

**ROQUIST WETLAND RESTORATION PLAN  
PHASE I**

**BERTIE COUNTY  
NORTH CAROLINA**

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**NC ECOSYSTEM  
ENHANCEMENT PROGRAM**

Prepared for:

**NORTH CAROLINA DEPARTMENT OF ENVIRONMENT  
AND NATURAL RESOURCES  
ECOSYSTEM ENHANCEMENT PROGRAM  
RALEIGH, NORTH CAROLINA**



**FINAL PLAN**  
August 2005

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## 1.0 INTRODUCTION

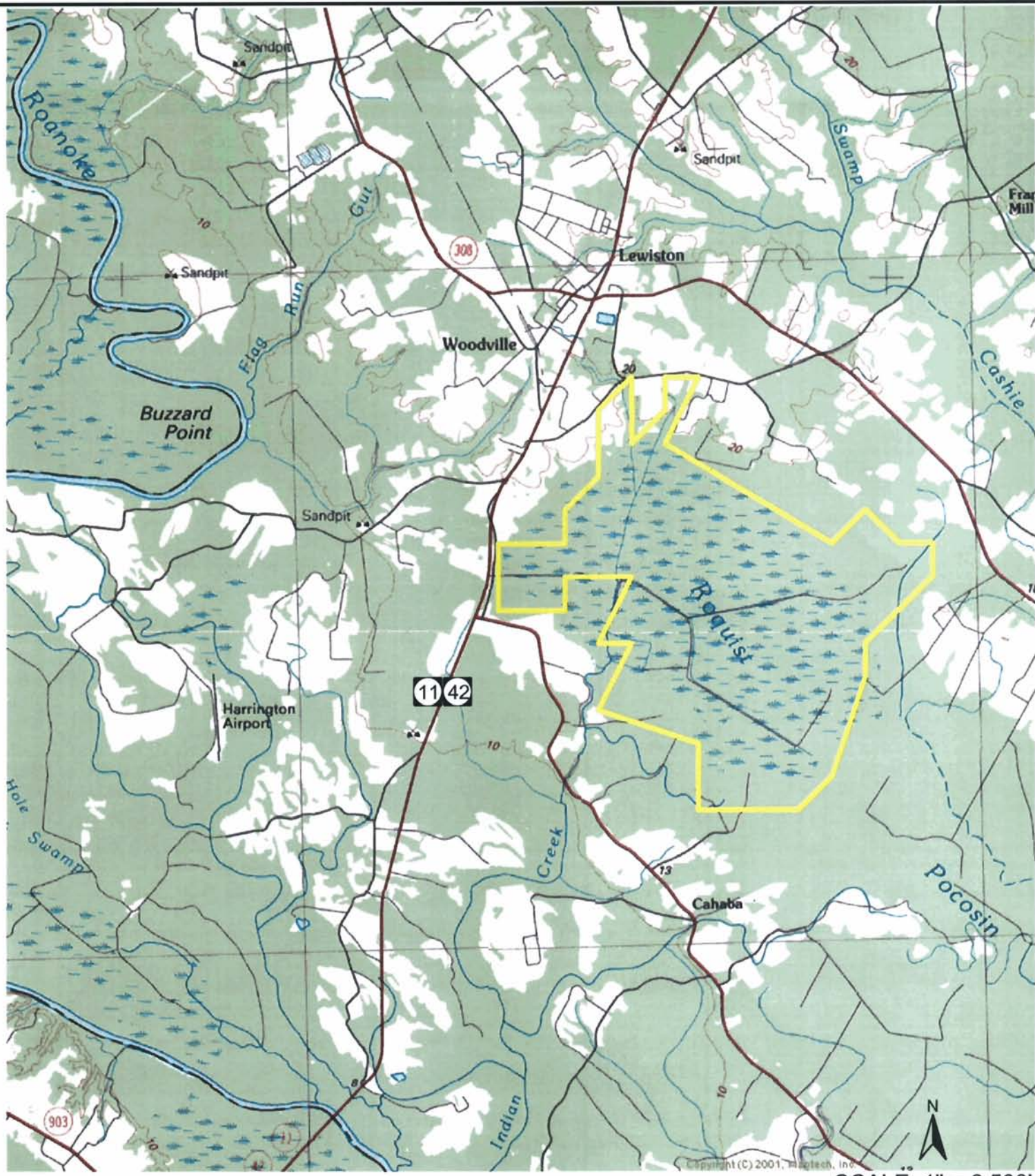
The North Carolina Ecosystem Enhancement Program (EEP) is developing a regional wetlands mitigation site in eastern North Carolina. The Roquist Wetland Restoration Site (hereafter referred to as “the Roquist Wetland Restoration Site” or “the Site”) is located in western Bertie County south of Lewiston-Woodville, North Carolina within Hydrologic Unit 03010107 of the Roanoke River Basin (Figure 1).

The Roquist Wetland Restoration Site is a unique ecosystem hosting prime examples of nonriverine wetland communities in large, nearly intact tracts. The Site encompasses 3,926 acres (ac) positioned on the interstream divide of the Roanoke and Cashie Rivers. Historically, the Site was known as a pocosin primarily for its geologic setting rather than its vegetative composition. The Site is almost entirely comprised of Nonriverine Swamp Forest and Wet Hardwood Forest Communities with relatively smaller portions of Mesic Mixed Hardwood Forest Communities (Schafale and Weakly 1990) positioned along the margins of the vast flat. Historic activities in the Site include intensive logging and some conversion of wetland hardwood forests into pine plantation. These efforts required constructing elevated roads for access into the area in addition to ditching in order to drain the site for ease of timber removal. Although the Roquist Wetland Restoration Site has been heavily timbered for nearly a century, there remains approximately 390 ac of high quality old growth forest harboring specimens of a rare 95+ years of age. The old growth forest forms a contiguous Nonriverine Swamp and Wet Hardwood (Schafale and Weakly 1990) stand that is uncommon to be of this age and size.

## 2.0 GOALS AND OBJECTIVES

Due to the magnitude of the restoration effort for the Roquist Wetland Restoration Site, the project will be divided into two major phase’s (hereafter referred to as Phase I and Phase II). Restoration components planned for Phase I of the Roquist Wetland Restoration Site consist of restoring ditched and filled wetlands, and preserving existing Nonriverine Swamp Forest, Nonriverine Wet Hardwood Forest, and Mesic Mixed Hardwood Forest Communities. Restoration components planned for Phase II of the Roquist Wetland Restoration Site will consist of restoring the remaining (53 ac) ditched and filled wetlands. Specifically the proposed mitigation credits for Phase I consist of:

- restoration of 52 ac of previously ditched and filled nonriverine wetlands
- preservation of 3,776 ac of nonriverine wetlands
- preservation of 45 ac of uplands



## SITE MAP

Roquist Wetland Restoration Site  
Bertie County, NC

FIGURE 1



## 2.0 LOCATION INFORMATION

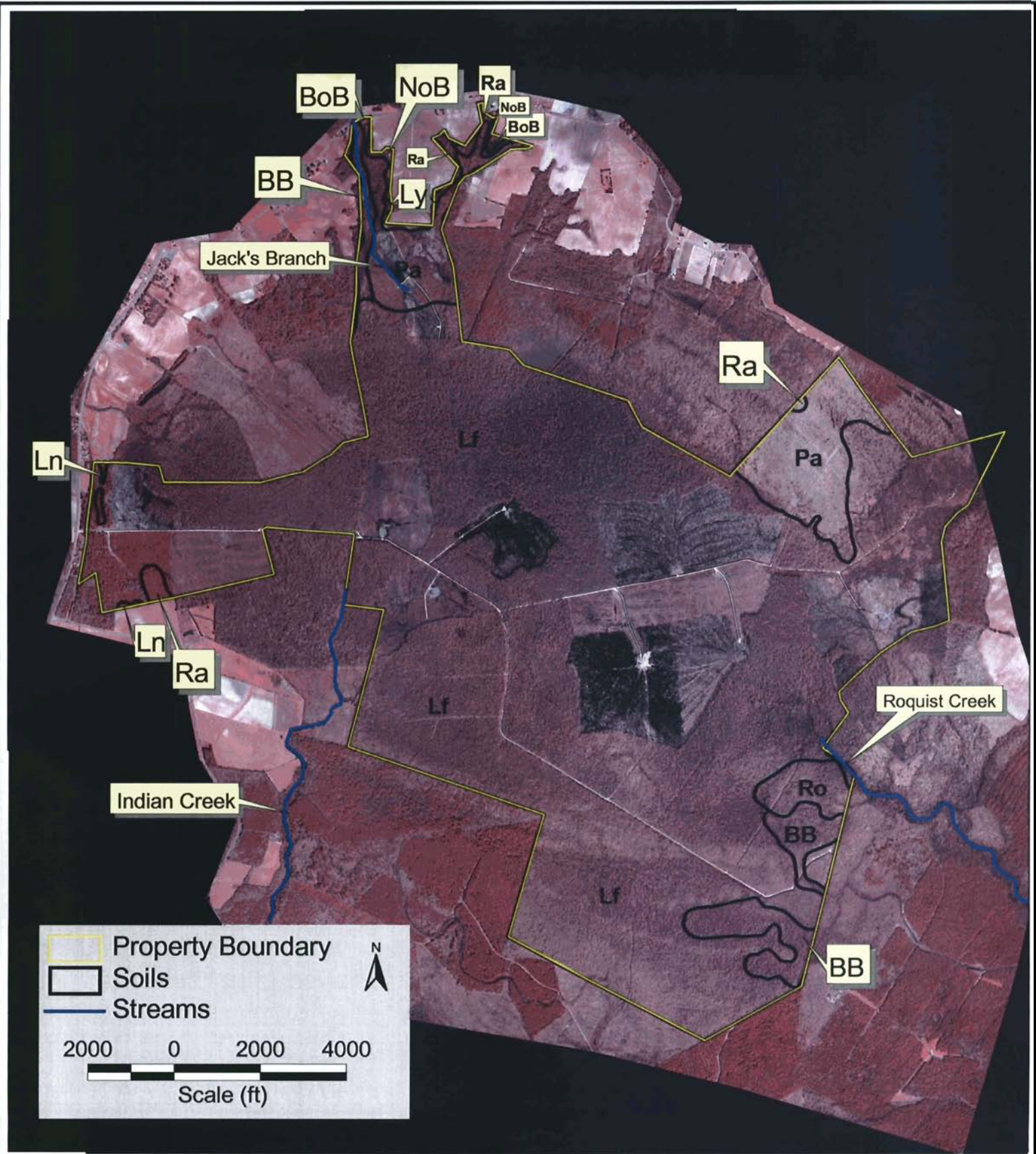
The Roquist Wetland Restoration Site is located in Bertie County within Hydrologic Unit 03010107 of the Roanoke River Basin along the interstream divide of the Cashie and Roanoke Rivers (Figure 1). The Roquist wetland forms the headwater basin of Roquist Creek and Indian Creek.

## 3.0 EXISTING CONDITIONS

### 3.1 Physiography, Site History, and Land Use

The Roquist wetland is a broad flat, elliptical in shape, and extending roughly 3.5 miles (mi) wide by 4.0 mi long (14 mi<sup>2</sup>). The drainage area is approximately 13,700 ac. Land use surrounding the wetland is mostly comprised of agriculture crops and pine plantations. The Site itself lies almost entirely within the limits of the wetland with some portions extending to the periphery (Figure 2). Ninety percent of the Site is 42 feet (ft) above mean sea level (msl) with a gradual rise to 54 ft above msl forming the rim. The highest elevation reaches 78 ft above msl and is located within the small stream basins (Jack's Branch) located in the northern portion of the Site.

Timber records from International Paper indicate the Roquist Wetland Restoration Site has been timbered for nearly a century with the oldest stands being established in 1905 and 1910. However, the majority of the existing forest within the Site ranges from twelve to sixty years of age. The most recent timbering activities occurred in 2003 with a final 927 ac harvested from April to October. In addition, logging records reveal an 80-ac pine plantation was established within timbered wetlands near the western entrance of the Site. Timbering in the Roquist wetland required elevated logging roads to be constructed throughout the Site to aid in removal of timber. Aerial photographs of the Site indicate that five miles of logging roads were present as early as 1964. These roads include ditches located adjacent and perpendicular to the logging roads ranging in width from 2 to 25 ft. Presently, 12 mi of logging roads traverse the Site including a small segment in the north.



**PROPERTY BOUNDARY  
& SOILS MAP**  
 Roquist Wetland Restoration Site  
 Bertie County, NC

FIGURE 2



## 3.2 Water Resources

### 3.2.1 Streams

There are three jurisdictional streams located within the Site. These streams include Jack's Branch (DWQ Index Number 24-2-7-1, Class "C Sw"), Roquist Creek (DWQ Index Number 24-2-7, Class "C Sw"), and Indian Creek (DWQ Index Number 23-47, Class "C") (Figure 2, Appendix A). On the USGS topographic map (Figure 1) Jack's Branch appears to have a continuous channel through the Roquist wetland and connecting with Indian Creek. Historically this may have been accurate but field investigations (2003) of Jack's Branch revealed no continuous channel through the Roquist wetland. Non-jurisdictional surface waters observed within the Site include drainage ditches located adjacent to and perpendicular to the existing logging roads.

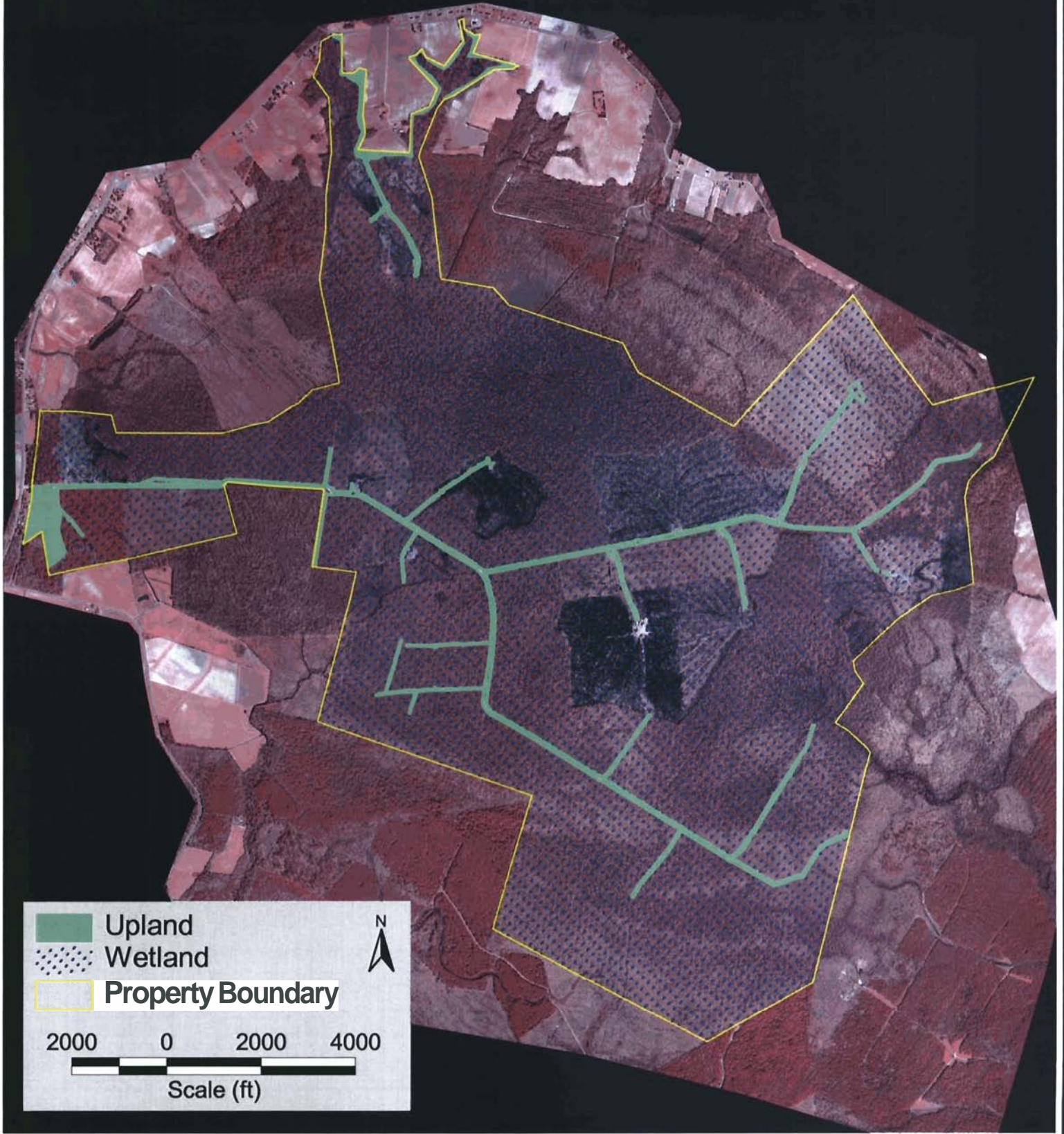
### 3.2.2 Wetlands

The Roquist Wetland Restoration Site is almost entirely comprised of an extensive wetland system. Specifically, the wetland accounts for 99%, or 3,881 ac of the Site. Based on field observations, the wettest hydrology is localized within the center of the Site where the lowest recorded elevations (41.5-42 ft above msl) occur. These areas experience more frequent and deeper inundation when compared with the adjacent wetland areas. Presumably this is due to the influx of water from the surrounding uplands. Relatively drier wetlands are located along the margins of the Roquist wetland where elevations are slightly higher (43-45 ft above msl) than elevations within the central flat. Environmental scientists of Hayes, Seay, Mattern and Mattern, Inc. (HSMM) delineated the wetland/upland boundary along the proposed mitigation areas from October 20 to 28, 2003 using the methods described in the *1987 U.S. Army Corps of Engineers (USACE) Manual, Field Guide for Wetland Delineation* (Figure 3). The jurisdictional determination was received from the USACE on February 11, 2004 (Appendix B)

## 3.3 Soils

The Bertie County Soil Survey (USDA 1990) indicates the Site is underlain by nine soil series (Figure 2). These soils include: Bibb and Johnston loam, Bonneau loamy sandy, Leaf sandy loam, Lenoir fine sandy loam, Lynchburg sandy loam, Norfolk sandy loam, Pantego loam, Rains sandy loam, and Roanoke fine sandy loam. Of the nine soil series, Leaf soil accounts for the majority of the Site and is almost entirely confined to the central flat of the wetland. Soil series





## WETLAND BOUNDARY

Roquist Wetland Restoration Site  
Bertie County, NC

FIGURE 3

mapped in the restoration areas were field verified by environmental scientist of HSMM on December 3, 2003. Table 1 describes the drainage class and hydric classification for each of these soils.

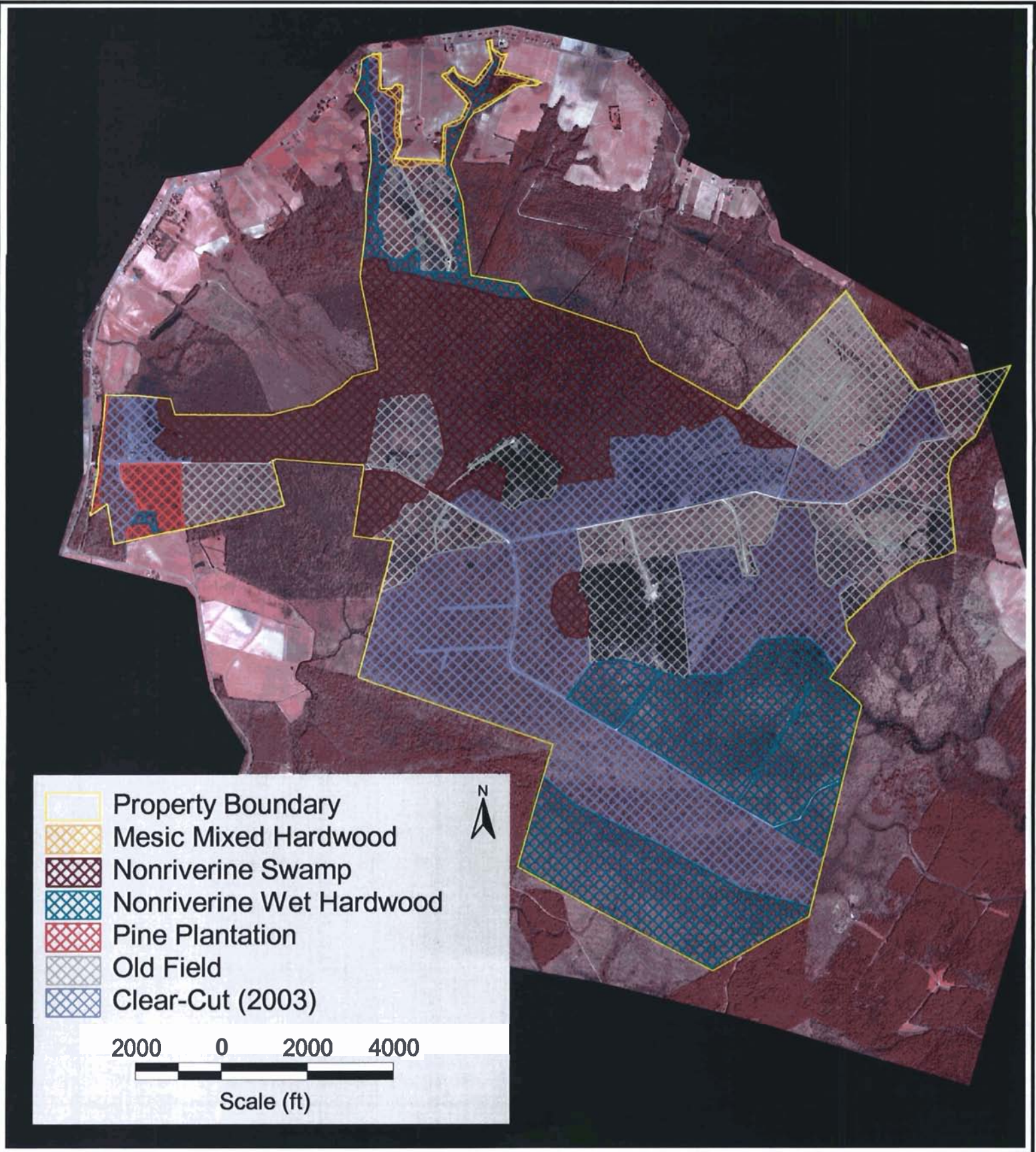
**Table 1. Roquist Wetland Restoration Site Mapped Soils**

Soil Name	Map Symbol	Percent Slope	Drainage Class	Hydric Class
Bibb and Johnston loam	BB	0 to 2	Poorly to very poorly drained	Hydric
Bonneau loamy sandy	BoB	0 to 6	Well drained	*
Leaf loam	Lf	-	Moderately well to somewhat poorly drained	Hydric
Lenoir fine sandy loam	Ln	-	Somewhat poorly drained	*
Lynchburg sandy loam	Ly	-	Somewhat poorly drained	*
Norfolk sandy loam	NoB	2 to 6	Well drained	Non-Hydric
Pantego loam	Pa	-	Very poorly drained	Hydric
Rains sandy loam	Ra	-	Poorly drained	Hydric
Roanoke fine sandy loam	Ro	-	Poorly drained	Hydric

\* Soils having hydric inclusions.

### 3.4 Plant Communities

The Classification of Natural Communities of North Carolina, Third Approximation (Schafale and Weakley 1990) was used to categorize the Site's natural plant communities. Consequently, the following natural communities were identified within the 3,926-ac Site: Nonriverine Swamp Forest, Nonriverine Wet Hardwood Forest, and Mesic Mixed Hardwood Forest (Coastal Plain Subtype). These communities are listed in the North Carolina Natural Heritage Program's (NCNHP) database for Natural Communities within the Roquist wetland. Floristic communities that could not be classified according to Schafale and Weakley (1990) included pine plantation, old-field community, and clear-cut areas (early succession) (Figure 4, Table 2, and Appendix A).



**PLANT COMMUNITIES**  
 Roquist Wetland Restoration Site  
 Bertie County, NC

FIGURE 4

**Table 2. Roquist Wetland Restoration Site Plant Communities**

Plant Community	Acres	Percent of Total Area
Nonriverine Swamp Forest	769	20
Nonriverine Wet Hardwood Forest	751	19
Mesic Mixed Hardwood Forest	23	1
Pine Plantation	46	1
Old-Field	981	25
Clear-Cut (Early Succession)	1,251	32
Logging Roads and Ditches*	105*	2*
<b>Total</b>	<b>3,926</b>	<b>100</b>

\* Non-plant community accounting for the remaining area.

### 3.4.1 Nonriverine Swamp Forest

Nonriverine Swamp Forests observed in the Roquist Wetland Restoration Site comprise approximately 20% or 769 ac of the property. Schafale and Weakley (1990) state that Nonriverine Swamp Forest communities typically occur in very poorly drained upland flats but the origin and dynamics of these communities are not well known. Presently, the Nonriverine Swamp Forest community consists of a mosaic of forest stands varying in age due to historic timbering activities. This community can be divided by stand age, including approximate acreage, into three groups: 10 to 30 years (240 ac); 30 to 70 years (139 ac); and 70 to 100 years of age (390 ac). Overall, the existing Nonriverine Swamp Forest community is centrally located within the flat and is distinguished biotically and abiotically from the peripheral, slightly elevated Nonriverine Wet Hardwood Forests. Nonriverine Swamp Forests differ from riverine swamp communities by source of water and topographic position. In Nonriverine Swamp Forests, upland run-off and water table fluctuations account for the majority of the flood source rather than from river flooding events or back-water (Schafale and Weakley 1990).

Timbering activities have influenced Nonriverine Swamp Forest plant species composition within the Roquist Wetland Restoration Site. Thus, stands of varying ages are dominated by varying canopy, shrub, and/or herbaceous species. The following is a list of the dominant vegetation for the mature Nonriverine Swamp Forest within the Site: CANOPY – bald cypress (*Taxodium distichum*), black gum (*Nyssa sylvatica* var. *biflora*), green ash (*Fraxinus pennsylvanica*), laurel oak (*Quercus laurifolia*), red maple (*Acer rubrum*), swamp tupelo (*Nyssa sylvatica* var. *biflora*), sweet gum (*Liquidambar styraciflua*), water tupelo (*Nyssa aquatica*), and willow oak (*Quercus phellos*); SUBCANOPY – iron wood (*Carpinus caroliniana*), red maple,

and sweet gum; SHRUB/VINE – greenbriar (*Smilax rotundifolia*), muscadine grape (*Vitis rotundifolia*), sweet pepperbush (*Clethra alnifolia*), and trumpet vine (*Campsis radicans*); HERBACEOUS – lizard’s tail (*Saururus cernuus*), netted chainfern (*Woodwardia areolata*), and royal fern (*Osmunda regalis*).

### 3.4.2 Nonriverine Wet Hardwood Forest

Nonriverine Wet Hardwood Forests observed in the Roquist Wetland Restoration Site account for approximately 751 ac, or 19% of the Site. This community was once common in Eastern North Carolina but is now considered threatened due to logging and the ease of converting this community to farmland or pine plantation by draining. Few of these communities are left, thus, preservation is highly valued. The Site contains large tracts of high quality Nonriverine Wet Hardwood stands adding to the importance of preservation.

Nonriverine Wet Hardwood Forests are located within the Site along the margin of the vast flat and are distinguished from the central Nonriverine Swamp Forest by a gradual elevating topography. Schafale and Weakley (1990) describe this palustrine community as occurring in poorly drained interstream flats and having fine textured mineral soils. Specifically, these communities commonly occur on the margins of wetlands. Nonriverine Wet Hardwood Forests are distinguished from Nonriverine Swamp Forests by relatively drier conditions and by the predominance of bottomland oaks or mixed hardwood species. Nonriverine Wet Hardwood Forests are distinguished from Mesic Mixed Hardwood Forests (Coastal Plain Subtype) by relatively wetter conditions and the presence but not dominance of swamp species (Schafale and Weakley 1990).

The following is a list of the dominant vegetation found in Nonriverine Wet Hardwood Forests within the Roquist Wetland Restoration Site: CANOPY – laurel oak, red maple, swamp chestnut oak (*Quercus michauxii*), swamp tupelo, sweet gum, and willow oak; SUBCANOPY – American holly (*Ilex opaca*), red maple, and sweet gum; SHRUB/VINE – grape (*Vitis* spp.), poison ivy (*Toxicodendron radicans*), and trumpet vine; HERBACEOUS – false nettle (*Boehmeria cylindrical*), lizard’s tail, and netted chainfern.

### 3.4.3 Mesic Mixed Hardwood Forest (Coastal Plain Subtype, Upland Flat Variant)

Mesic Mixed Hardwood Forests account for a small portion of the Roquist Wetland Restoration Site, roughly 23 ac, or one percent of the total acreage. Mesic Mixed Hardwood communities within the Site are considered of the *upland flat variant*, an ecotone to Nonriverine Wet Hardwood Forest, consisting of both hydrophytic and upland mesic plant species (Frost 1990). This community occurs near the margin of the Site surrounding Nonriverine Wet Hardwood

Communities. Schafale and Weakley (1990) describe this community as being distinguished from Nonriverine Swamp Forests by relatively drier conditions and the dominance of upland rather than wetland species. Mesic Mixed Hardwood Forests are distinguished from Nonriverine Wet Hardwood Forests by relatively drier conditions and the dominance of upland mesic species (Schafale and Weakley 1990). The vegetative distinction between Mesic Mixed Hardwood Forest and Nonriverine Wet Hardwood Forest is most likely due to small differences in microtopography between the two communities (Schafale and Weakley 1990). Within the Roquist wetland, Mesic Mixed Hardwood Forests presumably undergo relatively drier conditions than Nonriverine Wet Hardwood Forests.

The following is a list of the dominant vegetation found in Mesic Mixed Hardwood Forests within the Roquist Wetland Restoration Site: CANOPY – laurel oak, red maple, tulip poplar (*Liriodendron tulipifera*), and white oak (*Quercus alba*); SUBCANOPY – American beech (*Fagus grandifolia*), American holly, red maple, and white oak; SHRUB/VINE – greenbriar and muscadine grape; HERBACEOUS – giant cane (*Arundinaria gigantea*) and sedge (*Carex* spp.).

#### 3.4.4 Pine Plantation

Pine plantations represent a minimal portion (one percent, or 46 ac) of the total acreage within the Roquist Wetland Restoration Site. The existing pine plantation was established in 1993 and was presumably converted from Nonriverine Wet Hardwood Forest allowing loblolly pines (*Pinus taeda*) to establish in relatively drier soil conditions. Roughly, 36 ac of the pine plantation was bedded in order to elevate the loblolly roots above frequent inundation. Presently, the occurrence of hardwood species occupying the canopy, subcanopy, and herbaceous layers, and the presently low quality of the planted pines indicates that the plantation has not been managed with herbicidal or fertilization treatments. These species included Japanese honeysuckle (*Lonicera japonica*), muscadine grape, red maple, swamp chestnut oak, sweet gum, and trumpet vine.

#### 3.4.5 Old-Field

Old-field communities within the Site include early stages of Nonriverine Swamp and Wet Hardwood Forests and account for approximately 25%, or 981 ac. These communities were classified as those that have been intensively logged within 1 to 10 years of the investigation (October 2003). This community was dominated by herbaceous and sapling species including American sycamore (*Platanus occidentalis*), blackberry (*Rubus* spp.), common boneset (*Eupatorium perfoliatum*), devil's walking stick (*Aralia spinosa*), Eastern false-willow (*Baccharis halimifolia*), giant cane, meadow-beauties (*Rhexia* spp.), red maple, sweet gum, and tulip poplar.

### 3.4.6 Clear-Cut (Early Succession)

Clear-cut communities were classified as areas that had been intensively logged within one year of the Site investigation (October 2003). Clear-cut communities included approximately 32%, or 1,251 ac of the total 3,926 ac within the Site. At the time of the investigation, these communities were in the earliest stages of forest succession. Plant species observed were those that can tolerate long periods of inundation and soil anoxia due to the absence of mature canopy species to aid in water uptake. The clear-cut communities were dominated by herbaceous species including giant cane, soft rush (*Juncus effusus*), common reed (*Phragmites australis*), arrow-leaf tearthumb (*Polygonum sagittatum*), wool-grass bulrush (*Scirpus cyperinus*), and cattails (*Typha* spp.). The wettest areas, or areas of deepest inundation, were within skidder trails created by heavy equipment during logging. Most of these linear pools were absent of vegetation or had clumps of cattails. American sycamore, Eastern false-willow, red maple, and sweet gum were the only woody species present within the clear-cut communities with stump sprouts accounting for the majority of the stems.

### 3.5 Federally Protected Species

The red-cockaded woodpecker is the only species federally listed as threatened or endangered for Bertie County, North Carolina. The red-cockaded woodpecker was listed as endangered throughout its entire range on October 13, 1970. As of June 15, 2005, the NCNHP database for threatened and endangered species revealed the red-cockaded woodpecker has been observed in Bertie County within the last 20 years, though none have been observed within one mile of the Roquist Wetland Restoration Site. The closest known observation of the red-cockaded woodpecker in Bertie County is within seven miles of the Roquist Wetland Restoration Site near Burden, NC.

#### *Habitat*

Habitat for the red-cockaded woodpecker consists of old-growth open stands of southern pines, which are utilized for foraging and nesting grounds. The red-cockaded woodpecker shows a particular affinity for stands of longleaf pine (*Pinus palustris*). Inhabited stands typically contain more than 50 percent pine, lack a thick understory, and are contiguous with other suitable stands. The red-cockaded woodpecker nests exclusively in living pine trees that are greater than 60 years in age and are contiguous with pine stands that are at least 30 years in age.

#### *Biological Conclusion*

#### *No Effect*

The majority of the habitat observed within the Site consists primarily of swamp hardwood forests. Although there are pine stands within the Site, none harbor pines greater than 60 years old, thus not meeting habitat requirements for the red-cockaded woodpecker. Additionally,

construction activities will be limited to logging roads and roadside ditches in which red-cockaded woodpecker habitat does not exist. Consequently, construction of the Roquist Wetland Restoration Site will have “No Effect” on the red-cockaded woodpecker or its preferred habitat.

### 3.6 Federal Species of Concern

There are four species listed as Federal Species of Concern for Bertie County (Table 3). The Roquist Wetland Restoration Site includes suitable habitat for three of the four species. Specifically, habitat for the Eastern Henslow's sparrow includes clear-cut pocosins and other damp weedy fields [breeding season only] in the North Carolina coastal plain. Habitat for the Cerulean warbler includes mature hardwood swamp forest (breeding season only) in the North Carolina coastal plain. Chowanoke crayfish habitat includes streams and rivers occurring in the Roanoke River drainage (Indian Creek). The Rafinesque's big-eared bat roosts in caves, mines, and old buildings, none of which occur on the site.

**Table 3. Federal Species of Concern for Bertie County, NC**

Common Name	Scientific Name	NC Status	Habitat Present
Eastern Henslow's Sparrow	<i>Ammodramus henslowii</i>	SR	Yes
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>	SC*	No
Cerulean Warbler	<i>Dendroica cerulea</i>	SR	Yes
Chowanoke Crayfish	<i>Orconectes virginianus</i>	SC	Yes

“SC” Any species of plant in North Carolina which requires monitoring but which may be collected and sold under regulations adopted under the provisions of [the Plant Protection and Conservation Act]” (GS 19B 106:202.12). (Special Concern species that are not also listed as Endangered or Threatened may be collected from the wild and sold under specific regulations. Propagated material only of Special Concern species which are also listed as Endangered or Threatened may be traded or sold under specific regulations.)

“SR” A Significantly Rare species is one which is very rare in North Carolina, generally with 1-20 populations in the state, generally substantially reduced in numbers by habitat destruction, direct exploitation or disease.

\* Historic record - the species was last observed in the county more than 50 years ago.

## 4.0 REFERENCE WETLANDS

### 4.1 Vegetation

Each wetland community (Nonriverine Swamp and Nonriverine Wet Hardwood) proposed for restoration has a representative undisturbed forested area as a reference wetland. Tree species composition (qualitative) was inventoried in both reference communities and used as a guide for the planting plan. Refer to Sections 3.4.1 and 3.4.2 for species composition information.

### 4.2 Hydrology

Hydrologic monitoring within reference wetlands will consist of groundwater elevation observations using water gauges. Remote Data Systems, Inc. model Ecotone™ WM Series



automated groundwater monitoring gauges were installed within reference wetlands on May 10, 2005 in accordance with specifications in the Corps of Engineers' *Installing Monitoring Wells/Piezometers in Wetlands* (WRP Technical Note HY-IA-3.1, August, 1993). These gauges will continuously record water level data along a 40-inch gradient once daily for five years. Groundwater elevations within the reference wetland will be used as the target elevation for the associated restoration communities.

## **5.0 RESTORATION PLAN**

### **5.1 Wetland Restoration**

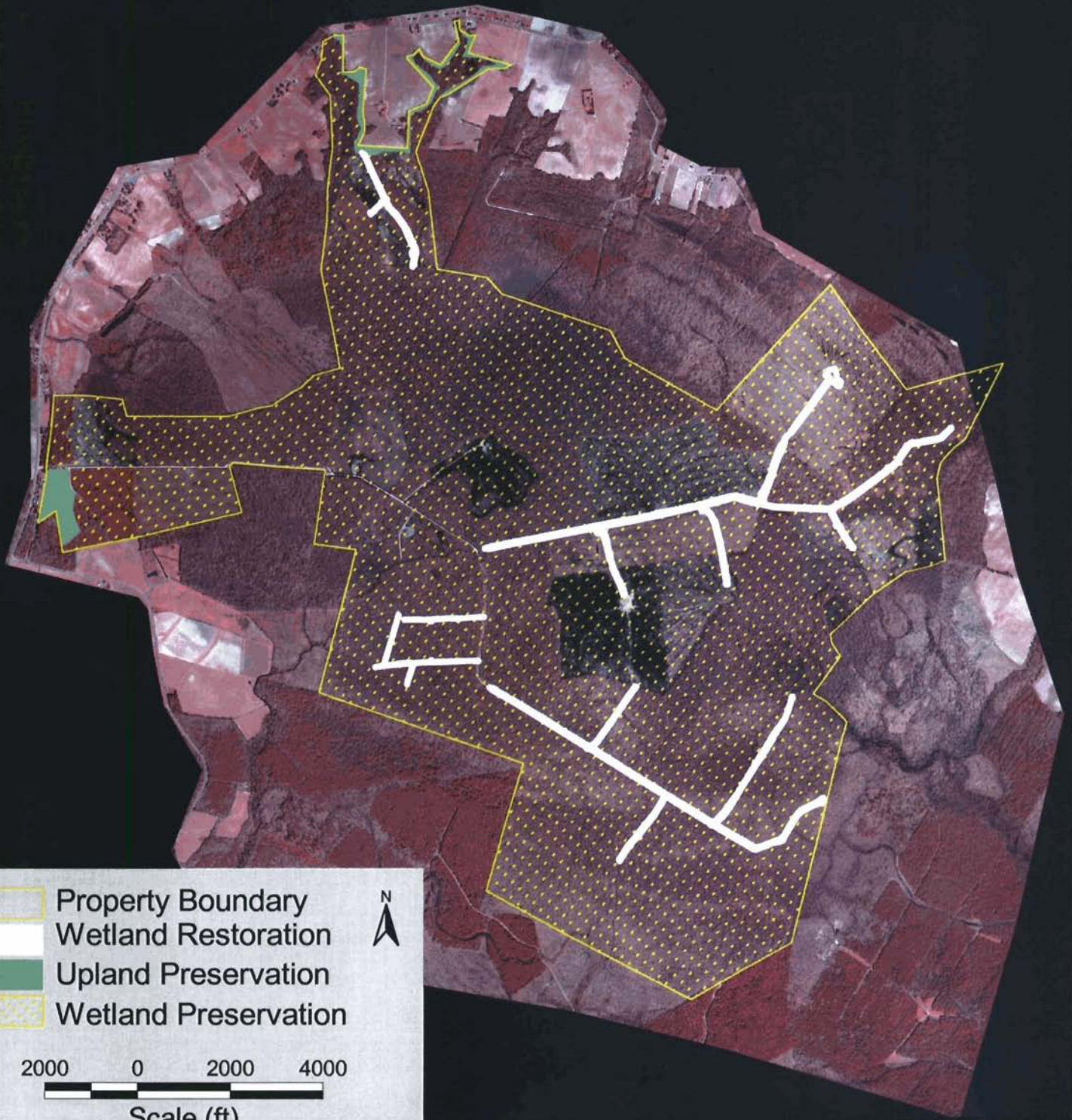
Wetland restoration efforts for Phase I of the Roquist Wetland Restoration Site will include 52 ac of nonriverine wetlands (Figure 5, Plan Sheets 4-8). The proposed restoration efforts will consist of grading the existing logging roads and spoil areas to their original wetland elevations, filling the existing roadside ditches to their original wetland elevations, and soil preparation (ripping/disking) of the restoration areas. Phase II of the wetland restoration effort will involve grading and filling the remaining roads and ditches (approx. 53 ac) to their original wetland elevations.

#### **5.1.1 Hydrology**

Original hydrologic regime will be restored in the proposed restoration areas by filling roadside ditches, grading road fill and spoil areas to the original wetland elevations, and soil preparation (ripping/disking) of the restoration areas. Additionally, impervious dikes will be placed in select locations within the restored ditch areas to restrict ground water movement through backfilled ditches. In order to compare existing natural elevations to road, ditch, and spoil area elevations, cross sections were surveyed approximately every 1,000 ft in the proposed restoration areas (Figure 6). Natural wetland elevations determined by these cross sections will be used as the target elevations in the restoration areas. Elevation surveys will be conducted throughout the construction process in order to meet target elevations.

#### **5.1.2 Soils**

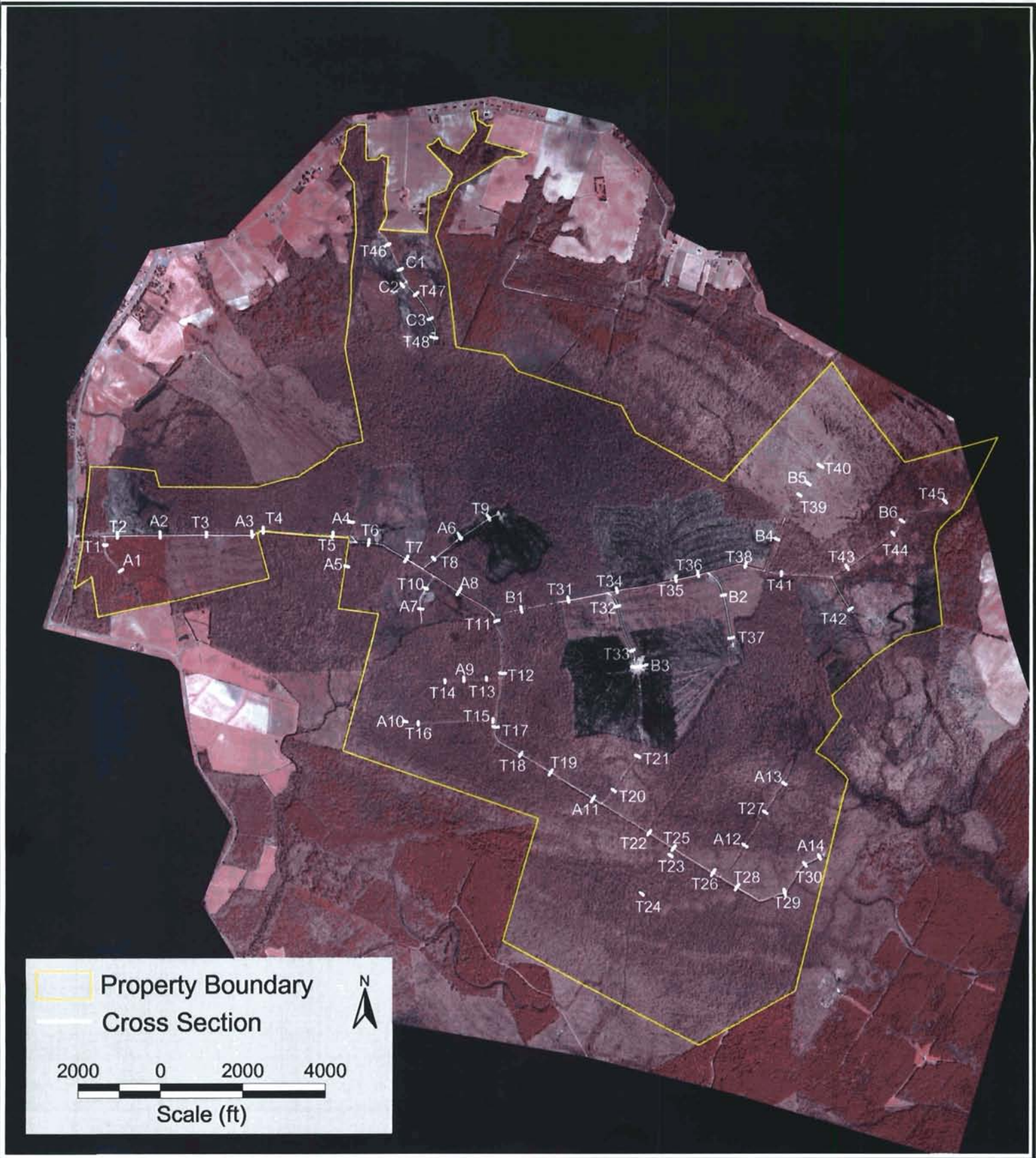
All soils utilized for construction within the restoration areas will consist of in situ soils. If there is material that is unsuitable for backfilling, it will be disposed of offsite and imported soil will be used to back fill the ditches. Additionally, if unsuitable materials exist in the soil below original ground elevations, these materials will be removed and replaced with imported soil. The restoration areas will be graded and ripped/disked following construction activities.



## MITIGATION AREAS PHASE I

Roquist Wetland Restoration Site  
Bertie County, NC

FIGURE 5



**CROSS SECTION LOCATIONS**  
 Roquist Wetland Restoration Site  
 Bertie County, NC

FIGURE 6



### 5.1.3 Vegetation

The proposed wetland restoration areas will be planted with trees in the form of bare-root stock. Planting will be performed between December 1 and March 15 while stock is dormant using a minimum stem count of 680 stems per acre. This translates to planting on approximately 8-foot centers. The restoration areas will be planted with either a Nonriverine Swamp Community or Nonriverine Wet Hardwood Community. The proposed plant community to be planted in the restoration areas will be determined by the existing plant community surrounding that location (Figure 7). In the restoration areas where the surrounding plant community is a clear cut or old field community, the proposed plant community to be planted will be determined by the plant community that existed prior to timbering. Tree species to be planted within the Nonriverine Swamp Community will be consistent with those species located within the reference wetlands (refer to section 5.0) and derived from the following list (as available):

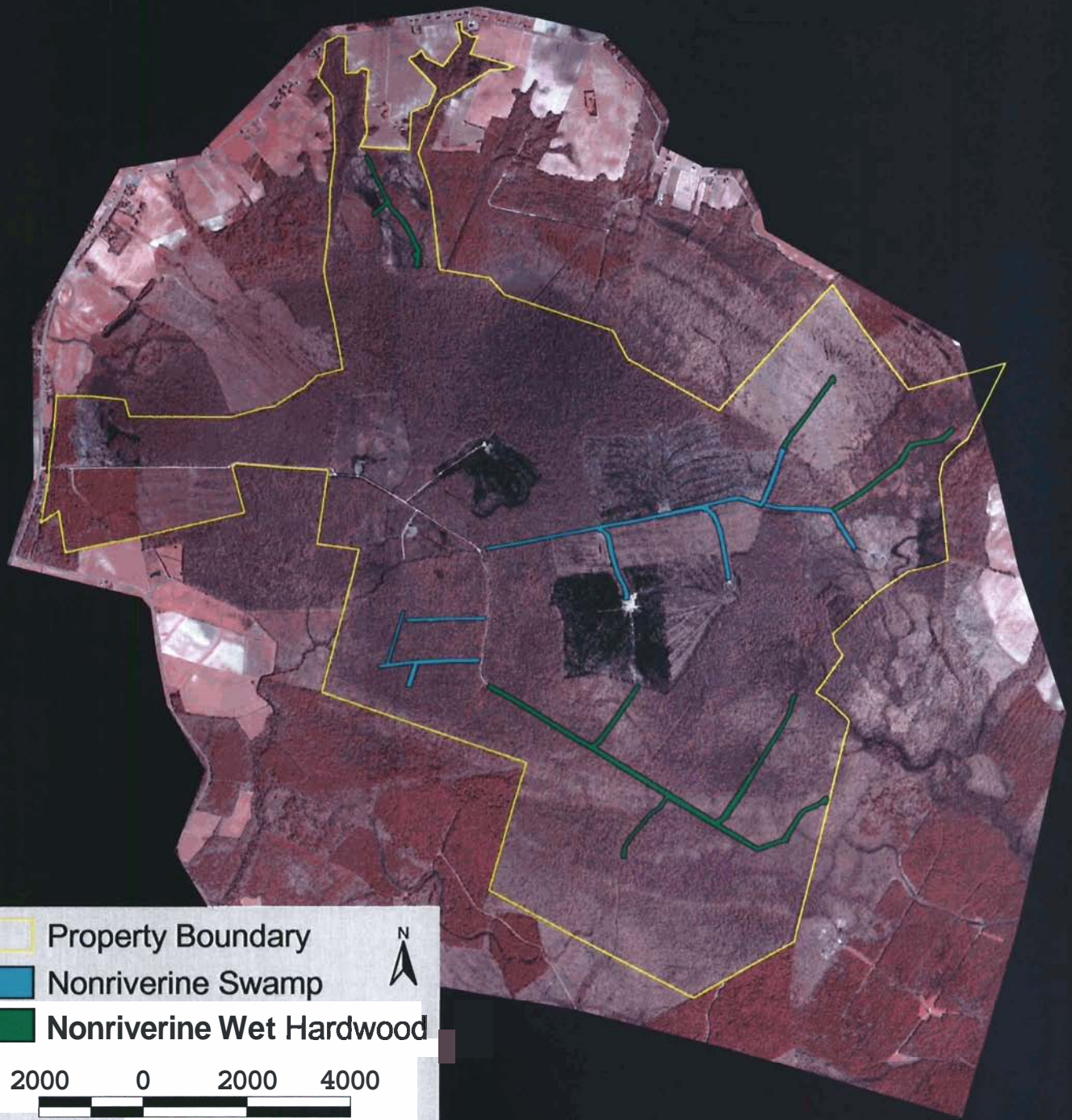
- *Fraxinus pennsylvanica* (green ash)
- *Nyssa sylvatica* var. *biflora* (black gum)
- *Quercus laurifolia* (laurel oak)
- *Quercus michauxii* (swamp chestnut oak)
- *Quercus phellos* (willow oak)
- *Taxodium distichum* var. *distichum* (bald cypress)

Shrub species to be planted within the Nonriverine Swamp Community will be consistent with those species located within the reference wetlands (refer to section 5.0) and derived from the following list (as available):

- *Carpinus caroliniana* (iron wood)
- *Clethra alnifolia* (sweet pepperbush)
- *Vaccinium corymbosum* (highbush blueberry)

Tree species to be planted within the Nonriverine Wet Hardwood Community will be consistent with those species located within the reference wetlands and derived from the following list (as available):

- *Nyssa aquatica* (water tupelo)
- *Quercus laurifolia* (laurel oak)
- *Quercus michauxii* (swamp chestnut oak)
- *Quercus pagoda* (cherry bark oak)
- *Ulmus Americana* (American elm)



Property Boundary

Nonriverine Swamp

Nonriverine Wet Hardwood

N

2000 0 2000 4000

Scale (ft)



**PROPOSED**  
**PLANT COMMUNITY LOCATIONS**  
Roquist Wetland Restoration Site  
Bertie County, NC

FIGURE 7

Shrub species to be planted within the Nonriverine Wet Hardwood Community will be consistent with those species located within the reference wetlands and derived from the following list (as available):

- *Clethra alnifolia* (sweet pepperbush)
- *Itea virginica* (Virginia willow)
- *Leucothoe axillaris* (coastal dog-hobble)

## 5.2 Wetland Preservation

The wetland preservation component for the Roquist Wetland Restoration Site will consist of preserving 3,776 ac (Figure 5). Of this, 390 ac are high quality wetland preservation. The total acreage proposed for preservation includes areas that contain stands established before 1993 (1,520 ac), areas that have been logged since 1993 (2,210 ac), and a ten year old pine plantation (established in 1993) (46 ac). Although the logged areas are absent of mature vegetation, they are considered an essential part of the existing high quality forests. These areas will ultimately contribute to the formation of an extensive wilderness area through the discontinuation of timber practices and the process of natural regeneration within the Site.

## 5.3 Upland Preservation

The upland preservation component for the Site will consist of preserving 45 ac of existing Mesic Mixed Hardwood Forests and clear-cut uplands. These areas are located along the western and northern boundaries of the Site (Figure 5).

## 6.0 MONITORING PLAN

Monitoring of wetland restoration efforts will be performed for five years or until success criteria are satisfied. Monitoring is proposed for two wetland components, hydrology and vegetation.

### 6.1 Hydrology

Automated monitoring gauges utilized to monitor the Site's groundwater hydrology will be designed and placed in accordance with specifications in the Corps of Engineers' *Installing Monitoring Wells/Piezometers in Wetlands* (WRP Technical Note HY-IA-3.1, August, 1993). The monitoring gauges installed will consist of Remote Data Systems, Inc. model Ecotone™ WM Series automated groundwater monitoring gauges. These gauges will continuously record water level data along a 40-inch gradient.

### 6.1.1 Hydrologic Monitoring

Thirteen Ecotone™ WM Series (40-in) automated groundwater monitoring gauges will be installed throughout five locations within the site (Figure 8). At least two gauges will be installed at each location with one gauge positioned in the restoration area and one gauge positioned in the adjacent reference wetland. Following installation, the automated groundwater gauges will be adjusted to record data once daily. The gauges will be in operation throughout the year, and data will be retrieved twice a year (at the beginning and end of the growing season) to provide effective monitoring and assessment of success criteria for wetland hydrology.

### 6.1.2 Hydrologic Success Criteria

Wetland hydrology success criterion will be satisfied in the restoration areas during average climatic conditions when saturated soil conditions occur within 12 in of the ground's surface for a minimum of 12.5% of the growing season, or if the hydroperiod in the restoration areas is within 20% of the reference wetland's hydroperiod during drought conditions.

## 6.2 Vegetation

After HSMM completes first year vegetation monitoring EEP will be responsible for monitoring and long-term management of the Site.

### 6.2.1 Vegetation Monitoring

Quantitative sampling plots (10 meter (m) x 10 m) for vegetation will be established in the wetland restoration areas. The number of vegetation plots will be specified by EEP in the Mitigation Plan. Vegetation plots will be inventoried after each growing season until vegetation success criteria is achieved. Floristic inventories will begin within the first growing season following completion of construction. Permanent photography stations will be established for each sampling plot at selected vantage points to provide a visual record of vegetation development over time. All vegetation monitoring plots will be correlated with hydrological monitoring sites where possible to allow for point-source data of hydrologic and vegetation parameters.

### 6.2.2 Vegetation Success Criteria

Wetland vegetation success criterion is defined by a minimum mean density of 320 trees per acre of approved target species surviving for the first three years (USACE 1995). The required success criteria will decrease by 10% per year after the third year to 290 stems per acre for year four and 260 stems per acre for year five. Vegetation success criteria apply to the Nonriverine



## GROUNDWATER MONITORING STATIONS

Roquist Wetland Restoration Site  
Bertie County, NC

FIGURE 8





Swamp Community and the Nonriverine Wet Hardwood Community to be planted within the Roquist Wetland Restoration Site.

### **6.3 Report Submittals**

As-built plans will be submitted within 90 days following the completion of mitigation construction. The as-built plans will show final site grading along with a description of post-construction site conditions. The report will also provide a map of groundwater monitoring gauge locations, proposed photographic monitoring stations and proposed vegetation sampling areas.

The first year monitoring report will be submitted to EEP in pdf format. Subsequent monitoring reports will be submitted by EEP annually to the resource agencies following each growing season. Submitted reports will include (1) sample plot data, (2) water level data from automated groundwater monitoring gauges, and (3) a discussion of substantiated problems and proposed recommendations for problem resolution. Density, survival and percent composition of targeted tree species will be reported. The duration of wetland hydrology during the growing season will also be calculated at each monitoring gauge location and extrapolated to each restored community.

### **6.4 Contingency**

In the event that vegetation and/or hydrology success criteria are not fulfilled, appropriate contingency measures will be implemented in coordination with the Resource Agencies. Examples of such actions include replanting and extension of the monitoring period if community mitigation types do not fulfill minimum species density and distribution requirements. If exotic invasive plant species are of concern, appropriate measures will be used to control for them. Hydrologic contingency will require consultation with hydrologists and the Resource agencies in the event that predicted hydrology is not achieved during the monitoring period. Recommendations for altering hydrology to establish wetland hydrology will be implemented and monitored until the hydrology success criteria are achieved.

## **7.0 MITIGATION VALUES**

The objective of the Roquist Wetland Restoration Site is to enhance and preserve 3,926 ac of the Roanoke and Cashie Rivers' headwater ecosystems. The proposed mitigation components should be viewed from the perspective of their cumulative contribution to the overall value of the ecosystem rather than their individual values. The nonriverine ecosystem to be protected in perpetuity not only provides valuable habitat to a diverse assemblage of flora and fauna but also

serves as a contiguous wildlife corridor. Wetland values that will be increased by the mitigation efforts proposed for the Site include water storage, pollutant removal, aquatic/wildlife habitat, recreation, and education. The types of natural communities available for mitigation within the Site are listed in Table 4.

The Roquist Wetland Restoration Site will be managed by EEP. All mitigation credits and the credit release schedule for the Roquist Wetland Restoration Site will be consistent with the July 22, 2003 MOA between the NCDENR, NCDOT, and USACE.

**Table 4. Phase I Mitigation acreages for the Roquist Wetland Restoration Site**

Mitigation Type	Acres
<b>Wetlands</b>	
Restoration	52
Preservation	
<i>Existing Forest</i>	1,520
<i>Pine Plantation</i>	46
<i>Clear-Cut Areas</i>	<u>2,210</u>
<b>Total</b>	<b>3,776</b>
<b>Uplands</b>	
Preservation	
<i>Existing Forest</i>	23
<i>Clear-Cut Areas</i>	<u>22</u>
<b>Total</b>	<b>45</b>

## 8.0 REFERENCES

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**APPENDIX A**  
**ROQUIST WETLAND RESTORATION SITE**  
**PHOTOGRAPHS**



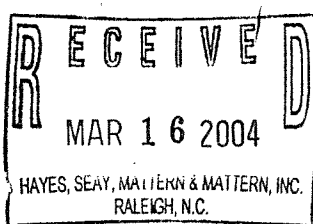
Photo: A) Jack's Branch; B) Nonriverine Swamp Community; C) Nonriverine Wet Hardwood Community; D) Mesic Mixed Hardwood Community; E) old-field community; F) clear-cut community; G) clear-cut community.



Photo: H) Logging road, roadside ditch, and spoil; I) new logging road and ditch; J) restoration corridor with adjacent mature stand (seed source); K) timber processing area – log-pile; L) ditch effect – surface water drainage; M) example cross section location.

**APPENDIX B**

**ROQUIST WETLAND RESTORATION SITE  
JURISDICTIONAL DETERMINATION**



U.S. ARMY CORPS OF ENGINEERS  
WILMINGTON DISTRICT

Action ID 200411232

County Bertie

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner/Agent: NCDOT, Gregory J. Thorpe, Ph.D.

Address: Environmental Management Director, PDEA  
1548 Mail Service Center  
Raleigh, North Carolina 27699-1548

Telephone No.: (919) 733-3141

Size and location of property (waterbody, highway name/number, town, etc.) The project area is approximately 3,926 acres located on the east side of NC Highway 11 just north of NCSR 1108 and south of Woodville/Lewiston adjacent to Roquist Pocosin, Roquist Creek, Jack's Branch, and Indian Creek.

Indicate Which of the Following Apply:

- There are waters of the U.S. and/or wetlands, on the above described property which we strongly suggest should be delineated and surveyed. The surveyed wetland lines must be verified by our staff before the Corps will make a final jurisdictional determination on your property.
- Because of the size of your property and our present workload, our identification and delineation of your wetlands cannot be accomplished in a timely manner. You may wish to obtain a consultant to obtain a more timely delineation of the wetlands. Once the consultant has flagged a wetland line on the property, Corps staff will review it, and, if it is accurate, we strongly recommend that you have the line surveyed for final approval by the Corps. The Corps will not make a final jurisdictional determination on your property without an approved survey.
- The waters of the U.S. and/or wetlands, within the construction corridor limits, have been delineated by your consultant, the delineation has been reviewed in the field by the Corps on February 11, 2004, and the delineation as shown in the submission by your consultant, dated February 18 and 23, 2004, has been determined by the Corps to be accurate, based on the information at this time. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- There are no waters of the U.S., to include wetlands, present on the above described 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 Elizabeth City, NC, at (252) 264-3901 to determine their requirements.

Placement of dredged or fill material in Waters of the US and/or wetlands on this property without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC 1311). A permit is not required for work restricted entirely to existing non-wetland area. If you have any questions regarding this determination and/or the Corps of Engineers regulatory program, please contact Bill Biddlecome at (252) 975-1616 ext. 31.

Basis For Determination: The wetlands are a broad continuum to Roquist Pocosin, Roquist Creek, Indian Creek, and Jack's Branch which are tributaries to the Roanoke River.

Owner/Authorized Agent Signature \_\_\_\_\_

Corps Regulatory Official William J. Biddlecome  
Date 2/5/2004 Expiration Date 2/5/2009

SURVEY PLAT OR FIELD SKETCH OF THE DESCRIBED PROPERTY AND THE WETLAND DELINEATION FORM MUST BE ATTACHED TO THE FILE COPY OF THIS FORM