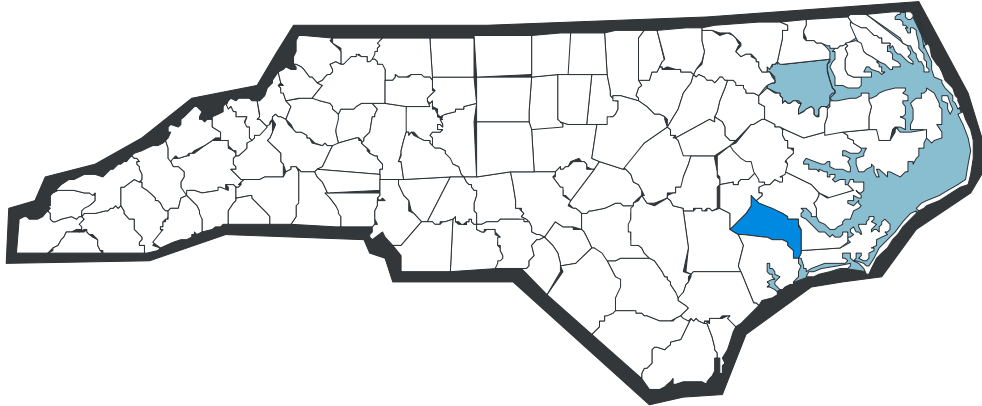


AS-BUILT MITIGATION REPORT CLAYHILL FARMS



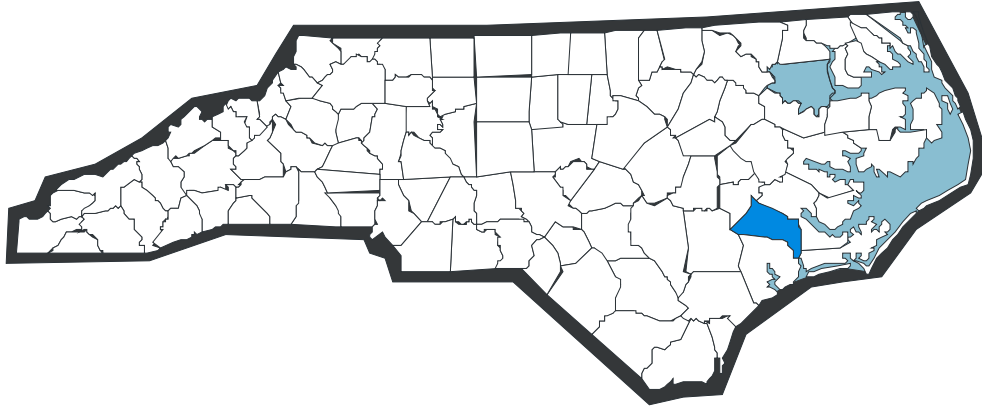
**CLAYHILL FARMS MITIGATION SITE
JONES COUNTY, NORTH CAROLINA
TIP No. R-2105 WM
(EEP Project Number .00018)
2006 Annual Monitoring Report (Year 1 of 5)**

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

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

April 2007

AS-BUILT MITIGATION REPORT CLAYHILL FARMS



CLAYHILL FARMS MITIGATION SITE
JONES COUNTY, NORTH CAROLINA
TIP No. R-2105 WM
(EEP Project Number .00018)
2006 Annual Monitoring Report (Year 1 of 5)



Axiom Environmental, Inc.



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

EXECUTIVE SUMMARY

The Clayhill Farms Stream and Wetland Restoration Site (Site) is located in southern Jones County, approximately 1 mile north of the Town of Kuhns and 0.75 mile north of the Carteret County/Jones County line. The Site is located east of Highway 58 and is bordered by the Croatan National Forest to the north, east, and west and by various forested and residential parcels to the south. Site streams, Billy's Branch and other unnamed tributaries to Hunters Creek, bisect the Site. The project is located within the White Oak River Basin in United States Geological Survey (USGS) 14-digit Hydrologic Unit 03020106010060 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-05-01).

In the early 1970s the Site was logged and portions of the Site were converted to agricultural land. At that time, perimeter and interior drainage ditches were excavated and Site streams were channelized in support of land uses.

The primary mitigation activities at the Site included

- restoration of 7931 linear feet of Billy's Branch through excavation of a new channel within a floodplain bench;
- restoration of 1667.8 linear feet of eight secondary tributaries,
- preservation of 2009.9 linear feet of forested secondary tributaries and the downstream forested reach of Billy's Branch;
- restoration of 21.6 acres of riverine wetlands by filling ditches, removing field crowns, and planting agricultural fields;
- enhancement of 1.8 acres of riverine wetlands by planting within agricultural fields;
- preservation of 3.9 acres of forested riverine wetlands;
- restoration of 79.9 acres of nonriverine wetlands by filling ditches, removing field crowns, and planting agricultural fields;
- enhancement of 52.0 acres of nonriverine wetlands by planting within agricultural fields;
- preservation of 110.5 acres of forested nonriverine wetlands.

Restoration activities at the Site entailed 1) plugging and filling of feeder ditches, 2) removal of crowning within fields, 3) clearing and grading to prepare for creation of the new stream alignment, 4) construction of a stable channel, 5) filling of the abandoned stream channel with onsite materials excavated from the floodplain and other upland areas, 6) installation of a grade control structure at the downstream end of the restoration reach, 7) removal of the bridge crossing of Billy's Branch within the southeast portion of the Site, and 8) ripping/scarifying soils to prepare for planting.

The primary goals of the project include 1) maximizing the area returned to historic wetland function; 2) establishing stable dimension, pattern, and profile along Billy's Branch; 3) expanding, enhancing, and preserving 355.6 acres adjacent to the Croatan National Forest; 4) protecting the Site with a conservation easement in perpetuity; 5) providing valuable habitat to a diverse assemblage of terrestrial and aquatic flora and fauna; 6) serving as a wildlife corridor; and 7) providing numerous wetland values including water storage, pollutant removal, aquatic/wildlife habitat, recreation, and education.

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1.0 PROJECT BACKGROUND

1.1 Project Description

The Clayhill Farms Stream and Wetland Restoration Site (Site) is located in southern Jones County, approximately 1 mile north of the Town of Kuhns and 0.75 mile north of the Carteret County/Jones County line. The Site is located east of Highway 58 and is bordered by the Croatan National Forest to the north, east, and west and by various forested and residential parcels to the south. Site streams, Billy's Branch and other unnamed tributaries to Hunters Creek, bisect the Site (Figure 1). The project is located within the White Oak River Basin in United States Geological Survey (USGS) 14-digit Hydrologic Unit 03020106010060 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-05-01).

Directions to the Site:

From Raleigh, North Carolina

- Travel east on US Highway 70 to Kinston
- Turn right and go south on NC 58 to US 17
- Turn right on US17/NC 58 and continue south approximately 6 miles to Maysville
- From Maysville, continue south on NC 58 approximately 8 miles to left on SR 1100 (Hunters Creek Road)
- Then make an immediate left onto a gravel road with a gate. The gate has a combination lock to access the Site.

In the early 1970s the Site was logged and portions of the Site were converted to agricultural land. At that time, perimeter and interior drainage ditches were excavated and Site streams were channelized in support of land uses. Figure 2 depicts preconstruction conditions at the Site.

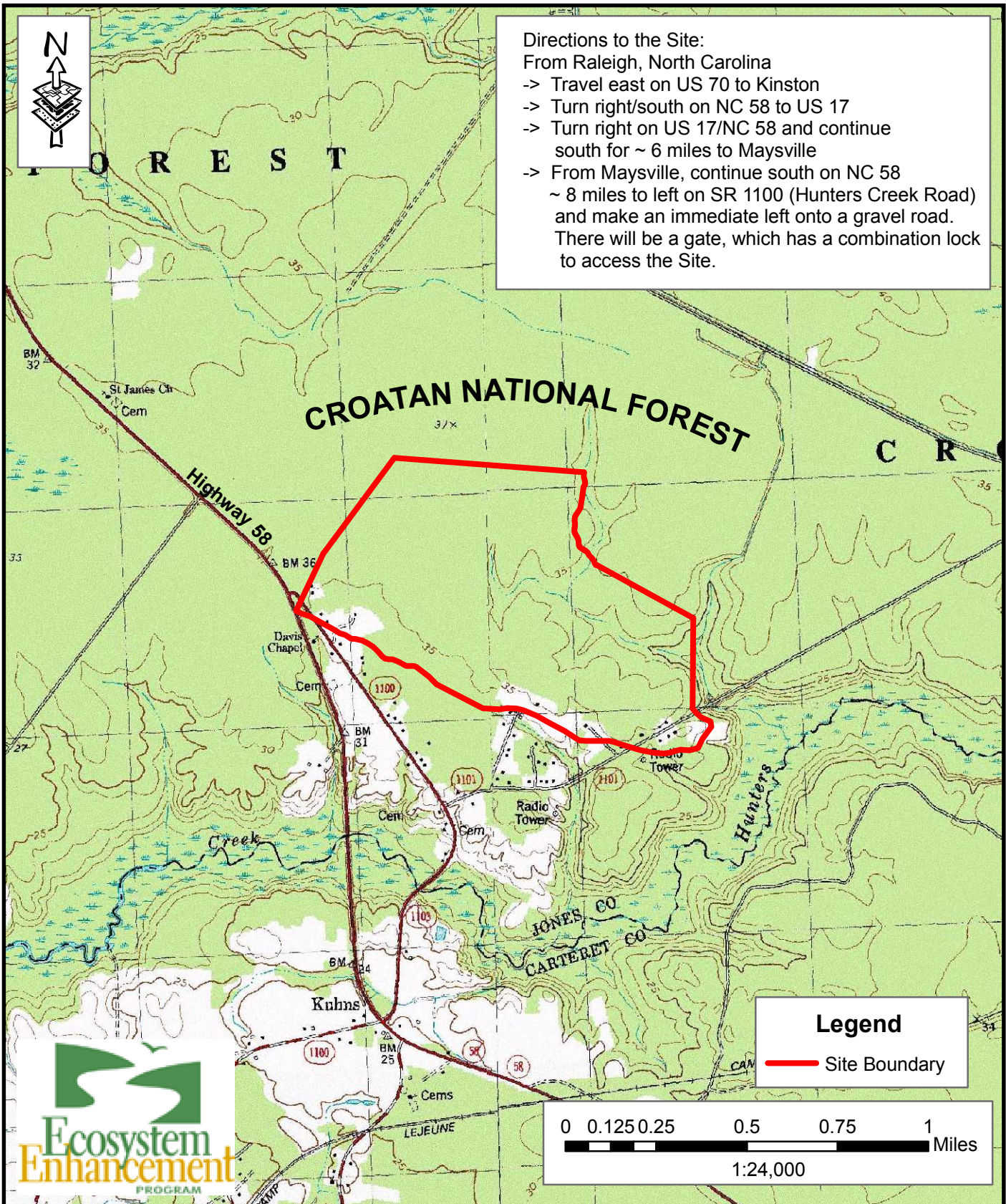
The primary mitigation activities at the Site are outlined in Figure 3 and included

- restoration of 7931 linear feet of Billy's Branch through excavation of a new channel within a floodplain bench;
- restoration of 1667.8 linear feet of eight secondary tributaries,
- preservation of 2009.9 linear feet of forested secondary tributaries and the downstream forested reach of Billy's Branch;
- restoration of 21.6 acres of riverine wetlands by filling ditches, removing field crowns, and planting agricultural fields;
- enhancement of 1.8 acres of riverine wetlands by planting within agricultural fields;
- preservation of 3.9 acres of forested riverine wetlands;
- restoration of 79.9 acres of nonriverine wetlands by filling ditches, removing field crowns, and planting agricultural fields;
- enhancement of 52.0 acres of nonriverine wetlands by planting within agricultural fields;
- preservation of 110.5 acres of forested nonriverine wetlands.

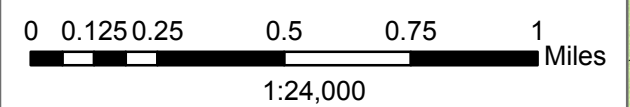
Restoration activities at the Site entailed 1) plugging and filling of feeder ditches, 2) removal of crowning within fields, 3) clearing and grading to prepare for creation of the new stream alignment, 4) construction of a stable channel, 5) filling of the abandoned stream channel with onsite materials excavated from the floodplain and other upland areas, 6) installation of a grade control structure at the downstream end of the restoration reach, 7) removal of the bridge crossing of Billy's Branch within the southeast portion of the Site, and 8) ripping/scarifying soils to prepare for planting.



Directions to the Site:
 From Raleigh, North Carolina
 -> Travel east on US 70 to Kinston
 -> Turn right/south on NC 58 to US 17
 -> Turn right on US 17/NC 58 and continue south for ~ 6 miles to Maysville
 -> From Maysville, continue south on NC 58 ~ 8 miles to left on SR 1100 (Hunters Creek Road) and make an immediate left onto a gravel road. There will be a gate, which has a combination lock to access the Site.



Legend
 — Site Boundary

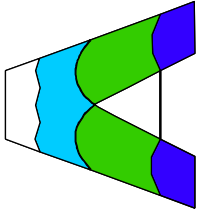


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SITE LOCATION
 CLAYHILL FARMS RESTORATION SITE
 EEP Project Number .00018
 As-built Mitigation Report
 Jones County, North Carolina

CLF
Date: March 2007
Project: 06-021

FIGURE
1



Axiom Environmental, Inc.



NOTES/REVISIONS

Project:

Clayhill Farms Restoration Site

Project No. .00018
As-built Mitigation Report
Jones County
North Carolina

Title:

DRAINMOD Preconstruction Conditions

Scale: 1 in. = 490 ft.







Date: FEB 2007

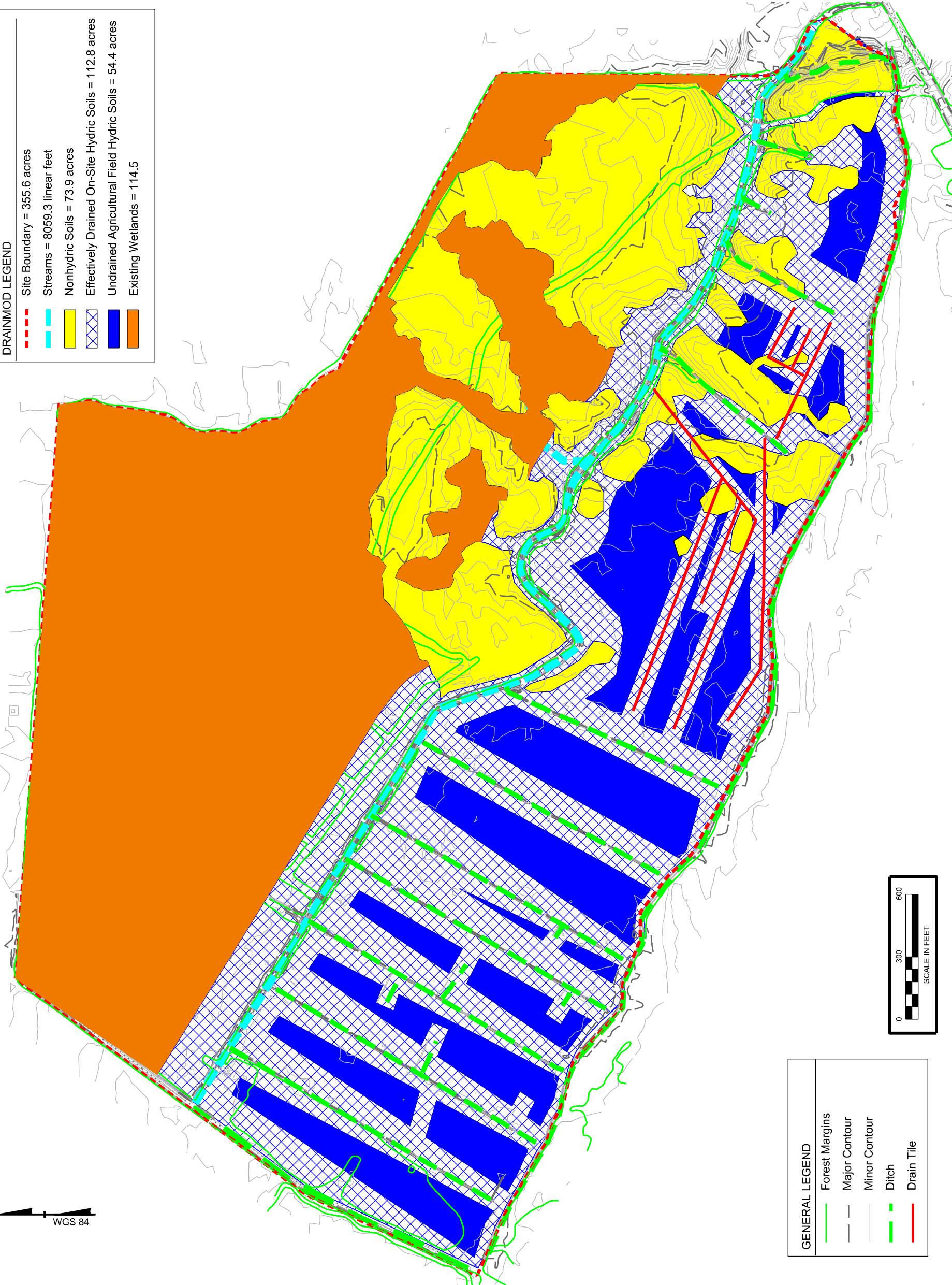
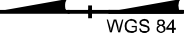
Project No.: 06-021

FIGURE NO.






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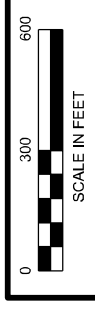
DRAINMOD LEGEND

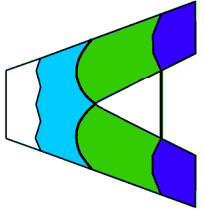
-  Site Boundary = 355.6 acres
-  Streams = 8059.3 linear feet
-  Nonhydic Soils = 73.9 acres
-  Effectively Drained On-Site Hydric Soils = 112.8 acres
-  Undrained Agricultural Field Hydric Soils = 54.4 acres
-  Existing Wetlands = 114.5



GENERAL LEGEND

-  Forest Margins
-  Major Contour
-  Minor Contour
-  Ditch
-  Drain Tile





Axiom Environmental, Inc.



NOTES/REVISIONS

Project:

Clayhill Farms Restoration Site

Project No. 18.00018
As-built Mitigation Report
Jones County
North Carolina

Title:

DRAINMOD Post Construction Conditions

Scale: 1 in. = 490 ft.

Date: FEB 2007

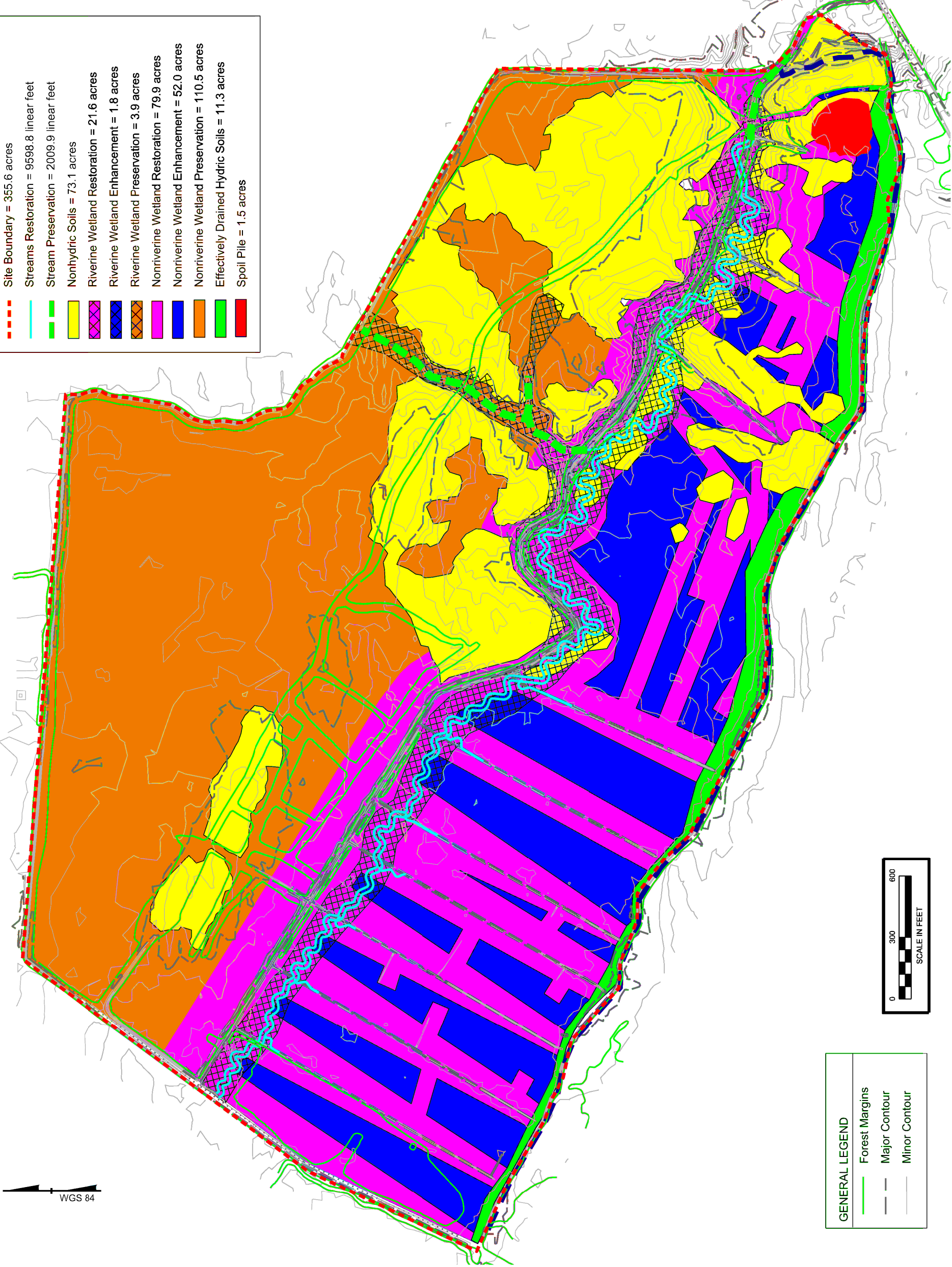
Project No.: 06-021

FIGURE NO.

3

DRAINMOD LEGEND

- Site Boundary = 355.6 acres
- Streams Restoration = 9598.8 linear feet
- Stream Preservation = 2009.9 linear feet
- Nonhydric Soils = 73.1 acres
- Riverine Wetland Restoration = 21.6 acres
- Riverine Wetland Enhancement = 1.8 acres
- Riverine Wetland Preservation = 3.9 acres
- Nonriverine Wetland Restoration = 79.9 acres
- Nonriverine Wetland Enhancement = 52.0 acres
- Nonriverine Wetland Preservation = 110.5 acres
- Effectively Drained Hydric Soils = 11.3 acres
- Spoil Pile = 1.5 acres



WGS 84

GENERAL LEGEND

- Forest Margins
- Major Contour
- Minor Contour



The primary goals of the project include 1) maximizing the area returned to historic wetland function; 2) establishing stable dimension, pattern, and profile along Billy's Branch; 3) expanding, enhancing, and preserving 355.6 acres adjacent to the Croatan National Forest; 4) protecting the Site with a conservation easement in perpetuity; 5) providing valuable habitat to a diverse assemblage of terrestrial and aquatic flora and fauna; 6) serving as a wildlife corridor; and 7) providing numerous wetland values including water storage, pollutant removal, aquatic/wildlife habitat, recreation, and education.

In order to demonstrate successful mitigation, hydrologic, vegetative, and stream monitoring must be conducted for five years or until success criteria are achieved. Success criteria are based on federal guidelines for mitigation. These guidelines stipulate criteria for hydrologic conditions, vegetation survival, and stream morphology. The following report details the results of monitoring for the 2006 (year 1) growing season at the Clayhill Farms Stream and Wetland Mitigation Site.

2.0 MONITORING PLAN

Vegetation and hydrology will be monitored at the Site for five years or until success criteria have been achieved. The monitoring plan is outlined in Figures 4A-4B.

2.1 Hydrologic Success Criteria

Success criteria for wetland hydrology at Clayhill Farms require inundation or saturation within 12 inches of the ground surface for a consecutive period of 12.5 percent of the growing season, or if the hydroperiod is within 20 percent of an approved reference wetland hydroperiod within drought years. The growing season for Jones County begins March 15 and ends November 11 (242 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 Description

Twenty groundwater monitoring gauges and a rain gauge will be maintained and monitored throughout the growing season for each monitoring year.

2.3 Vegetation Success Criteria

Vegetation success criteria at Clayhill Farms 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, species within the reference forest, and species listed within appropriate Schafale and Weakley (1980) communities.

According to the 2005 *Revised Clayhill Farms Wetland and Stream Mitigation Plan*, planted species were to include the following communities as described in Schafale and Weakley (1990):

1. Coastal Plain Small Stream Swamp
2. Nonriverine Wet Hardwoods Forest
3. Mesic Pine Flatwoods
4. Mixed-Mesic Hardwood Forest (Coastal Plain subtype)
5. Coastal Plain Bottomland Hardwood Forest (Blackwater subtype)

In addition, according to the 2005 *Revised Clayhill Farms Wetland and Stream Mitigation Plan*, species within the reference community included the following:

LATITUDE	LONGITUDE	VEG. PLOT/TYPE
77.12442	34.80796	p1 mesic pine flatwoods
77.12335	34.80683	p2 mesic pine flatwoods
77.12629	34.80637	p3 nonriverine wet hardwood
77.12560	34.80832	p4 nonriverine wet hardwood
77.13168	34.80919	p5 headwater swamp
77.12943	34.81004	p6 headwater swamp
77.13004	34.80805	p7 headwater swamp
77.12384	34.80544	p8 nonriverine wet hardwoods
77.11757	34.80511	p9 mixed mesic hardwood
77.11664	34.80417	p10 mixed mesic hardwood

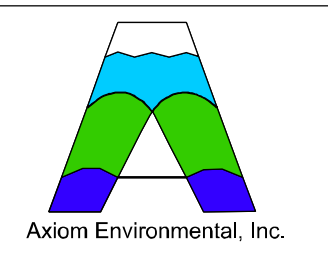
LATITUDE	LONGITUDE	REACH 4
77.12649	34.80966	benchmark 4
77.12571	34.80948	end reach 4
77.12607	34.80956	xs1 right bank
77.12603	34.80966	xs1 left bank
77.12621	34.80964	xs2 left bank
77.12617	34.80954	xs2 right bank
77.12688	34.80994	xs3 right bank
77.12678	34.81000	xs3 left bank
77.12679	34.81003	xs4 left bank
77.12690	34.81006	xs4 right bank
77.12728	34.81015	end reach 4

LATITUDE	LONGITUDE	REACH 3
77.12285	34.80777	end of reach 3
77.12296	34.80769	xs1 left bank
77.12282	34.80765	xs1 right bank
77.12293	34.80747	xs2 right bank
77.12301	34.80758	xs2 left bank
77.12370	34.80726	xs3 right bank
77.12361	34.80723	xs3 left bank
77.12363	34.80738	xs 4 left bank
77.12367	34.80734	xs4 right bank
77.12337	34.80682	benchmark 3
77.12396	34.80739	start reach 3

LATITUDE	LONGITUDE	REACH 5
77.12825	34.81067	start reach 5
77.12851	34.81077	xs1 right bank
77.12847	34.81086	xs1 left bank
77.12849	34.81091	xs2 left bank
77.12860	34.81086	xs2 right bank
77.12895	34.81117	benchmk 5
77.12918	34.81132	xs3 left bank
77.12924	34.81121	xs3 right bank
77.12958	34.81147	xs4 right bank
77.12946	34.81150	xs4 left bank
77.12955	34.81155	start reach 5

GENERAL LEGEND	
	Forest Margins
	Major Contour
	Minor Contour

DRAINMOD LEGEND	
	Site Boundary = 355.6 acres
	Streams Restoration = 9598.8 linear feet
	Stream Monitoring Reach (minimum 600 ft. in length)
	Permanently Monumented Cross Section
	Vegetation Monitoring Plot (> 320 Stems Per Acre)
	Vegetation Monitoring Plot (< 320 Stems Per Acre)
	Groundwater Gauge (> 12.5% of Growing Season)
	Groundwater Gauge (5% to 12.5% of Growing Season)
	Groundwater Gauge (< 5% of Growing Season)
	Benchmark
	Photograph Location
	Cross-vane (Functional)
	Cross-vane (Stressed)

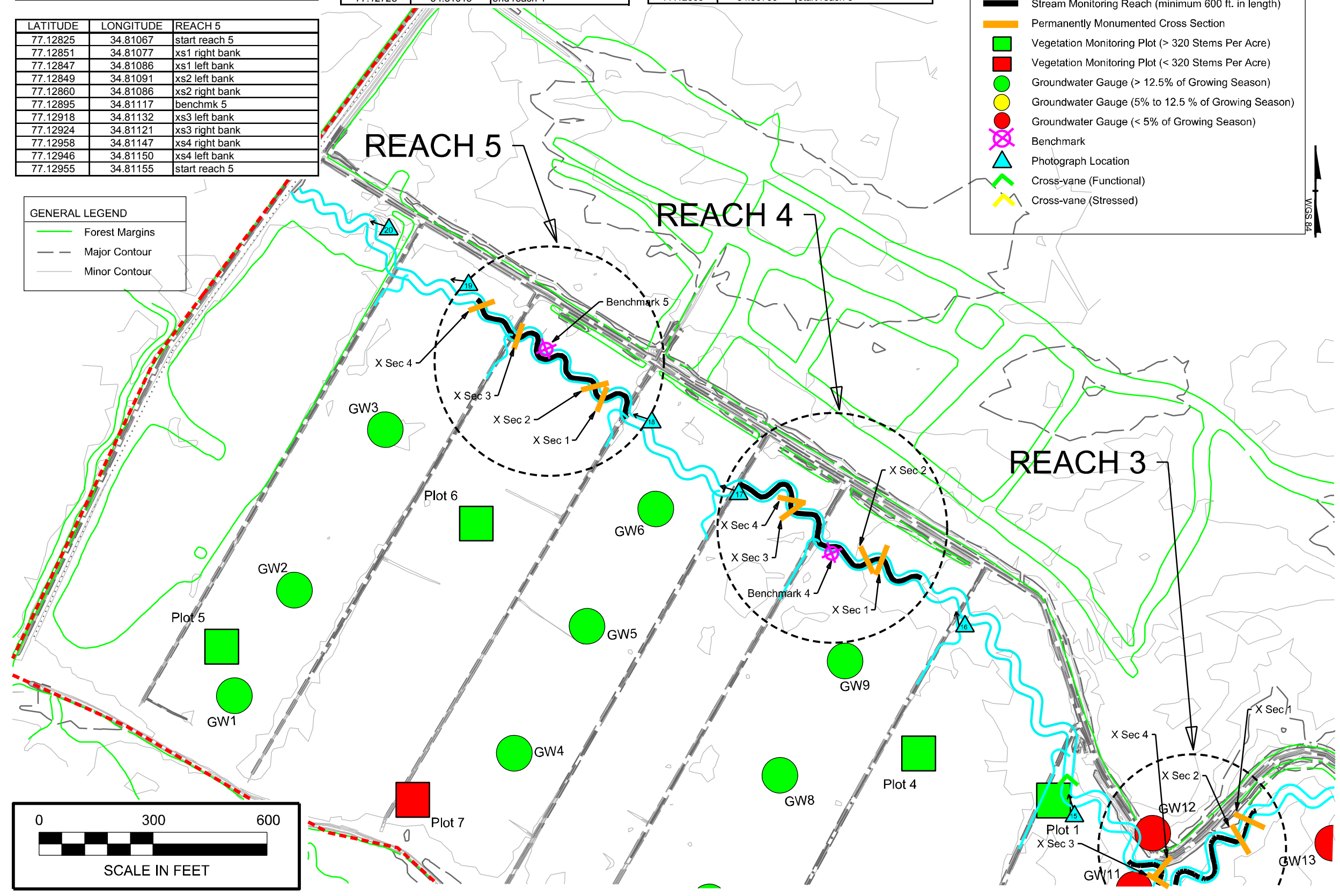


NOTES/REVISIONS

Project:
Clayhill Farms Restoration Site
 Project No. .00018
 As-built Mitigation Report
 Jones County
 North Carolina

Title:
Monitoring Plan

Scale: 1 in. = 270 ft.	FIGURE NO. 4A
Date: FEB 2007	
Project No.: 06-021	



LATITUDE	LONGITUDE	VEG. PLOT/TYPE
77.12442	34.80796	p1 mesic pine flatwoods
77.12335	34.80683	p2 mesic pine flatwoods
77.12629	34.80637	p3 nonriverine wet hardwood
77.12560	34.80832	p4 nonriverine wet hardwood
77.13168	34.80919	p5 headwater swamp
77.12943	34.81004	p6 headwater swamp
77.13004	34.80805	p7 headwater swamp
77.12384	34.80544	p8 nonriverine wet hardwoods
77.11757	34.80511	p9 mixed mesic hardwood
77.11664	34.80417	p10 mixed mesic hardwood

LATITUDE	LONGITUDE	REACH 3
77.12285	34.80777	end of reach 3
77.12296	34.80769	xs1 left bank
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77.12301	34.80758	xs2 left bank
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77.12361	34.80723	xs3 left bank
77.12363	34.80738	xs 4 left bank
77.12367	34.80734	xs4 right bank
77.12337	34.80682	benchmark 3
77.12396	34.80739	start reach 3

LATITUDE	LONGITUDE	REACH 5
77.12825	34.81067	start reach 5
77.12851	34.81077	xs1 right bank
77.12847	34.81086	xs1 left bank
77.12849	34.81091	xs2 left bank
77.12860	34.81086	xs2 right bank
77.12895	34.81117	benchmk 5
77.12918	34.81132	xs3 left bank
77.12924	34.81121	xs3 right bank
77.12958	34.81147	xs4 right bank
77.12946	34.81150	xs4 left bank
77.12955	34.81155	start reach 5

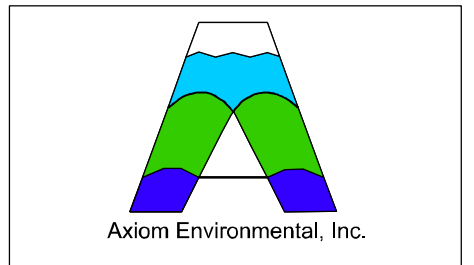
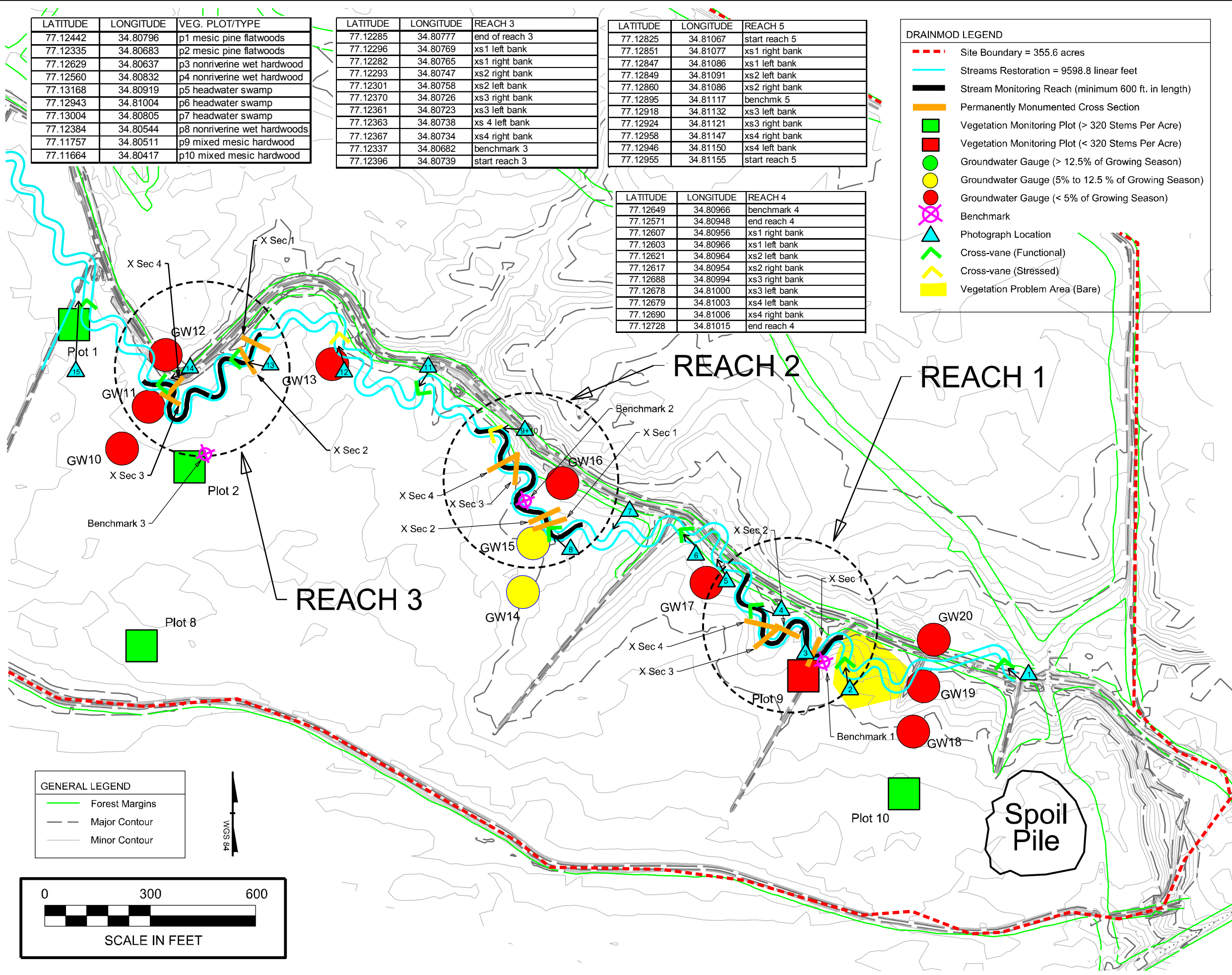
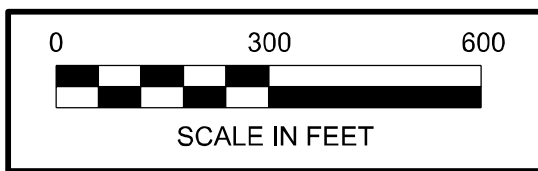
LATITUDE	LONGITUDE	REACH 4
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77.12571	34.80948	end reach 4
77.12607	34.80956	xs1 right bank
77.12603	34.80966	xs1 left bank
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77.12617	34.80954	xs2 right bank
77.12688	34.80994	xs3 right bank
77.12678	34.81000	xs3 left bank
77.12679	34.81003	xs4 left bank
77.12690	34.81006	xs4 right bank
77.12728	34.81015	end reach 4

DRAINMOD LEGEND

- Site Boundary = 355.6 acres
- Streams Restoration = 9598.8 linear feet
- Stream Monitoring Reach (minimum 600 ft. in length)
- Permanently Monumented Cross Section
- Vegetation Monitoring Plot (> 320 Stems Per Acre)
- Vegetation Monitoring Plot (< 320 Stems Per Acre)
- Groundwater Gauge (> 12.5% of Growing Season)
- Groundwater Gauge (5% to 12.5 % of Growing Season)
- Groundwater Gauge (< 5% of Growing Season)
- Benchmark
- Photograph Location
- Cross-vane (Functional)
- Cross-vane (Stressed)
- Vegetation Problem Area (Bare)

GENERAL LEGEND

- Forest Margins
- Major Contour
- Minor Contour



NOTES/REVISIONS

Project:
Clayhill Farms Restoration Site
 Project No. .00018
 As-built Mitigation Report
 Jones County
 North Carolina

Title:
Monitoring Plan

Scale: 1 in. = 270 ft.	FIGURE NO. 4B
Date: FEB 2007	
Project No.: 06-021	

Coastal Plain Bottomland Hardwoods

1. swamp blackgum (*Nyssa biflora*)
2. ironwood (*Carpinus caroliniana*)
3. American holly (*Ilex opaca*)
4. water oak (*Quercus nigra*)
5. sweetgum (*Liquidambar styraciflua*)
6. sweetbay (*Magnolia virginiana*)
7. bald cypress (*Taxodium distichum*)

Mixed-Mesic Hardwood Forest

1. loblolly pine (*Pinus taeda*)
2. yellow poplar (*Liriodendron tulipifera*)
3. flowering dogwood (*Cornus florida*)
4. ironwood
5. sweetgum
6. water oak
7. longleaf pine (*Pinus palustris*)

2.4 Vegetation Monitoring

Ten 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.

2.5 Stream Success Criteria

Success criteria dictate that there should be little or no change in the as-built cross-sections. If a change takes place it should be determined if the change is to a more unstable condition (downcutting, erosion) or to a more stable condition (settling, increase in vegetative diversity, deposition along the banks, decrease in the width-depth ratio, decrease in cross-sectional area). The as-built longitudinal profile should show that bed features are neither aggrading or degrading; however, short-term aggradation/degradation may occur depending on the peak annual discharge. Bed features should be consistent with those observed in typical E- and C-type channels. The as-built pattern should not change and the riffle-pool sequence should remain constant. A significant coarsening of bed materials is not expected due to the sand/silt/clay substrate; therefore, bed materials will not be analyzed for stream success.

2.6 Stream Description

Twenty permanent cross-sections will be measured each year surveying points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections will be classified using the Rosgen stream classification system. Longitudinal profiles will be measured each year along five 600-foot reaches. Longitudinal profile measurements will include thalweg, water surface, bankfull, and top of low bank; each taken at the head of facets (i.e. riffle, run, pool, and glide) and the maximum pool depth. The surveys will also be used to calculate sinuosity. In addition, channel substrate is not expected to coarsen over time and will not be monitored for success at this Site. Stream photographs will be taken each year to document stream changes.

3.0 MAINTENANCE AND CONTINGENCY PLAN

In the event that vegetation, stream, 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.

Stream contingency may include, but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success include 1) structure failure, 2) head-cut migration through the Site, and/or 3) bank erosion.

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

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