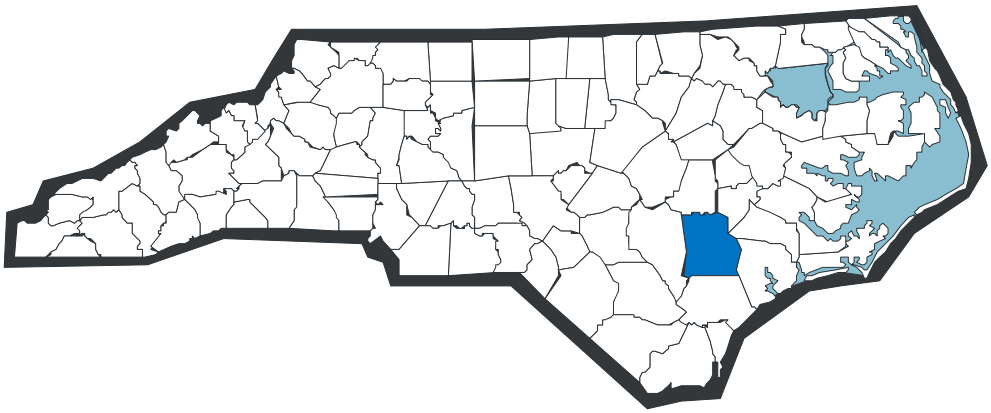
AS-BUILT MITIGATION REPORT
GROVE CREEK



GROVE CREEK MITIGATION SITE
DUPLIN COUNTY, NORTH CAROLINA
TIP No. R-2204 WM
NCDOT Project No. 8.1241801
(EEP Project Number .00038)

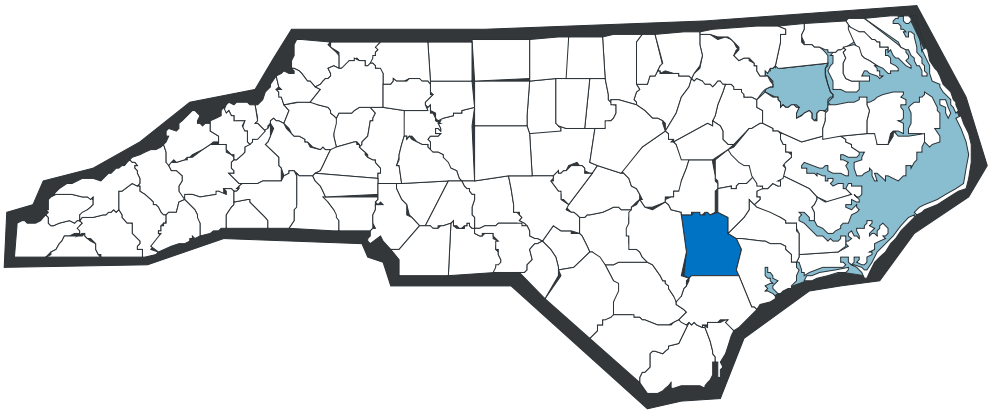
Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

Prepared by:
Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Spring, North Carolina 27592

Design Firm:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
Raleigh, North Carolina

April 2007

AS-BUILT MITIGATION REPORT
GROVE CREEK



GROVE CREEK MITIGATION SITE
DUPLIN COUNTY, NORTH CAROLINA
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Ecosystem Enhancement PROGRAM

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April 2007

EXECUTIVE SUMMARY

The Grove Creek Wetland Mitigation Site (Site) is located within the United States Geological Survey (USGS) Hydrologic Unit 03030007 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-06-22) of the Cape Fear River Basin. The Site includes an approximately 549-acre tract, located 5 miles east of Kenansville in central Duplin County.

Prior to implementation of wetland restoration activities, the Site was characterized by active agricultural fields, mixed hardwood forests, and a large Bottomland Hardwood/Cypress-Gum Swamp wetland system located adjacent to the Northeast Cape Fear River.

Primary mitigation activities included

- restoration of 3.0 acres of previously ditched and filled riverine wetlands,
- creation of 9.2 acres of riverine wetlands within existing upland agricultural fields,
- hydrological enhancement of 18.4 acres of previously ditched riverine wetlands,
- preservation of the 375.9 acres of existing Coastal Plain Bottomland Hardwoods/Cypress-Gum Swamp Forest wetlands,
- restoration of 7.3 acres of a previously drained nonriverine wetland area,
- hydrological enhancement of 1.9 acres of previously drained nonriverine wetlands,
- and creation of 1.4 acres of nonriverine wetlands within existing upland agricultural fields.

Wetland restoration and creation at the Site entailed 1) ditch cleaning prior to backfill, 2) impervious ditch plug construction, 3) ditch/canal backfilling, and 4) removal of fill material from wetlands.

According to the January 2004 Mitigation Plan, the primary goals of the project include 1) maximizing the area returned to historic wetland function; 2) expand, enhance, and preserve 549 acres of the Northeast Cape Fear River riparian ecosystem; 3) protect the Site with a conservation easement in perpetuity; 4) provide valuable habitat to a diverse assemblage of flora and fauna; 5) serve as a wildlife corridor along the Northeast Cape Fear river; and 6) provide numerous wetland values including water storage, pollutant removal, aquatic/wildlife habitat, recreation, and education.

Table of Contents

List of Figures

1.0 PROJECT BACKGROUND

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Directions to the Site:
From Raleigh take Interstate 40 East to Exit 373

- Travel east on Highway 24 through Kenansville
- Travel approximately 6 miles further east on Highway 24 (if you reach the Cape Fear River, you have gone too far) to a left onto Dobson Chapel Road.
- Road surface becomes gravel and intersects another gravel road in about 0.3 mile. The Site is straight ahead.

Prior to implementation of wetland restoration activities, the Site was characterized by active agricultural fields, mixed hardwood forests, and a large Bottomland Hardwood/Cypress-Gum Swamp wetland system located adjacent to the Northeast Cape Fear River.

Primary mitigation activities are outlined in Figure 2 and included

- restoration of 3.0 acres of previously ditched and filled riverine wetlands,
- creation of 9.2 acres of riverine wetlands within existing upland agricultural fields,
- hydrological enhancement of 18.4 acres of previously ditched riverine wetlands,
- preservation of the 375.9 acres of existing Coastal Plain Bottomland Hardwoods/Cypress-Gum Swamp Forest wetlands,
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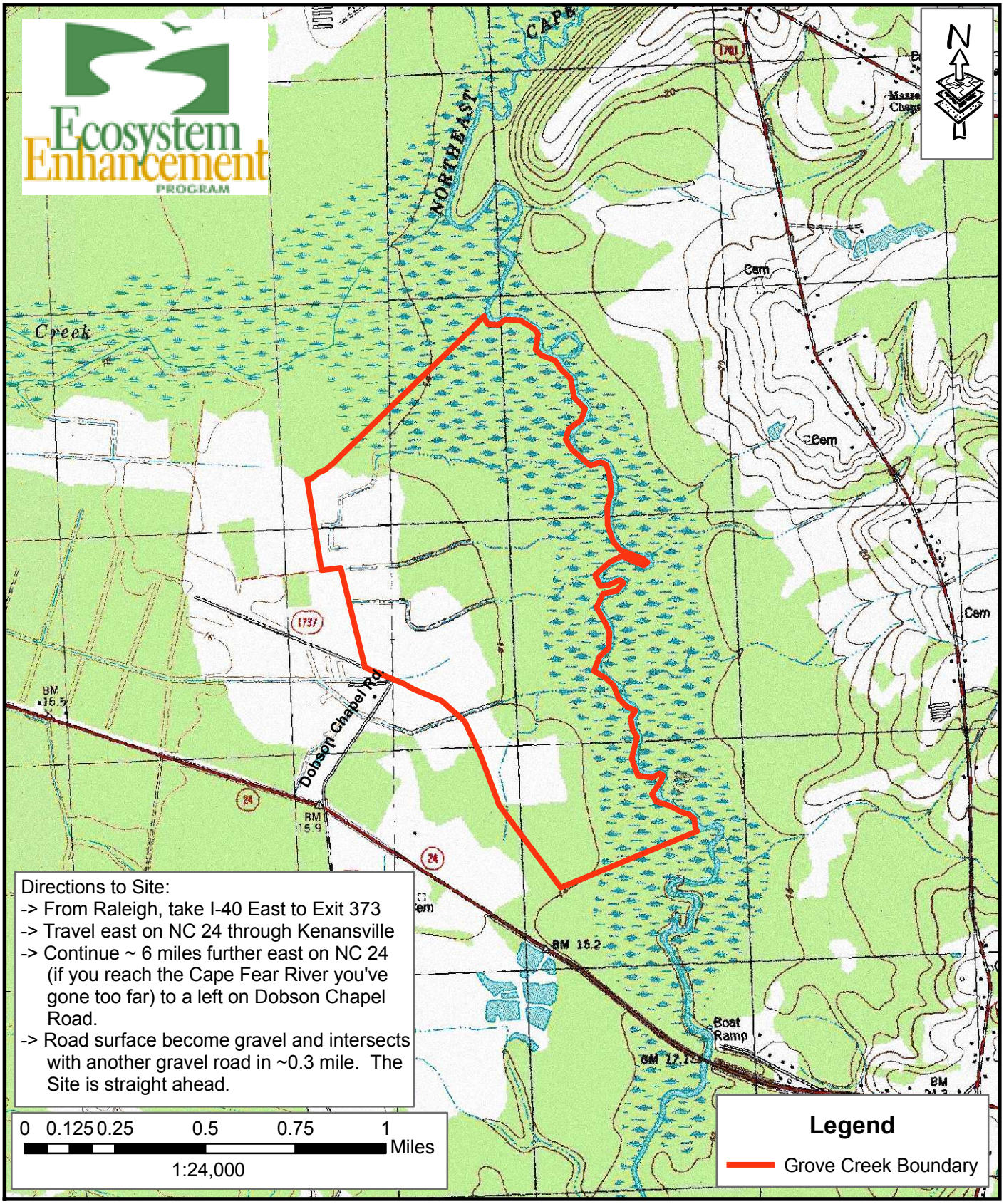
In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for five years or until success criteria are achieved. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring for the 2006 (year 1) growing season at the Grove Creek Mitigation Site.

2.0 MITIGATION PLAN

Vegetation and hydrology will be monitored at the Site for five years or until success criteria have been achieved. The mitigation plan is outline in Figure 3.

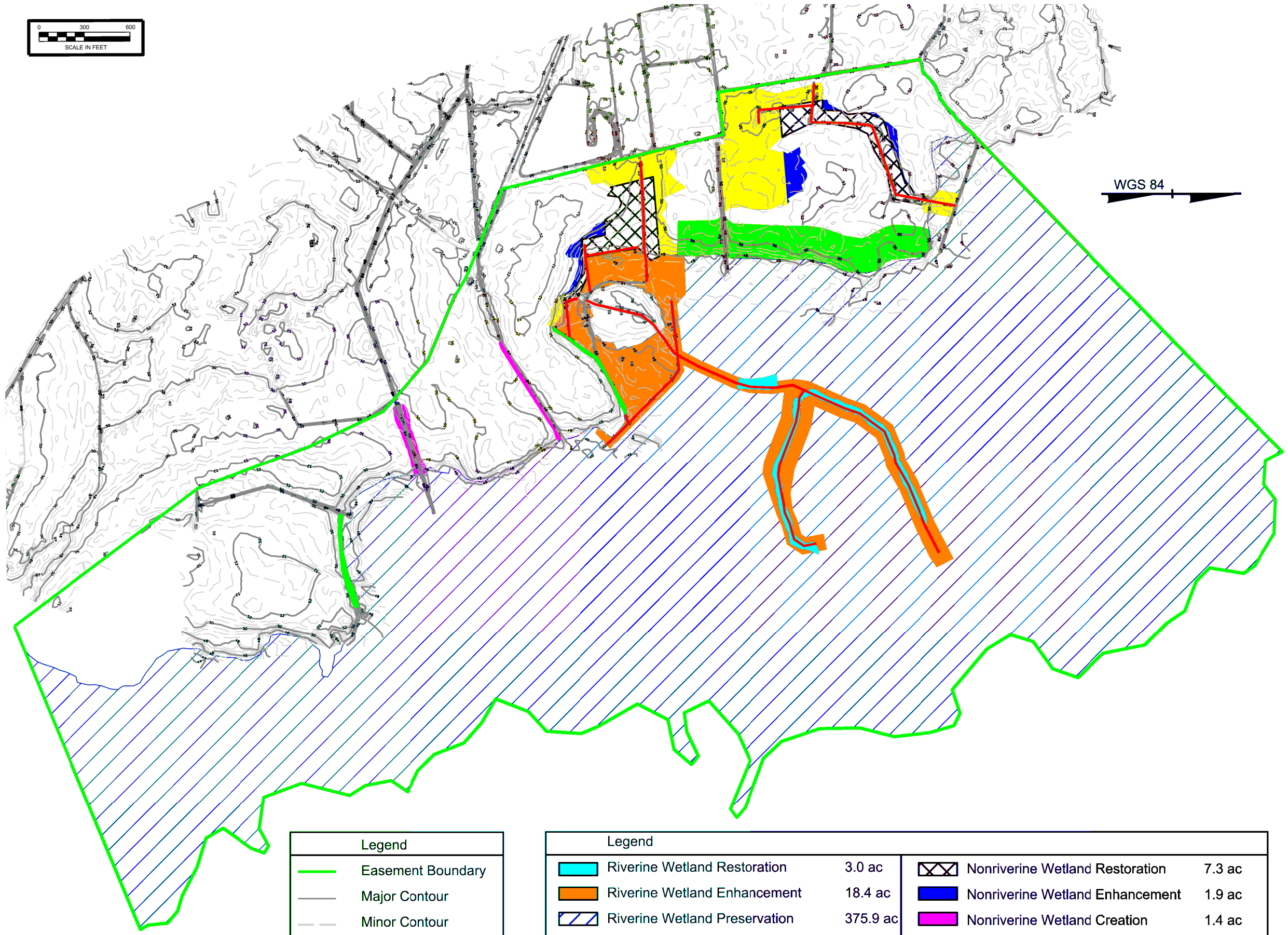


Axiom Environmental, Inc
2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax
Axiom Environmental, Inc.

SITE LOCATION
GROVE CREEK WETLAND RESTORATION SITE
EEP Project Number .00038
As-built Mitigation Report
Duplin County, North Carolina

CLF
Date: April 2007
Project: 06-021

FIGURE
1



Axiom Environmental, Inc.

Ecosystem Enhancement Program

NOTES/REVISIONS

Project:

Grove Creek Restoration Site

Project No. .00038
Year 1 (2006) Monitoring Report
Duplin County
North Carolina

Title:

As-Built Wetland Restoration Plan

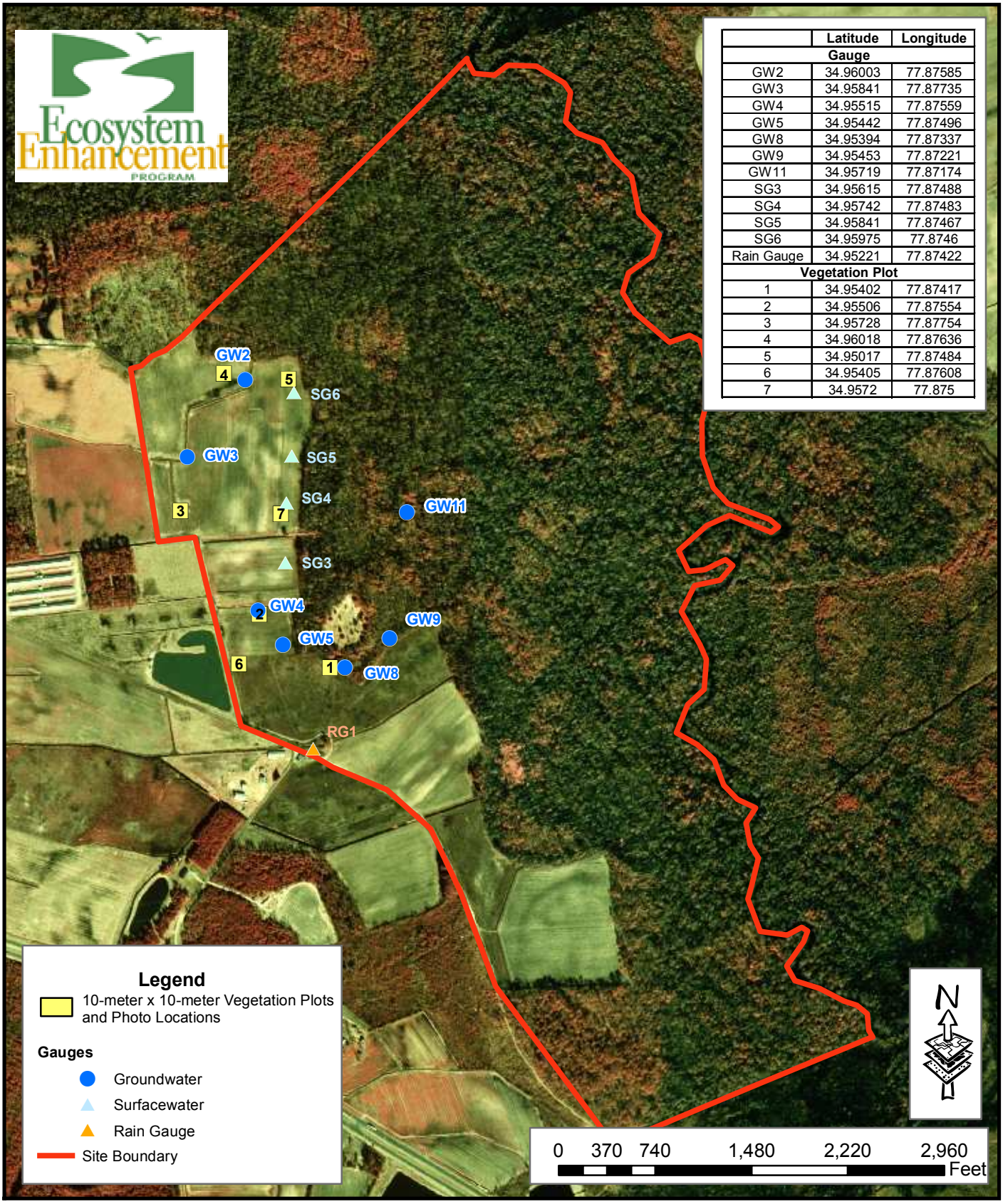
Scale: 1" = 655 '

Date: MAR 2007

Project No.: 06-021

FIGURE NO.

2



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Gauge		
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GW3	34.95841	77.87735
GW4	34.95515	77.87559
GW5	34.95442	77.87496
GW8	34.95394	77.87337
GW9	34.95453	77.87221
GW11	34.95719	77.87174
SG3	34.95615	77.87488
SG4	34.95742	77.87483
SG5	34.95841	77.87467
SG6	34.95975	77.8746
Rain Gauge	34.95221	77.87422
Vegetation Plot		
1	34.95402	77.87417
2	34.95506	77.87554
3	34.95728	77.87754
4	34.96018	77.87636
5	34.95017	77.87484
6	34.95405	77.87608
7	34.9572	77.875

Axiom Environmental, Inc.
Axiom Environmental, Inc
2126 Rowland Pond Drive
Willow Spring, NC 27592
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(919) 341-3839 fax

MONITORING PLAN
GROVE CREEK WETLAND RESTORATION SITE
EEP Project Number .00038
As-built Mitigation Plan
Duplin County, North Carolina

CLF

Date: Mar 2007

Project: 06-021

FIGURE
3

2.1 Hydrologic Success Criteria

Success criteria for wetland hydrology at Grove Creek require inundation or saturation within 12 inches of the ground surface for a consecutive period of 12.5 percent of the growing season. The soil survey for Duplin County does not contain growing season data; therefore, due to its close proximity the Sampson County soil survey was used. The estimate growing season begins March 18 and ends November 4 (239 days). In order to attain hydrologic success, saturation within 12 inches of the ground surface is required for at least 30 consecutive days (12.5 percent of the growing season).

2.2 Hydrologic Monitoring

Seven groundwater monitoring gauges, four surfacewater monitoring gauges, and one rain gauge will be maintained and monitored throughout the growing season for each monitoring year.

2.3 Vegetation Success Criteria

Wetland vegetation success criteria at Grove Creek will require an average across the Site of 320 stems per acre of approved target species surviving for the first three years of monitoring, 290 stems per acre in year four, and 260 stems per acre in year five. Target species include but are not limited to planted species and species listed within appropriate Schafale and Weakley (1980) communities.

According to the 2004 *Groove Creek Mitigation Plan*, seedlings were to be planted at a minimum density of 680 stems per acre and included:

1. water oak (*Quercus nigra*)
2. willow oak (*Quercus phellos*)
3. laurel oak (*Quercus laurifolia*)
4. swamp chestnut oak (*Quercus michauxii*)
5. green ash (*Fraxinus pennsylvanica*)
6. river birch (*Betula nigra*)
7. bald cypress (*Taxodium distichum* var. *distichum*)
8. water tupelo (*Nyssa biflora*)

2.4 Vegetation Monitoring

Seven 10-meter by 10-meter vegetation monitoring plots will be sampled each year using the EEP/CVS methods for vegetation sampling (Lee et al. 2006). In addition, photographs will be taken at each of the plots to provide a visual record of vegetation development over the monitoring period.

3.0 MAINTENENCE AND CONTINGENCY PLAN

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 the minimum species density requirements. Additionally, invasive species concerns will be addressed if the need arises. 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 will then be implemented and monitored until success criteria are achieved.

4.0. REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

North Carolina Department of Transportation (NCDOT). 2004. Grove Creek Mitigation Plan, Duplin County, North Carolina, TIP No. R-2204 WM. Office of Natural Environment & Roadside Environmental Unit.

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

United States. Department of Agriculture (USDA). 1985. Soil Survey of Sampson County, North Carolina. United States Department of Agriculture.

09/08/9

R-2204WM

PROJECT: 8.1241801

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

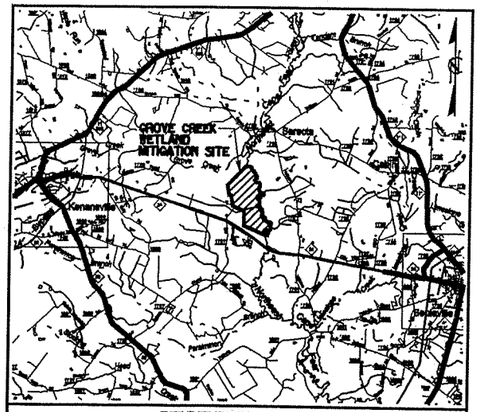
DUPLIN COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2204WM	1	

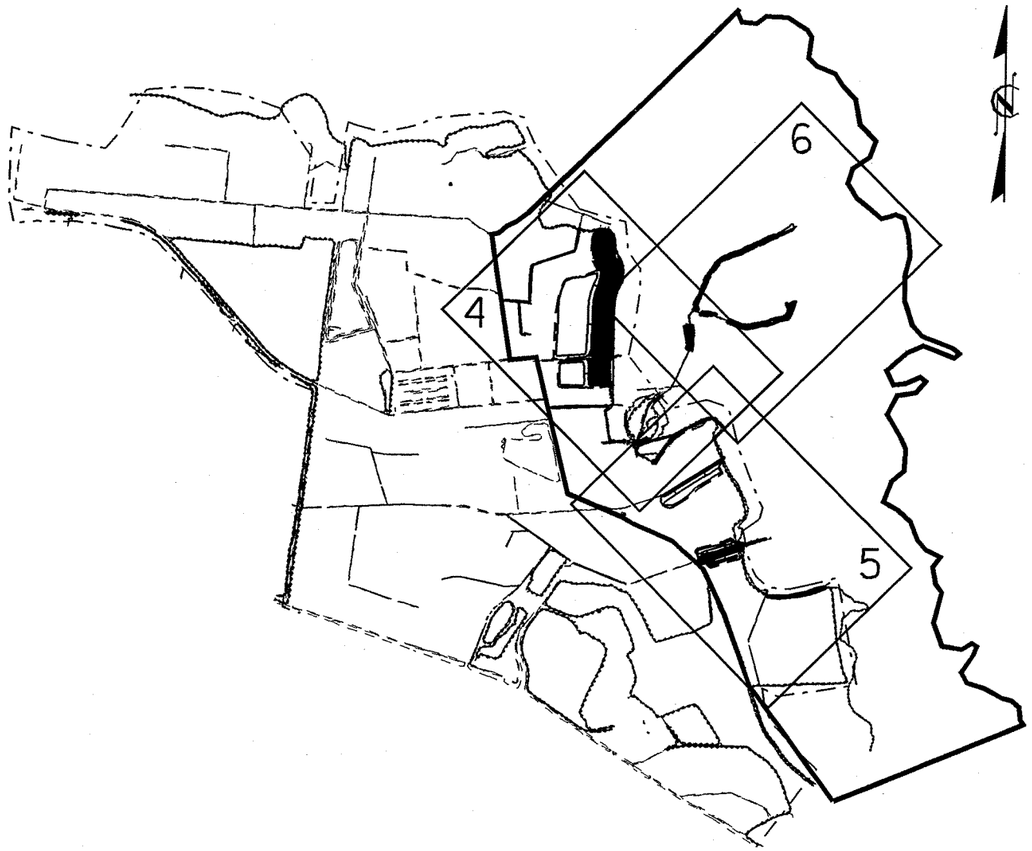
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
8.1241801	STP-11(4)	P.E.
8.1241801	STP-11(4)	R/W
NOT AVAILABLE	NOT AVAILABLE	CONST.

LOCATION: EAST OF KENANSVILLE, EAST OF SR 1737

TYPE OF WORK: WETLAND RESTORATION, GRADING, AND DRAINAGE



VICINITY MAP



INDEX OF SHEETS

SHEET NO.	SHEET
1	TITLE SHEET
1A	CONVENTINAL SYMBOLS
2	TYPICAL SECTIONS AND DETAILS
3	SUMMARY OF QUANTITIES
4-6	PLAN SHEETS
7	PLANTING PLAN SHEET
X-1 THRU X-19	CROSS SECTION

NCDOT CONTACT: JAMIE LANCASTER & PHILLIP TODD

GRAPHIC SCALES

200 100 0 200 400

PLANS

DESIGN DATA

PROJECT LENGTH

Prepared for the North Carolina Department of Transportation in the Office of:

HSMM
1305 NAVAHO DR., SUITE 303
RALEIGH, NC 27609
(919) 878-5250

2002 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:

LETTING DATE:

S.G. GINN, P.E.
PROJECT ENGINEER

PROJECT DESIGN ENGINEER

PROJECT ENGINEER

SIGNATURE: *P.E.*

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA

STATE DESIGN ENGINEER *P.E.*

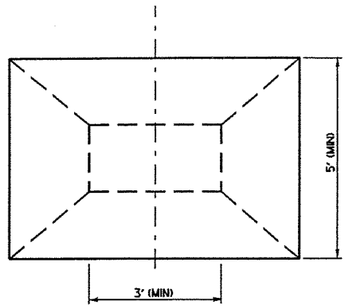
DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED
DIVISION ADMINISTRATOR *DATE*

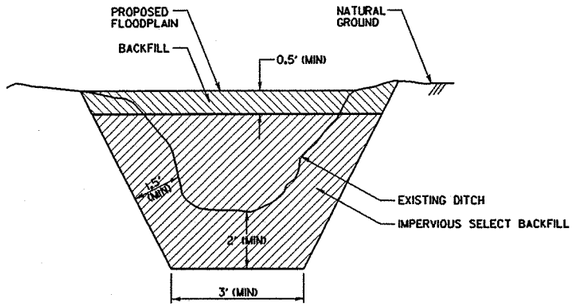
6/2/99

PROJECT REFERENCE NO.	SHEET NO.
R-2204WM	2
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

H S M M
ARCHITECTS - ENGINEERS - PLANNERS
1305 NAVAHO DR. SUITE 303 RALEIGH, NC 27609



IMPERVIOUS BLOCK - PLAN
NOT TO SCALE



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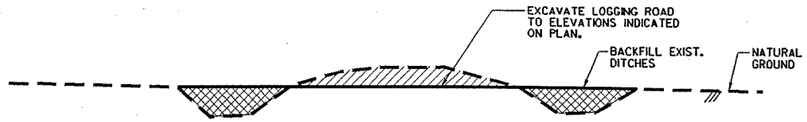

LOGGING ROAD - SECTION
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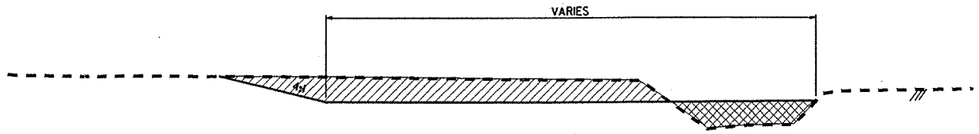

DITCH 22 - SECTION
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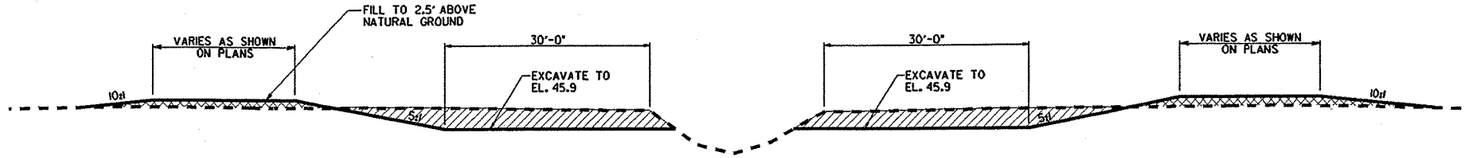

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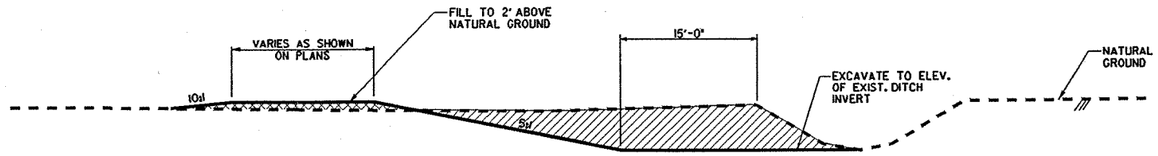

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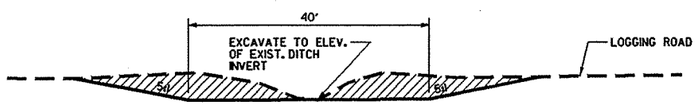
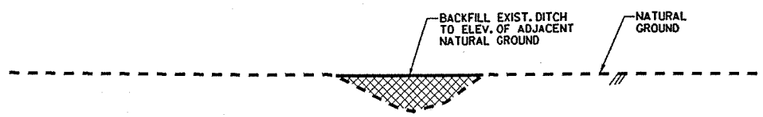
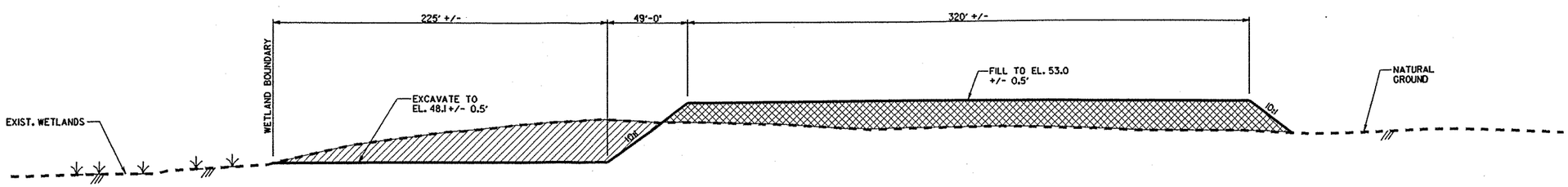


CONVEYANCE CHANNEL - SECTION
NOT TO SCALE

DITCH 8 - SECTION
NOT TO SCALE



TYPICAL DITCH - SECTION
DITCHES 1, 2, 3, 5, 7, 16, AND 17
NOT TO SCALE



AREA B - SECTION
NOT TO SCALE

8/17/99

PROJECT REFERENCE NO.	SHEET NO.
R-2204WM	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

H S M M
ARCHITECTS - ENGINEERS - PLANNERS
1305 NAVAHO DR. SUITE 303 RALEIGH, NC 27609

100 50 0 100 200

MATCHLINE SHEET 5

BEGIN BACKFILL DITCH 8, STA. 10+00

IMPERVIOUS BLOCK

DITCH 17 BACKFILL 87 L.F.

END BACKFILL DITCH 7, STA 12+23

BEGIN BACKFILL DITCH 7 STA 10+00

DITCH 7 10+00

IMP. BLOCK

DITCH 6 NO BACKFILL

CREATE FLOODPLAIN AT ELEV. 47.5

DITCH 22 BACKFILL 130 L.F.

REMOVE CORRUGATED PLASTIC PIPE

CLASS B RIPRAP EST 1 TON

DITCH 8 BASELINE

IMPERVIOUS BLOCK

END BACKFILL DITCH 8, STA 17+87

EXIST LOGGING ROAD

IMPERVIOUS BLOCK

DITCH 16 BACKFILL 140 L.F.

BEGIN BACKFILL DITCH 5, STA 10+00

DITCH 5 BASELINE

END BACKFILL DITCH 5 STA 15+90

IMPERVIOUS BLOCK

EXCAVATE TO ELEV. 48.1

PROPERTY BOUNDARY

FILL TO ELEV. 53.0

END BACKFILL DITCH 3, STA 13+70

IMPERVIOUS BLOCK

DITCH 4 NO BACKFILL

DITCH 3 13+71

AREA B STOCKPILE

DITCH 3 BASELINE

BEGIN BACKFILL DITCH 3, STA. 10+00

DITCH 2 BASELINE

SLOPE STAKE LINE

TOP OF FILL

FILL TO ELEV. 53.0

END BACKFILL DITCH2, STA 12+70

BEGIN BACKFILL DITCH 2, STA. 10+00

END BACKFILL DITCH 1, STA. 21+10

TOP OF FILL

TOE OF CUT

AREA B SECTION SEE SHEET 2

EXCAVATE TO ELEV. 48.1

DITCH 1 BASELINE

AREA B BASELINE

TRANSITION PROPOSED GRADE

BEGIN BACKFILL DITCH 1, STA 10+46

IMPERVIOUS BLOCK

EXCAVATE TO ELEV. 49.0

MATCHLINE SHEET 6

MATCHLINE SHEET 6

NOTES

1. EXCAVATION OF AREA B SHALL BE LIMITED BY THE WETLAND BOUNDARY AND CONSTRUCTION ACTIVIES SHALL NOT DISTURB EXISTING WETLANDS.
2. MATERIAL EXCAVATED FROM AREA B SHALL BE USED FOR THE BACKFILL OF DITCHES 1, 2, 3, AND 5. SURPLUS MATERIAL SHALL BE PLACED IN THE LOCATION DESIGNATED AS "AREA B STOCKPILE".
3. MATERILAL EXCAVATED ADJACENT TO DITCH 22 SHALL BE USED FOR THE BACKFILL OF DITCHES 7, 16, 17, AND 22.

LEGEND

AREA TO BE CUT

DITCH TO BE FILLED

CLAY PLUG

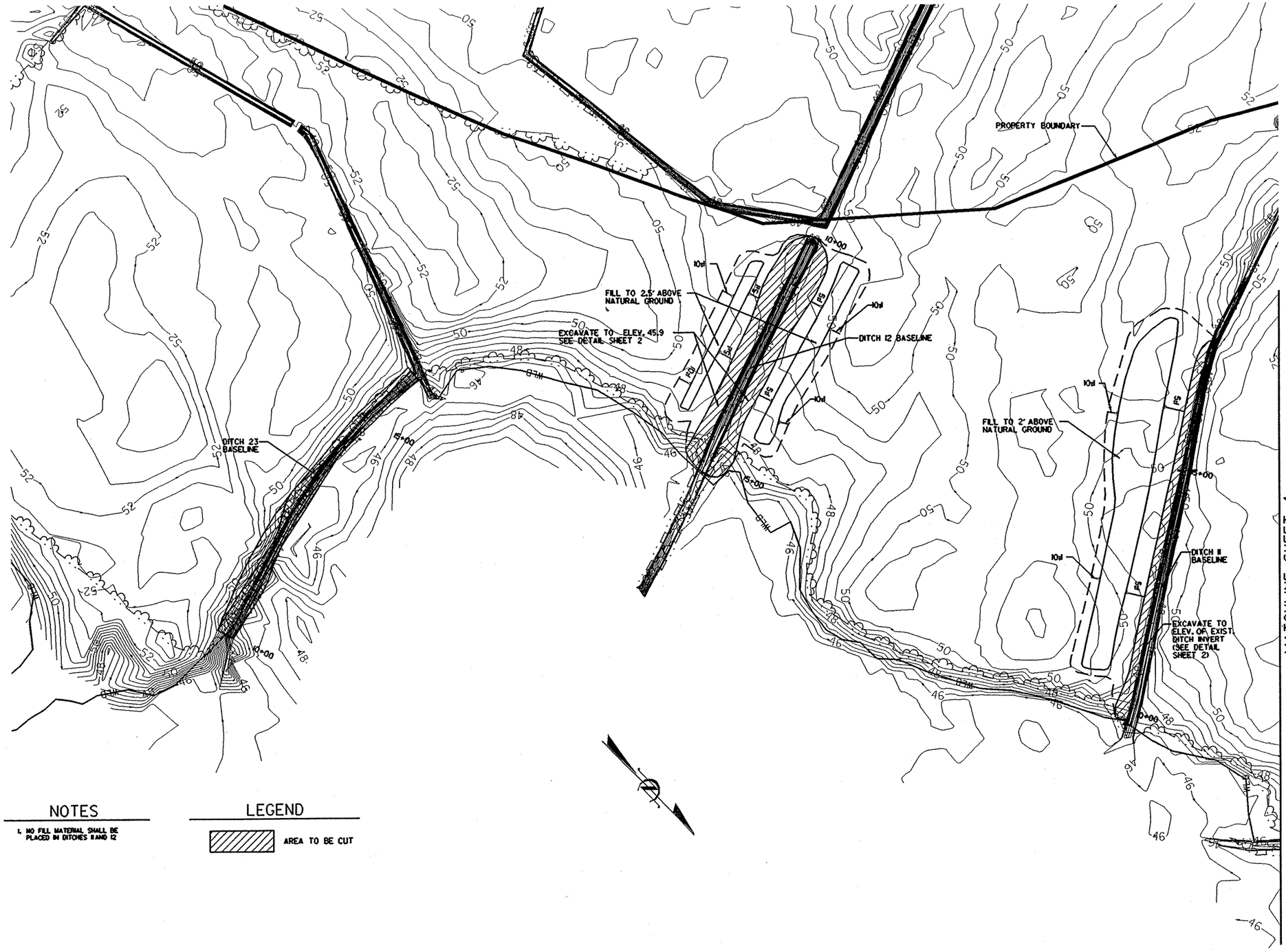
$FILE$ $COMM$ $DATE$ $TIME$ $USER$ RS

8/17/99

100 50 0 100 200

PROJECT REFERENCE NO.	SHEET NO.
R-2204WM	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

H S M M
ARCHITECTS - ENGINEERS - PLANNERS
1305 NAVAHO DR. SUITE 303 RALEIGH, NC 27609



NOTES

1. NO FILL MATERIAL SHALL BE PLACED IN DITCHES 11 AND 12

LEGEND

AREA TO BE CUT

$FILE$ $COMM$ $DATE$ $TIME$ $USER$

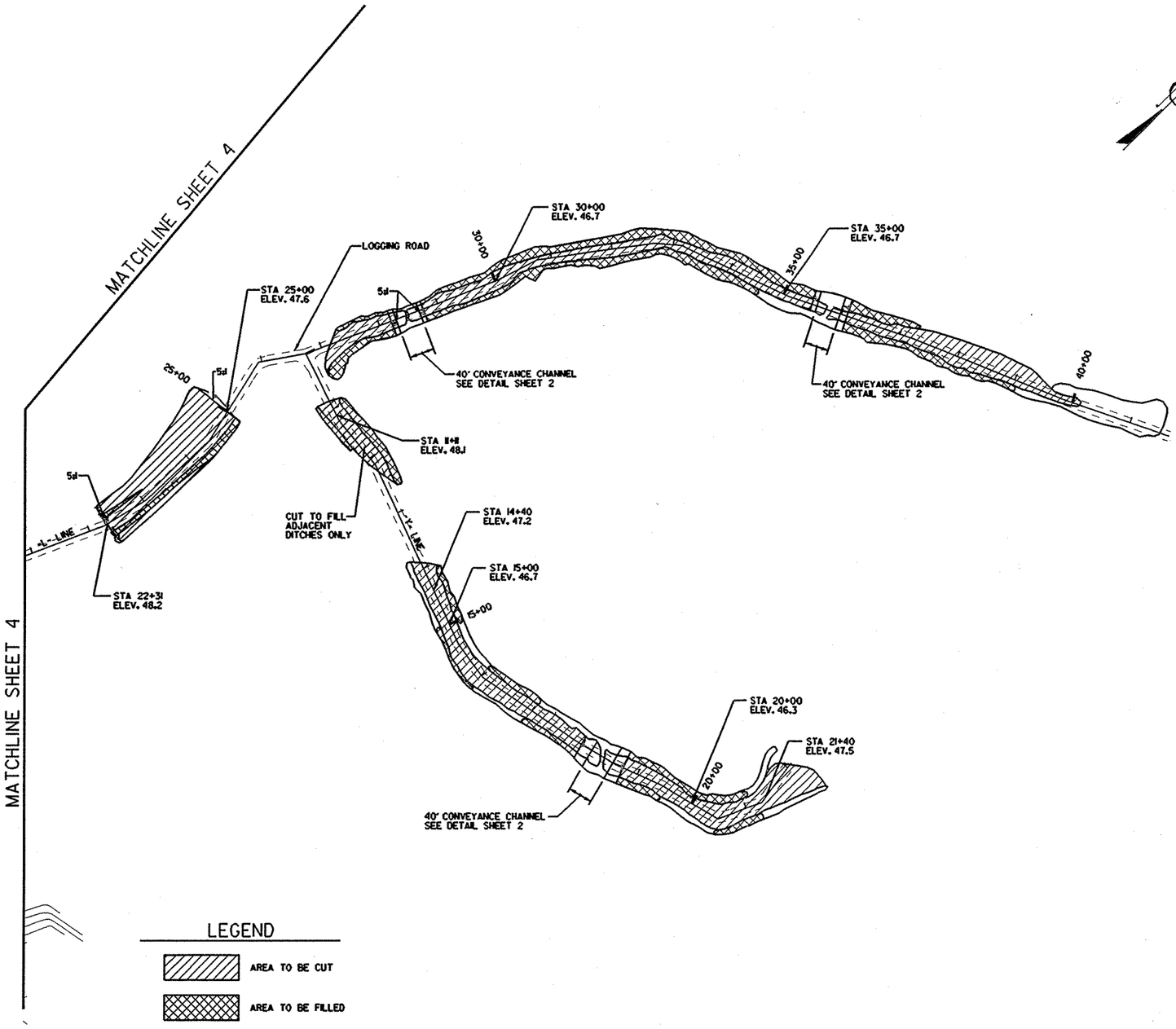
R

8/17/99

100 50 0 100 200

PROJECT REFERENCE NO.	SHEET NO.
R-2204WM	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

H S M M
ARCHITECTS - ENGINEERS - PLANNERS
1305 NAVAHO DR. SUITE 303 RALEIGH, NC 27609



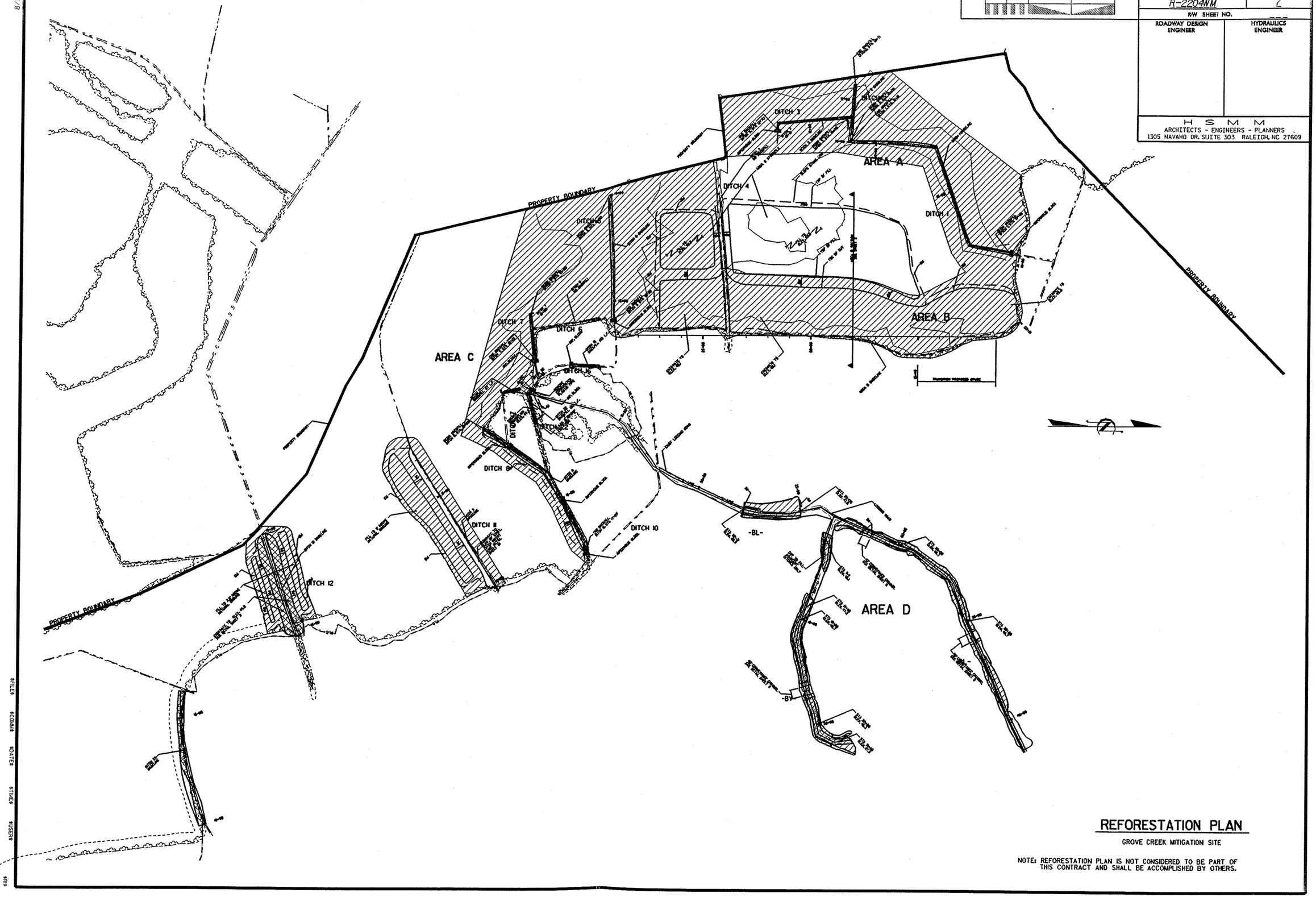
$FILE$ $COMMA$ $DATE$ $TIME$ $USER$ RUN

8/17/99

200 100 0 200 400

PROJECT REFERENCE NO.	SHEET NO.
R-2204WM	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

H S M M
ARCHITECTS - ENGINEERS - PLANNERS
1305 NAVAHO DR. SUITE 303 RALEIGH, NC 27609



REFORESTATION PLAN

GROVE CREEK MITIGATION SITE

NOTE: REFORESTATION PLAN IS NOT CONSIDERED TO BE PART OF THIS CONTRACT AND SHALL BE ACCOMPLISHED BY OTHERS.

$FILE$ $COMM$ $DATE$ $TIME$ $USER$ RB

8/17/99

MONITORING GAUGE AND VEGETATION PLOT LOCATIONS

200 100 0 200 400

PROJECT REFERENCE NO.	SHEET NO.
R-2204WM	7A
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

H S M M
ARCHITECTS - ENGINEERS - PLANNERS
1305 NAVAHO DR. SUITE 303 RALEIGH, NC 27609

PROPERTY BOUNDARY
DITCH 1
DITCH 2
DITCH 3
DITCH 4
DITCH 5
DITCH 6
DITCH 7
DITCH 8
DITCH 10
DITCH 11
DITCH 12
DITCH 17
DITCH 22
GW1-9BE3FC
GW2-9BEB018
GW3-9BE9072
GW4-9B51251
GW5-9DE4A01
GW7-9BEB429
GW9-9BEAF26
GW10-9BEA410
GW12-9BE88DF
GW-9DE9B91
SG1-9BEA3FC
SG2-9DE3F3E
SG3-9DE5342
SG4-9DF22A3
SG5-9BEBF27
SG6-B6B496B
GW-9DE9B91
AREA A
AREA B
AREA C
AREA D
Waste Area
17.9 Acres
-BL-
-BY-

LEGEND

- VEGETATION PLOT LOCATIONS
- GROUNDWATER AND SURFACE WATER GAUGE LOCATIONS

$FILE$ $COMM$ $DATE$ $TIME$ $USER$

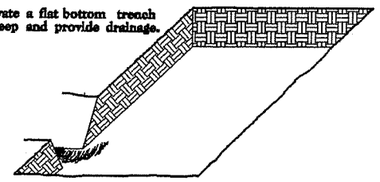
PLANTING DETAILS

SEEDLING / LINER BAREROOT PLANTING DETAIL

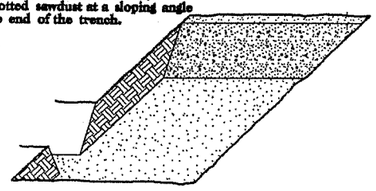
HEALING IN

1. Locate a healing-in site in a shady, well protected area.

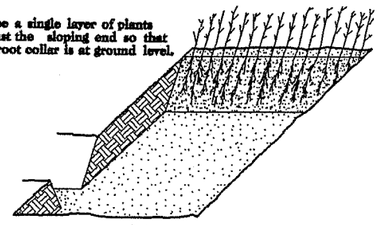
2. Excavate a flat bottom trench 12" deep and provide drainage.



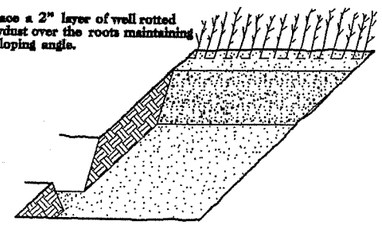
3. Backfill the trench with 2" well rotted sawdust. Place a 2" layer of well rotted sawdust at a sloping angle at one end of the trench.



4. Place a single layer of plants against the sloping end so that the root collar is at ground level.

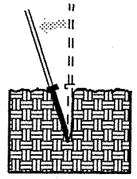


5. Place a 2" layer of well rotted sawdust over the roots maintaining a sloping angle.

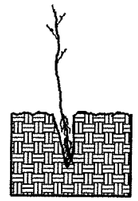


6. Repeat layers of plants and sawdust as necessary and water thoroughly.

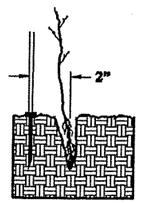
DIBBLE PLANTING METHOD
USING THE KBC PLANTING BAR



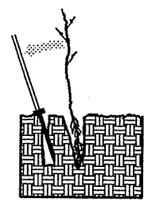
1. Insert planting bar as shown and pull handle toward planter.



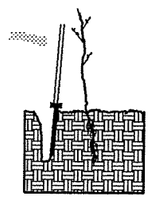
2. Remove planting bar and place seedling at correct depth.



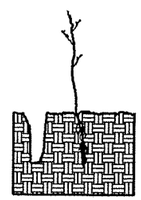
3. Insert planting bar 2" toward planter from seedling.



4. Pull handle of bar toward planter, firming soil at bottom.



5. Push handle forward firming soil at top.



6. Leave compaction hole open. Water thoroughly.

PLANTING NOTES:

PLANTING BAG
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.

KBC PLANTING BAR
Planting bar shall have a blade with a triangular cross section, and shall be 12" long, 4" wide and 1" thick at center.

ROOT PRUNING
All seedlings shall be root pruned, if necessary, so that no roots extend more than 10 inches (10") below the root collar.

GROVE CREEK WETLAND PLANTING

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2204WM	RF-1	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	

WETLAND TREE REFORESTATION

MIXTURE, TYPE, SIZE, AND FURNISH SHALL CONFORM TO THE FOLLOWING:

FRAXINUS PENNSYLVANICA	GREEN ASH	BAREROOT SEEDLING
TAXODIUM DISTICHUM	BALDCYPRESS	BAREROOT SEEDLING
BETULA NIGRA	RIVER BIRCH	BAREROOT SEEDLING
QUERCUS MICHAUXII	SWAMP CHESTNUT OAK	BAREROOT SEEDLING
QUERCUS LAURIFOLIA	LAUREL OAK	BAREROOT SEEDLING
NYSSA AQUATICA	WATER TUPELO	BAREROOT SEEDLING
LIRIODENDRON TULIPIFERA	TULIP POPLAR	BAREROOT SEEDLING

TREE REFORESTATION SHALL BE PLANTED 6' TO 10' ON CENTER, RANDOM SPACING, AVERAGING 8' ON CENTER, APPROXIMATELY 680 PLANTS PER ACRE.

WETLAND REFORESTATION DETAIL SHEET

N.C.D.O.T. - ROADSIDE ENVIRONMENTAL UNIT