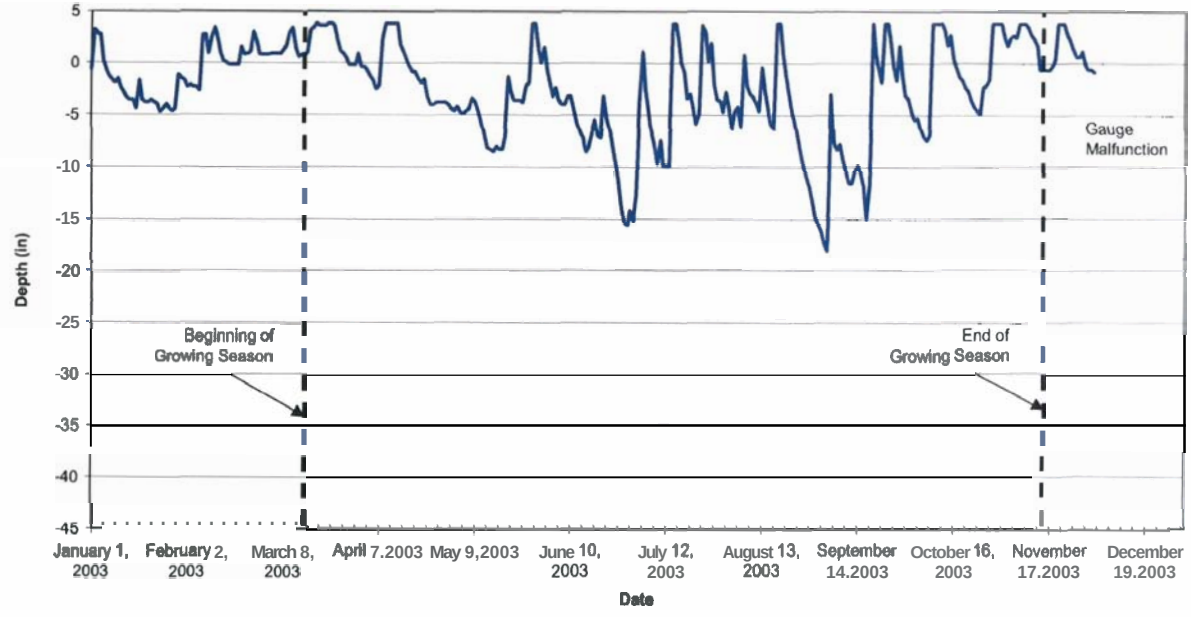
2003 Groundwater Data
Well I



2002 Groundwater Data
Well J



2003 Groundwater Data
Well J



Appendix 11. HEC–RAS Analysis

Stallings
Existing Plan: Coastal Plain Curve Data
Proposed Plan: Coastal Plain Curve Data Proposed
Date: September 28, 2004
K. McKeithan
HEC-RAS Profile: 100-yr

Reach	Station	Plan	Q_{100} (cfs)	Water Surface Elevation (ft)	Change in WS
Main	34	existing	383.4	42.99	-0.05
	34	proposed	383.4	42.94	
	169	existing	383.4	43.31	0.00
	169	proposed	383.4	43.31	
Main 2	238	existing	339.1	43.42	0.00
	238	proposed	339.1	43.42	
	379	existing	339.1	43.38	0.17
	379	proposed	339.1	43.55	
	551	existing	339.1	44.03	-0.28
	551	proposed	339.1	43.75	
	689	existing	339.1	44.63	-0.67
	689	proposed	339.1	43.96	
	787	existing	339.1	44.82	-0.45
	787	proposed	339.1	44.37	
	991	existing	339.1	45.08	0.08
	991	proposed	339.1	45.16	
	1247	existing	339.1	45.18	0.42
	1247	proposed	339.1	45.6	
	1491	existing	339.1	46.34	-0.56
	1491	proposed	339.1	45.78	
Main 3	1567	existing	224.0	46.53	-0.71
	1567	proposed	224.0	45.82	
	1835	existing	224.0	46.85	-0.43
	1835	proposed	224.0	46.42	
	2100	existing	224.0	47.51	-0.57
	2100	proposed	224.0	46.94	
	2442	existing	224.0	48.69	-0.86
	2442	proposed	224.0	47.83	
Main 4	2516	existing	200.2	48.77	-0.85
	2516	proposed	200.2	47.92	
	2762	existing	200.2	48.99	-0.41
	2762	proposed	200.2	48.58	
	3012	existing	200.2	49.2	-0.15
	3012	proposed	200.2	49.05	
Culvert	3120		Culvert		
Main 4	3156	existing	200.2	53.17	0.00
	3156	proposed	200.2	53.17	
	3440	existing	200.2	53.17	0.00
	3440	proposed	200.2	53.17	
	3621	existing	200.2	53.17	-0.01
	3621	proposed	200.2	53.16	
Culvert	3661		Culvert		
Main 4	3716	existing	200.2	53.16	0.05
	3716	proposed	200.2	53.21	
	3974	existing	200.2	53.18	0.07
	3974	proposed	200.2	53.25	
	4224	existing	200.2	53.49	0.15
	4224	proposed	200.2	53.64	

Reach	Station	Plan	Q_{100} (cfs)	Water Surface Elevation (ft)	Change in WS
Upper - Tributary	67	existing	54.0	48.83	-0.9
	67	proposed	54.0	47.93	
	273	existing	54.0	48.87	-0.63
	273	proposed	54.0	48.24	
	521	existing	54.0	48.88	-0.26
	521	proposed	54.0	48.62	
	722	existing	54.0	49.16	-0.03
	722	proposed	54.0	49.13	
Middle Tributary	73	existing	221.2	46.55	-0.69
	73	proposed	221.2	45.86	
	338	existing	221.2	47.24	-1.09
	338	proposed	221.2	46.15	
Lower - Tributary	23	existing	146.8	43.42	0.01
	23	proposed	146.8	43.43	
	246	existing	146.8	43.38	0.09
	246	proposed	146.8	43.47	
	449	existing	146.8	45.57	-0.12
	449	proposed	146.8	45.45	
	773	existing	146.8	46.99	0.20
	773	proposed	146.8	47.19	
	1142	existing	146.8	48.69	0.08
	1142	proposed	146.8	48.77	
	1332	existing	146.8	49.38	0.06
	1332	proposed	146.8	49.44	

Appendix 12. DRAINMOD Analysis

BACKGROUND

The Stallings Mitigation Site includes 5.3 acres of proposed riverine bottomland hardwood forest wetlands. In order for a wetland to be a successful mitigation site, it must meet specific hydrologic success criteria. More specifically, groundwater must be within 12 inches of the ground surface for consecutive days comprising no less than 12.5 percent of the growing season for five consecutive growing seasons.

Given the high cost of wetland restoration, it is best to have a clear understanding of the likelihood of success. There are a number of different computer models that can help determine the likelihood of success. For the riverine bottomland hardwood forest proposed on the Stallings Mitigation Site, DRAINMOD is well suited to help with the hydrologic analysis. DRAINMOD is a computer model developed by Dr. R. W. Skaggs, at North Carolina State University in Raleigh, North Carolina.

DRAINMOD predicts the depth to groundwater on a day-to-day basis and, therefore, can be used to help determine the likelihood of meeting the hydrologic success criteria. DRAINMOD was used to predict groundwater elevations at four different locations within the proposed riverine bottomland hardwood forest.

DRAINMOD INPUTS

Model inputs can be organized into five major types: General, Weather, Drainage Design, Soil, and Crop.

GENERAL

Wetland hydrology was analyzed to determine the number of continuous days during the growing season that the water table was within 12 inches of the surface. The United States Army Corps of Engineers requires that the water table be within the top 12 inches for 12.5 percent of the growing season. The growing season for Jones County is from March 15 (day 74) to November 11 (day 315), 241 days. Therefore, 12.5 percent of the growing season is 30 days.

Other general parameters (e.g., evapotranspiration) were derived from D.M. Amatya, R.W. Skaggs and J.D. Gregory's article entitled Comparison of Methods from Estimating REF-ET published in the November/December 1995 Journal of Irrigation and Drainage Engineering.

WEATHER

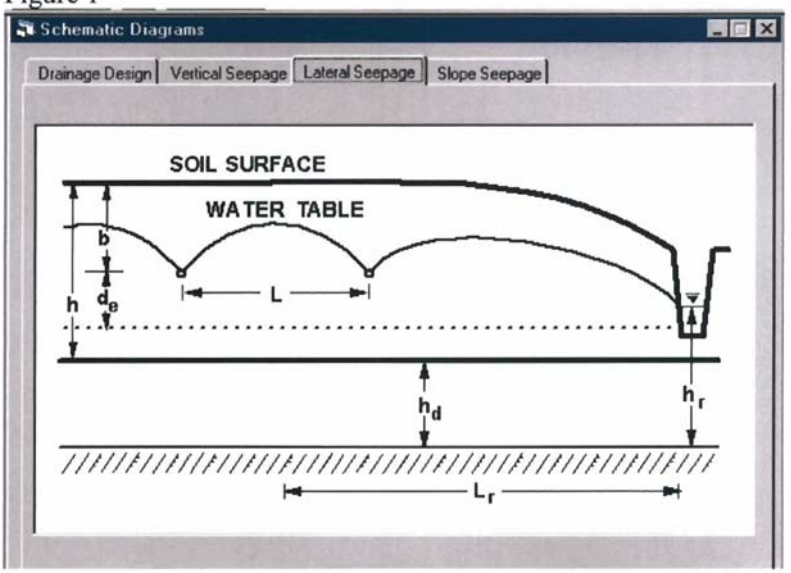
The nearest useful meteorological station to the Stallings Site is located in the City of New Bern. North Carolina State University provided the necessary precipitation and temperature files for the New Bern station in DRAINMOD format for the years 1951 to 1991. The precipitation data used is in hundredths of inches. The inputs for the temperature files consisted of a daily maximum and minimum temperature in degrees Fahrenheit. DRAINMOD uses the temperature data files to compute potential evapotranspiration using the Thornthwaite equation. This equation uses the latitude (35° 04' N) and heat index (estimated at 75 degrees Fahrenheit) for the location along with the temperature data.

DRAINAGE DESIGN

Figure 1 is a schematic showing the conditions modeled. Listed below are the input values entered into the model.

- b (depth from the soil surface to drain) = varies by site
- Re (effective radius of drains) = 1 cm
- L (spacing between drains) = varies by site
- h (distance to impermeable layer) = 203 cm
- de (equivalent depth from drain to impermeable layer) = varies by site
- W (initial depth to water table) = 27 cm
- M (maximum surface storage) = 4 cm

Figure 1



Data for the drainage design were obtained from the Jones County Soil Survey (Barnhill, 1981) and groundwater gauges installed on the Stallings Mitigation Site.

Table 1 shows the range of lateral hydraulic conductivity used in the model.

Table 1 – Hydraulic Conductivity Values for each soil layer

Soil Layer	Bottom depth of layer (cm)	Saturated hydraulic conductivity (cm/hr)
1	13	1.50 - 5.10
2	140	0.15 - 0.51
3	203	0.51 - 5.10

SOILS

The soil parameters used in the model are as follows: soil water characteristic, drain volume, upward flux, and infiltration.

The soil water characteristic is a measure of how tightly water is held in the soil matrix in the unsaturated state. The soil water characteristic is a basic soil property, which is second in importance to hydraulic conductivity in modeling soil water movement. It is usually determined in the laboratory using tension tables or pressure plates. The soil water characteristic for each profile horizon was estimated by matching texture and structure with similar soils as found in the DRAINMOD Reference Manual, titled "Methods for Design and Evaluation of Drainage-Water Management Systems for Soils with High Water Tables" (Skaggs, 1990).

Drain volume is the volume of air or water free pore space in the soil profile after the free or gravitational water has moved down to the water table. Values of air volume corresponding to various water table depths are entered in the Drain Vol-Upflux tab of the soil input screen. DRAINMOD uses the volume-drained relationship to determine rise and fall of the water table when a given amount of water is removed or added.

Upward flux is the rate of upward water movement of the water table. Upward flux is synonymous with the term "capillary movement". This value is important since there may be insufficient water in the root zone for potential evapotranspiration. In these cases the upward flux into the root zone may limit evapotranspiration.

Values for each of these parameters were not available for the specific soils found at the Stallings Site. Therefore, values for similar soil types were used. The values used for the soil water characteristic were those for Goldsboro Sandy Loam – the soil most closely resembling the Meggett Soil found at Stallings. The values used for volume drained and infiltration, were those for Portsmouth Sandy Loam. The values used for upward flux were those for the sandy loam found in the DRAINMOD Manual.

CROPS

The proposed "crop" on the Stallings wetland site is trees. Wetland trees generally have shallow roots. For the purposes of this model, the root depth was specified at 18 inches.

RESULTS

In order to determine if a wetland mitigation site would meet the hydrologic success criteria, DRAINMOD was run for the 40-year period for each of the four locations. The results were analyzed to identify the years when precipitation was within five percent of the 40-year average for the growing season. This analysis showed that nine years met the criterion. The typical year was selected by comparing monthly distribution of rainfall to the historical monthly average. The year 1969 demonstrated a monthly distribution which most closely resembled the historical monthly average.

As a result, the probable success of each location was determined using the results of the DRAINMOD analysis for 1969. At all four locations, the water table was within 12 inches of the surface for 12.5 percent of the growing season (30 days). The output of the four simulations is presented in the following pages, along with monthly and yearly weather data.

Appendix 13. Correspondence

Stantec Consulting Services Inc.
801 Jones Franklin Road Suite 300
Raleigh NC 27606
Tel: (919) 851-6866 Fax: (919) 851-7024
stantec.com

Stantec

November 18, 2005

Mr. Gary Jordan
US Fish and Wildlife Service
Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636-3726

RE: EEP Wetland and Stream restoration projects in Jones County.

Dear Mr. Jordan:

The purpose of this letter is to request a review and comments on any possible issues that might emerge with respect to endangered species, and migratory birds from two potential wetland and stream restoration projects in Jones County (see attached site maps).

The Stallings site and Brock site have been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Several sections of channel have been identified as significantly degraded. The agriculture fields on the Stallings site are classified as prior converted wetlands.

We have reviewed the information on your website and provided a letter to the North Carolina Natural Heritage Program. Any comments and/or recommendations that you may have for the site would be greatly appreciated. If you have any questions concerning this project, or need additional information, please do not hesitate to call me at (919) 851-6866 ext. 259. We greatly appreciate your assistance in this matter.

Sincerely,

Melissa Ruiz
Scientist, Environmental Management

cc:
Julia Hunt,
EEP Project Manager
1652 Mail Service Center
Raleigh, NC 27699

Enclosed: Project Vicinity and Project Site maps

Stantec Consulting Services Inc.
801 Jones Franklin Road Suite 300
Raleigh NC 27606
Tel: (919) 851-6866 Fax: (919) 851-7024
stantec.com

Stantec

November 18, 2005

Mr. Harry E. LeGrand
NC Natural Heritage Program
1601 Mail Service Center
Raleigh, NC 27569-1601

RE: EEP Wetland and Stream restoration projects in Jones County.

Dear Mr. LeGrand:

The purpose of this letter is to request a review and comments on any possible issues that might emerge with respect to endangered species, and migratory birds from two potential wetland and stream restoration projects located in Jones County (see attached site maps).

The Stallings site and Brock site have been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Several sections of channel have been identified as significantly degraded. The agriculture fields at the Stallings site are classified as prior converted wetlands.

We have reviewed the information on your website and provided a letter to the US Fish and Wildlife Service. Any comments and/or recommendations that you may have for the site would be greatly appreciated. If you have any questions concerning this project, or need additional information, please do not hesitate to call me at (919) 851-6866 ext. 259. We greatly appreciate your assistance in this matter.

Sincerely,

Melissa Ruiz
Scientist, Environmental Management

cc:
Julia Hunt,
EEP Project Manager
1652 Mail Service Center
Raleigh, NC 27699

Enclosed: Project Vicinity and Project Site maps

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor

William G. Ross Jr., Secretary

November 29, 2005

Ms. Melissa Ruiz
Stantec Consulting Services, Inc.
801 Jones Franklin Road, Suite 300
Raleigh, NC 27606

Subject: EEP Wetland and Stream Restoration Projects –Stallings and Brock sites; Jones County

Dear Ms. Ruiz:

The Natural Heritage Program has no record of rare species, significant natural communities, or priority natural areas at either site nor within a mile of the project areas. Although our maps do not show records of such natural heritage elements in the project area, it does not necessarily mean that they are not present. It may simply mean that the area has not been surveyed. The use of Natural Heritage Program data should not be substituted for actual field surveys, particularly if the project area contains suitable habitat for rare species, significant natural communities, or priority natural areas.

You may wish to check the Natural Heritage Program database website at <www.ncsparks.net/nhp/search.html> for a listing of rare plants and animals and significant natural communities in the county and on the topographic quad map. Please do not hesitate to contact me at 919-715-8697 if you have questions or need further information.

Sincerely,

Harry E. LeGrand Jr.

Harry E. LeGrand, Jr., Zoologist
Natural Heritage Program

HEL/hel

Stantec Consulting Services Inc.
801 Jones Franklin Road Suite 300
Raleigh NC 27606
Tel: (919) 851-6866 Fax: (919) 851-7024
stantec.com

Stantec

November 18, 2005

Rene Gledhill-Early
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 28516

RE: EEP Wetland and Stream restoration projects in Jones County.

Dear Ms. Gledhill-Early:

The Ecosystem Enhancement Program (EEP) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with two potential wetland and stream restoration projects in Jones County (see attached vicinity map).

The Stallings site and Brock site have been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Several sections of channel have been identified as significantly degraded. The agriculture fields on the Stallings site are classified as prior converted wetlands.

At the Stallings site, remnants of a brick foundation have been observed in an area adjacent to Webb Farm Rd during preliminary surveys of the site for restoration purposes (see Stallings Site map). Stream and wetland restoration would not occur where the foundation is located although this area would most likely be used as a staging area for construction. The majority of the site has historically been disturbed due to agricultural purposes such as tilling. Enclosed are current photos (photo 1-4) of the site and the foundation. We ask that you review this site based on the attached information to determine the presence or absence of any historic properties.

At the Brock site, according to a survey conducted in 2003, a cemetery is located adjacent to the stream in an area covered with shrubs and vines measuring approximately 50 feet wide by 200 feet long. The cemetery also appears on an old property survey map, with dates on the map ranging from the late 1800s to 1937. On this map the cemetery is labeled "negro cemetery". The area was recently investigated and five headstones were found in the southern section of the area marked as a cemetery. All of the located headstones were dated between 1920 and 1955. The dense vegetation covering the area could be concealing additional headstones or graves with no headstones. Enclosed are current photos of the cemetery area and the headstones (photos 5-10). Stream restoration would occur in the grading area as shown on the Brock Site map, adjacent to the cemetery avoiding any impact on headstones. We are investigating the potential of cleaning up the cemetery by removing the dense growth currently covering it. The remainder of the site has historically been disturbed due to agricultural purposes such as tilling.

Reference: EEP Wetland and Stream restoration projects in Jones County

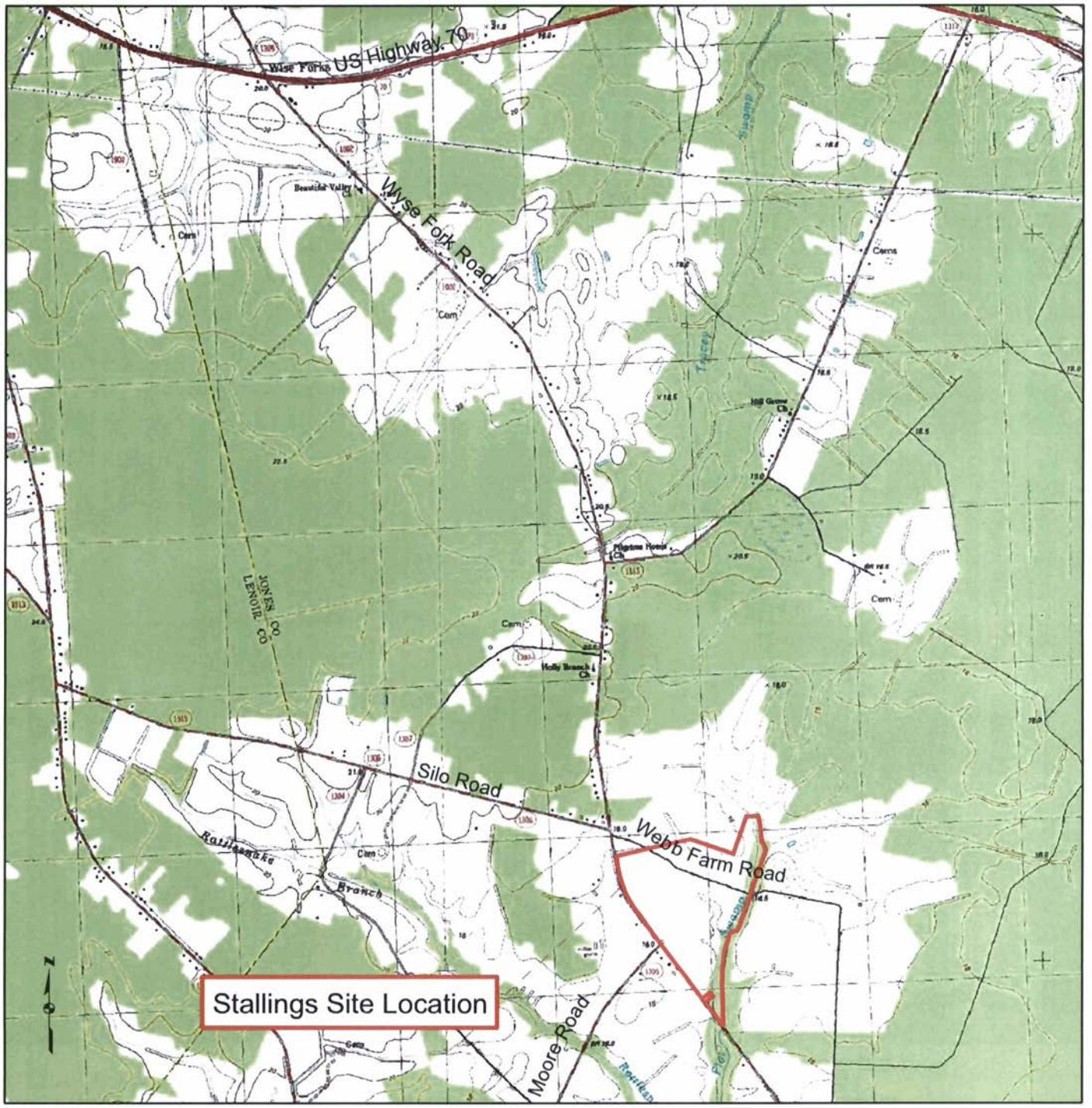
We thank you in advance for your timely response and cooperation. Please feel free to contact us at (919) 851-6866 ext. 259 with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Melissa Ruiz
Scientist, Environmental Management

cc:
Julia Hunt,
EEP Project Manager
1652 Mail Service Center
Raleigh, NC 27699

Enclosed: Site photos, Project Vicinity and Project Site maps

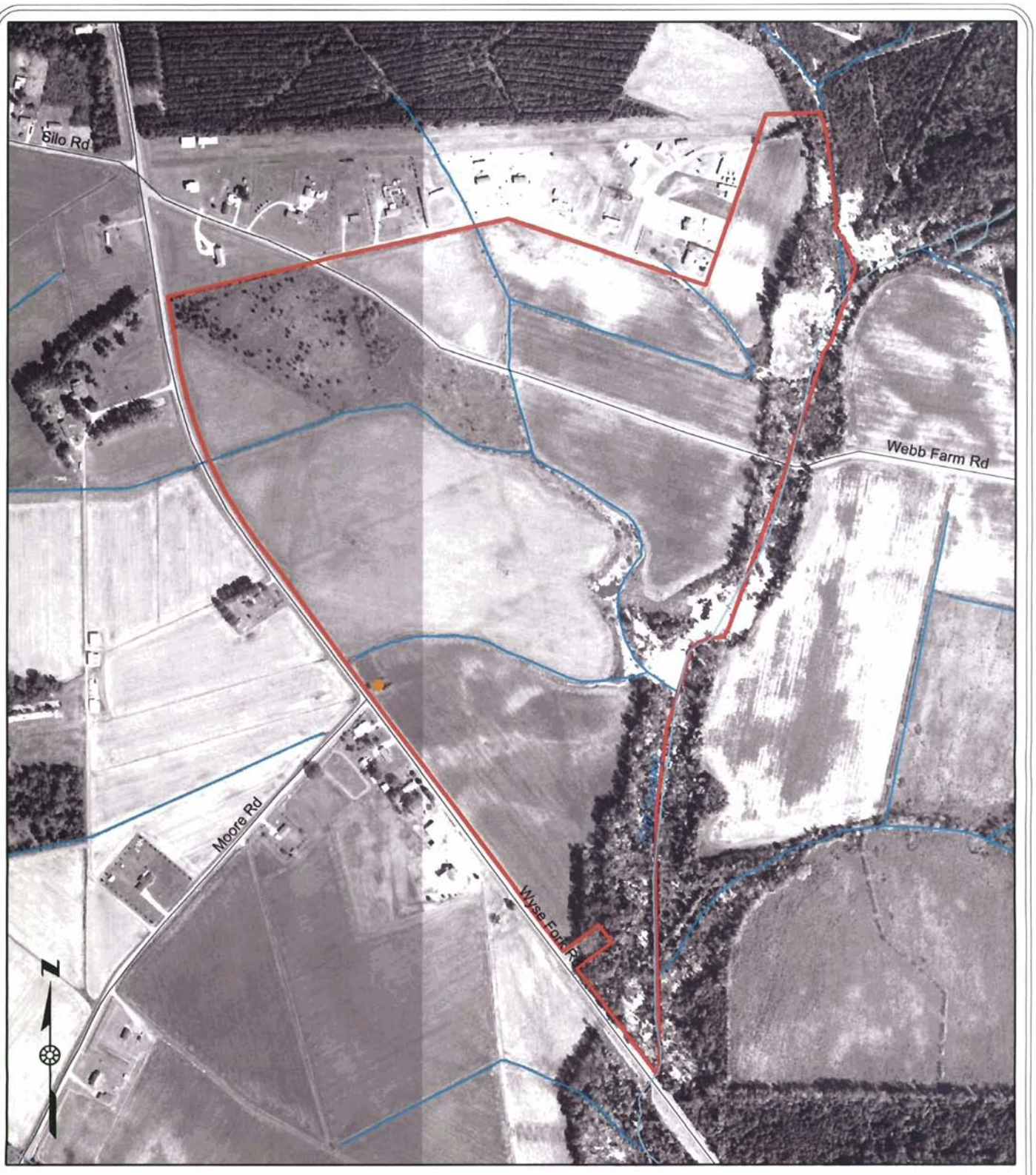


Stallings Restoration Site
Jones County, North Carolina

0 2,000 4,000 8,000 Feet

Stantec

Ecosystem Enhancement Program



Legend

- Property Boundary
- Roads
- Streams
- Foundation

Stallings Restoration Site
Jones County, North Carolina

0 390 780 1,560 Feet

Photos of foundation found at Stallings Site in Jones County

Photo 1: Stallings Site

Photo 2: Foundation extends from tree in foreground to tree in background

Photo 3: Close up of brick foundation

Photo 4: Brick foundation covered in vines

North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

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

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

January 4, 2006

Melissa Ruiz
Stantec Consulting Services, Inc.
801 Jones Franklin Road, Suite 300
Raleigh, NC 27606

RE: EPP Wetland and Stream Restoration Project, Stallings Site, Jones County, ER 05-2735

Thank you for your letter of November 18, 2005. We have reviewed this project and offer the following comments.

We have determined that the project as proposed will not have an effect on any historic structures.

No previously recorded archaeological sites are noted on maps housed at the Office of State Archaeology. A professional archaeologist, however, has never formally surveyed the project area. The project area is located in the general vicinity of the 1862 Battle of Kinston and the 1865 Battle of Wyse Fork. Given this setting, it is recommended that a comprehensive archaeological survey be conducted to record any sites within the APE. In particular a survey is watranted to fully document the cemetery located within the APE and to determine if there are any sites or remains related to the Civil War era.

We recommend that the survey be conducted by an experienced archaeologist to identify and evaluate the significance of archaeological remains that may be damaged or destroyed by the proposed project. Potential effects on unknown resources must be assessed prior to the initiation of construction activities. We also recommend that the archaeologist consult with the Office of State Archaeology prior to the commencement of any fieldwork.

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

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

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-733-4763. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

cc: Julia Hunt, EEP Project Manager

OCT 4 2006

North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

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

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

October 2, 2006

Dawn Reid
Archaeological Consultants of the Carolinas, Inc.
704 West Main Street
Clayton, NC 27520

Re: Archaeological Survey of the Stallings Stream and Wetland Restoration Tract, Jones County, ER 05-2735

Dear Ms. Reid:

Thank you for your letter of September 6, 2006. We have reviewed the archaeological survey report regarding the project referenced above and offer the comments below.

The report presents information regarding an archaeological survey of the Stallings stream and wetland restoration tract, in Jones County. No archaeological sites were recorded as a result of this effort. It was concluded that the proposed project would not adversely impact any significant cultural resources. Clearance to proceed with the undertaking was recommended based on the results of the survey. We concur with the conclusions and recommendations presented in this report.

The report meets our office's guidelines and those of the Secretary of the Interior. There are no specific concerns and/or corrections, which need to be addressed in regards to this report. The present version of this document can serve as the final report.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-733-4763. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

cc: Julia Hunt, EEP
Robert J. Goldstein
Melissa Ruiz, Stantec Consulting Services, Inc.

	Location	Mailing Address	Telephone/Fax
ADMINISTRATION	507 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-4763/733-8653
RESTORATION	515 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6547/715-4801
SURVEY & PLANNING	515 N. Blount Street, Raleigh, NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6545/715-4801

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **200610236** County: **Jones** U.S.G.S. Quad: **Dover**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner/Agent: **North Carolina Ecosystem Enhancement Program**
Address: **c/o Mr. Pete Colwell, Stantec Consulting**
801 Jones Franklin Road, Suite 300
Raleigh, North Carolina 27606
Telephone No.: **(919) 851-6866**

Property description:
Size (acres) **approximately 120 acres** Nearest Town **Dover**
Nearest Waterway **Flat Swamp** River Basin **Lower Neuse**
USGS HUC **03020204** Coordinates N **35.170704** W **-77.483656**
Location description **An approximate 120 acre tract known as Stallings Restoration Site and located immediately east of the intersection between Wyse Fork Road (NCSR 1002) and Webb Farm Road (NCSR 1306) adjacent to Flat Swamp near the Town of Dover in Jones County, North Carolina.**

Indicate Which of the Following Apply:

A. Preliminary Determination

_ Based on preliminary information, there may be wetlands on the above described property. We strongly suggest you have this property inspected to determine the extent of Department of the Army (DA) jurisdiction. To be considered final, a jurisdictional determination must be verified by the Corps. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).

B. Approved Determination

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

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

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

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

X The wetlands have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on **4/10/2006**. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ Please be advised that a Prior Converted Cropland (PC) determination made by the Natural Resource Conservation Service (NRCS) remains valid as long as the area is devoted to an agricultural use. If the land changes to a non-agricultural use, the PC determination is no longer applicable and a new wetland determination is required for Clean Water Act purposes.

Action ID: 200610236

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

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

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Mr. Scott Jones, PWS** at **(252) 975-1616 extension 27**.

C. Basis For Determination

This site exhibits wetland criteria as described in the 1987 Corps Wetland Delineation Manual and is part of a broad continuum of wetlands connected to Flat Swamp and the Trent River.

D. Remarks

Plat entitled "Stallings Restoration Site," and prepared by Stantec Consulting, Inc. on 12/14/2005 (project no. 171300123).

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

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

Mr. Michael F. Bell, Administrative Appeal Review Officer
CESAD-ET-CO-R
U.S. Army Corps of Engineers, South Atlantic Division
60 Forsyth Street, Room 9M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **06/10/2006**.

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

Corps Regulatory Official: Scott Jones PWS

Date **04/10/2006** Expiration Date **04/10/2011**

Copy furnished:

JURISDICTIONAL DETERMINATION

Revised 8/13/04

U.S. Army Corps of Engineers

DISTRICT OFFICE: CESAW-RG-W
FILE NUMBER: 200610236

PROJECT LOCATION INFORMATION:

State: NC
County: Jones
Center coordinates of site (latitude/longitude): 35.170704 / -77.483656
Approximate size of area (parcel) reviewed, including uplands: 120 acres.
Name of nearest waterway: Flat Swamp
Name of watershed: Lower Neuse River

JURISDICTIONAL DETERMINATION

Completed: Desktop determination ☐ Date:
Site visit(s) ☒ Date(s): 12/01/2005

Jurisdictional Determination (JD):

☐ Preliminary JD - Based on available information, ☐ *there appear to be* (or) ☐ *there appear to be no* "waters of the United States" and/or "navigable waters of the United States" on the project site. A preliminary JD is not appealable (Reference 33 CFR part 331).

☒ Approved JD – An approved JD is an appealable action (Reference 33 CFR part 331).
Check all that apply:

☐ *There are* "navigable waters of the United States" (as defined by 33 CFR part 329 and associated guidance) within the reviewed area. Approximate size of jurisdictional area:

☒ *There are* "waters of the United States" (as defined by 33 CFR part 328 and associated guidance) within the reviewed area. Approximate size of jurisdictional area: 30 acres.

☐ *There are "isolated, non-navigable, intra-state* waters or wetlands" within the reviewed area.
☐ Decision supported by SWANCC/Migratory Bird Rule Information Sheet for Determination of No Jurisdiction.

BASIS OF JURISDICTIONAL DETERMINATION:

A. Waters defined under 33 CFR part 329 as "navigable waters of the United States":

☐ The presence of waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.

B. Waters defined under 33 CFR part 328.3(a) as "waters of the United States":

☐ (1) The presence of waters, which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.
☐ (2) The presence of interstate waters including interstate wetlands[1].
☐ (3) The presence of other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate commerce including any such waters (check all that apply):
- ☐ (i) which are or could be used by interstate or foreign travelers for recreational or other purposes.
- ☐ (ii) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
- ☐ (iii) which are or could be used for industrial purposes by industries in interstate commerce.

☐ (4) Impoundments of waters otherwise defined as waters of the US.
☐ (5) The presence of a tributary to a water identified in (1) – (4) above.
☐ (6) The presence of territorial seas.
☒ (7) The presence of wetlands adjacent[2] to other waters of the US, except for those wetlands adjacent to other wetlands.

Rationale for the Basis of Jurisdictional Determination (applies to any boxes checked above). *If the jurisdictional water or wetland is not itself a navigable water of the United States, describe connection(s) to the downstream navigable waters. If B(1) or B(3) is used as the Basis of Jurisdiction, document navigability and/or interstate commerce connection (i.e., discuss site conditions, including why the waterbody is navigable and/or how the destruction of the waterbody could affect interstate or foreign commerce). If B(2, 4, 5 or 6) is used as the Basis of Jurisdiction, document the rationale used to make the determination. If B(7) is used as the Basis of Jurisdiction, document the rationale used to make adjacency determination:* This site exhibits wetland criteria as described in the 1987 Corps Wetland Delineation Manual and is part of a broad continuum of wetlands connected to Flat Swamp and the Trent River.

Lateral Extent of Jurisdiction: (Reference: 33 CFR parts 328 and 329)

☒ Ordinary High Water Mark indicated by:
- ☐ clear, natural line impressed on the bank
- ☐ the presence of litter and debris
- ☐ changes in the character of soil
- ☐ destruction of terrestrial vegetation
- ☐ shelving
- ☐ other:

☒ High Tide Line indicated by:
- ☐ oil or scum line along shore objects
- ☐ fine shell or debris deposits (foreshore)
- ☐ physical markings/characteristics
- ☐ tidal gages
- ☐ other:

☒ Mean High Water Mark indicated by:
☐ survey to available datum; ☐ physical markings; ☐ vegetation lines/changes in vegetation types.

☒ Wetland boundaries, as shown on the attached wetland delineation map and/or in a delineation report prepared by: Stantec Consulting, Inc.

Basis For Not Asserting Jurisdiction:

☒ The reviewed area consists entirely of uplands.
☒ Unable to confirm the presence of waters in 33 CFR part 328(a)(1, 2, or 4-7).
☒ Headquarters declined to approve jurisdiction on the basis of 33 CFR part 328.3(a)(3).
☒ The Corps has made a case-specific determination that the following waters present on the site are not Waters of the United States:
- ☐ Waste treatment systems, including treatment ponds or lagoons, pursuant to 33 CFR part 328.3.
- ☐ Artificially irrigated areas, which would revert to upland if the irrigation ceased.
- ☐ Artificial lakes and ponds created by excavating and/or diking dry land to collect and retain water and which are used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing.
- ☐ Artificial reflecting or swimming pools or other small ornamental bodies of water created by excavating and/or diking dry land to retain water for primarily aesthetic reasons.
- ☐ Water-filled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States found at 33 CFR 328.3(a).
- ☐ Isolated, intrastate wetland with no nexus to interstate commerce.
- ☐ Prior converted cropland, as determined by the Natural Resources Conservation Service. Explain rationale:
- ☐ Non-tidal drainage or irrigation ditches excavated on dry land. Explain rationale:
- ☐ Other (explain):

DATA REVIEWED FOR JURSIDICTIONAL DETERMINATION (mark all that apply):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant.
☒ Data sheets prepared/submitted by or on behalf of the applicant.
- ☒ This office concurs with the delineation report, dated 12/19/2005, prepared by (company): Stantec Consulting, Inc.
- ☐ This office does not concur with the delineation report, dated , prepared by (company):

☒ Data sheets prepared by the Corps.
☒ Corps' navigable waters' studies:
☒ U.S. Geological Survey Hydrologic Atlas:
☒ U.S. Geological Survey 7.5 Minute Topographic maps: Dover
☒ U.S. Geological Survey 7.5 Minute Historic quadrangles:
☒ U.S. Geological Survey 15 Minute Historic quadrangles:
☒ USDA Natural Resources Conservation Service Soil Survey: Jones
☒ National wetlands inventory maps:
☒ State/Local wetland inventory maps:
☒ FEMA/FIRM maps (Map Name & Date):
☒ 100-year Floodplain Elevation is: (NGVD)
☒ Aerial Photographs (Name & Date): CESAW
☒ Other photographs (Date):
☒ Advanced Identification Wetland maps:
☒ Site visit/determination conducted on: 12/01/2005
☒ Applicable/supporting case law:
☒ Other information (please specify):

[1]Wetlands are identified and delineated using the methods and criteria established in the Corps Wetland Delineation Manual (87 Manual) (i.e., occurrence of hydrophytic vegetation, hydric soils and wetland hydrology).

[2]The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other waters of the U.S. by man-made dikes or barriers, natural river berms, beach dunes, and the like are also adjacent.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: NCEEP	File Number: 200610236	Date: 04/10/2006
Attached is:		See Section below
☐ INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
☐ PROFFERED PERMIT (Standard Permit or Letter of permission)		B
☐ PERMIT DENIAL		C
☒ APPROVED JURISDICTIONAL DETERMINATION		D
☐ PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I: The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

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

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

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

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

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

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

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

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

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

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

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

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact: Mr. Scott Jones, Project Manager CESAW-RG-W Post Office Box 1000 Washington, North Carolina 27889	If you only have questions regarding the appeal process you may also contact: Mr. Michael F. Bell, Administrative Appeal Review Officer CESAD-ET-CO-R U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 9M15 Atlanta, Georgia 30303-8801

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

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

DIVISION ENGINEER:
Commander
U.S. Army Engineer Division, South Atlantic
60 Forsyth Street, Room 9M15
Atlanta, Georgia 30303-3490