Implementation Plan for Agricultural Restoration at Timberlake Farms

21 July 2006

Prepared for
Great Dismal Swamp RestorationBank, LLC

by
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Executive Summary

Prior to hydrologic alterations, the tract was the headwaters for two coastal black water streams. These are: Riders Creek to the west which is a tributary of the Scuppernong River and Little Alligator River to the northeast. The restored agricultural land will have three habitat types. These habitats are described below.

Cypress-gum-ash ("wet mix") within the median of the five highest independent flood events (exclusive of agreed outliers, as below) is considered **riverine**. Cypress-gum-ash at elevations higher than the median of the five highest independent flood events will be **non-riverine**. A second **non-riverine** habitat is the "oak mix" planted on the Weeksville mineral soil series.

The hydrology of the restored site will be influenced by precipitation and wind tide. At times these sources of hydrology will tend to offset each other and at other times they may coincide to amplify water levels. The precise extent of restored riverine wetlands and stream length will be finalized on the basis of the prescribed monitoring. At the conclusion of the first year of monitoring, an estimate of riverine acreage will be made based on the median of the five highest events during that first year. The remaining four years of monitoring will be useful in determining the precise extent of the outer edges of the riverine boundary and the length of established stream(s).

Numerous sources were reviewed for defining riverine extent and are discussed in the appendices to this plan. Doctors Bernhardt and Doyle presented an analysis of **three options** for Riverine, supplied as Appendix 1. GDSRB has proposed a riverine definition between their Options 1 and 3 (see **Appendix 5** by Dr. Doyle). This definition approximates the one year floodplain.

GDSRB agrees with the recommendation of NCDWQ that the members of the MBRT should undertake field observations in Fall 2006, in order to make an initial determination of the width and extent of any 'clearly visible valley' within the contemplation of current agency guidance. For purposes of determining the extent of riverine wetlands at this site, these observations will be taken into account in the quantification of riverine acreage pursuant to the calculation of the median of the five highest, independent flood events, during a five year monitoring period. GDSRB further agrees that certain anomalous weather events should be excluded from this calculation pursuant to the analysis by Doyle in Appendix 7B.

GDSRB agrees that the MBRT may determine stream length based on current Corps/DWQ guidance, and as corroborated and quantified pursuant to the monitoring scheme established herein.

Stream Credits

Streams were not specifically addressed in the Umbrella Memorandum of Agreement Between Bank Sponsor, U.S. Army Corps of Engineers, et. al., August 1997 (hereinafter MBI). Stream credits restored pursuant to this plan must meet the same requirements under Section V. Operation of the Bank, A. Geographic Service Area of the MBI, page 14.

> (*ii) restoration credits produced in North Carolina may only be used to compensate for impacts to wetlands in North Carolina (with restoration credits produced south of Albemarle Sound used to compensate for impacts south of the Albemarle Sound). The use of the Wetland Bank to compensate for impacts beyond the geographic service area may be considered by the Corps or the permitting agency in appropriate circumstances, but authorization for any specific project is within the discretion of the Corps and State regulatory agencies.*

Introduction

Timberlake Farm, a component of the Great Dismal Swamp RestorationBank, LLC, is approximately five miles east of the city of Columbia in Tyrrell County, North Carolina (Figure 1- Site Location Map). The site is in the eight digit Hydrologic Unit 03010205 (USGS, 1974) within the Albemarle Sound basin, and south of Albemarle Sound. Restoration of the agricultural portion of the GDSRB mitigation bank (approximately 1000 acres) represents a reduction of 1.6% of agricultural land in the DWQ 03-01-51 sub-basin (Alligator River) and a 1.47% reduction of agricultural land within Tyrrell County. Prior to canal excavation and construction of forestry roads, the site was the headwaters of Riders Creek to the west which is a tributary of the Scuppernong River, and Little Alligator River to the northeast. Runoff from the restored agricultural land will be toward Alligator River via Little Alligator River.

Purpose

This plan has been prepared along the conceptual terms of section V.C. of the Umbrella Memorandum of Agreement for the purpose of detailing the specific plans, specifications, monitoring regimes, and performance standards for the Timberlake Farm restoration site, and is an amendment to Restoration Plan for Timberlake Farm, Phase II Agricultural Areas, Columbia, North Carolina, 31 March 2002, which was previously approved by the MBRT.

Figure 1 - DOT Location map

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Goals and Objectives

Restore Wetland Hydrology

Restore wetland hydrology similar to that predicted by DRAINMOD as conducted by Brian Hayes in 1995 on this site **(non-riverine)**; and plant seedlings for the re-establishment of natural forest types per soil series as suggested in *Pocosin Lakes National Wildlife Refuge, Forest Habitat Management Plan*, December 1999 by L. Eric Hinesley. This plan reviews the association of soil type and hydrology with overstory vegetation. It is presently intended that the Timberlake Farms tract will be donated to Pocosin Lakes National Wildlife Refuge upon completion of restoration, monitoring and credit debiting (Figure 2 - Refuge map).

Restore Headwater Stream

Restore headwater stream within the general topographic "valley" of the site. Implementation of this plan will result in such stream restoration credits as are corroborated and quantified pursuant to the monitoring scheme established herein.

Restore Riverine Wetlands

Low elevational areas, adjacent and connected to the stream will be monitored during frequent flood events, to determine extent of Riverine wetlands. These areas have been planted with a higher percentage of bald cypress. The planted area must meet the MBRT approved density per acre for success criteria. Implementation of this plan will result in such riverine restoration credits as are corroborated and quantified pursuant to the monitoring scheme established herein. The initial determination of width and length of clearly visible valley will be made in the field by members of the MBRT, during fall 2006. GDSRB agrees that this field observation is an essential starting point for riverine/stream restoration credit decisions.

Re-connect Hydrologically Separated Western Forest

Hydrologically reconnect the restored western forest to the restored stream valley. This forest had wetland hydrology restored between 1998 and 2002, but is presently separated from its historic drainage to Little Alligator River by a spoil pile and access road on the west bank of Timberlake Canal. This amended restoration plan may generate three types of credits; non-riverine forest, riverine swamp forest and stream footage. Stream credits should meet current Outer Coastal Plain Guidance and be corroborated and quantified pursuant to the monitoring scheme established herein.

Figure 2 - Refuge Map

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Mitigation Site

Location and General Description

The site is located on the USGS Columbia East 7.5' quad sheet of 1953 with photo revisions of 1974 shown in magenta (Figure 3 - 1953 USGS). Property boundary with Phase I and Phase II restoration is overlayed on the map. An updated version of this USGS 7.5 minute quad dated 2001 is included in this report (Figure 4 - 2001 USGS). This map is shown to document that restoration completed by Great Dismal Swamp RestorationBank LLC at Timberlake Farms, has been mapped by USGS in the 2001 revision. The agricultural field is shown in white.

Acres

Phase 1 and Phase 2 of Timberlake Farms totals 4154.6 acres. U.S. Highway 64 (US 64) crosses the northern tip of the tract. The southern boundary is roughly defined by Mills Ridge Road (SR1301). The site is comprised of 633.43 acres of agricultural land, not including 455 acres of EEP, 1041.3 acres of restored forest and 1949.4 acres of jurisdictional forested wetland. Approximately 141.81 acres of drained shrub-scrub are associated, but not included, with the agricultural acreage. Phase 2 Agricultural Restoration totals 970.93 credits, outside of the 455 acres contracted to NCEEP. Restoration of the agricultural portion of this tract represents a reduction of 1.6% of agricultural land in the 030151 sub-basin (Ref. Pasquotank Basin Plan).

The total size of the site is 4154.6 acres. Approximately 3197 acres flow toward Little Alligator River. The remainder of the tract flows west out of Riders Creek into the Scuppernong River. Mills Ridge Road in the south is the natural north-south divide from the remaining 6000 ± acres of Timberlake Farm not owned by GDSRB. The Timberlake agricultural site is the historic upper headwaters of the Little Alligator River (Figure 5 - USGS RAD Waterbody Map)

Timberlake Canal, Lateral Canals and Vee-ditches

A network of farm/woodland roads and canals/ditches exist on the property. The main farm road called Timberlake Road (shown on some surveys as Dillon Road), runs north/south along the primary canal. The site is bisected north - south by the 3.15 mile long Timberlake Canal. Canal size ranges from 30 feet wide and 6 feet below grade (bottom of canal) at the southern boundary with Mills Ridge Road to 50 feet wide and 10 feet below grade (bottom of canal) at the pump station, near US 64. Grade depths indicate canal bottom, not depth to water surface.

Four lateral canals are found in the agricultural area. Drainage from the vee-ditches was directed into the lateral canals. The lateral canals drain from east to west and are connected to Timberlake Canal by 48 inch culverts that are 40 feet long extending under Timberlake Road. The top of these 48 inch culverts is level with the surrounding soil elevations within the field area.

Figure 3- 1953 Quad sheet

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Figure 4 - 2001 Quad sheet

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Figure 5 - USGS RAD Waterbody Map

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Agricultural "vee" ditching was on 300 foot centers. These ditches ranged in size from 6 feet wide and 3½ feet deep at the confluence with the lateral canals to 3½ feet wide and 3 feet deep at point of origin. There were **33** miles of vee ditching in the cultivated land, all of which have been filled, instead of plugged. The filling of 33 miles of vee-ditches increased the restoration by 24 acres.

The canal and ditch system is drained by three pumps located in a northern pump station. These pumps have a maximum capacity of 200,000 gallons per minute. The discharge through this station goes to the Little Alligator River, which has been classified by the North Carolina Wildlife Resources Commission as an Inland Primary Nursery Area for the production and recruitment of larval game fishes (pers.comm. Sarah Winslow, 1997). The Little Alligator River, the Scuppernong River and Riders Creek are classified as anadromous fish spawning areas in the Pasquotank Basinwide Water Quality Management Plan (Figure 6 - Anadromous Fish Spawning Areas, Pasquotank River Basin).

A recorded drainage easement precludes the elimination of all drainage across this tract. The eastern boundary of the agricultural land contains a property line ditch running north to south. The resulting spoil was placed between the adjacent property boundary to the east and serves as a hydrologic boundary between the timberland to the east and Timberlake Farms. Post restoration, surface water from agricultural area will drain into the restored headwaters of Little Alligator River.

Existing Conditions

Roads

Timberlake Road has a power line easement the entire length of the road and access will have to be provided for utility crews as long as this electric line exists. Pocosin Lakes National Wildlife Refuge which may be the future owner of the tract will also need access into the property

Topography

Elevations are based on National Geodetic Vertical Datum (NGVD29) and range from minus 1 foot (-1') in the agricultural field to positive seven feet (7') on a spoil pile along Timberlake canal found near Mills Ridge Road. Representative elevation surveys by Geodetic Services, Inc. were conducted on Timberlake Farm using Global Positioning System (GPS) in 1997. Additional kinematic GPS elevation data was collected in September 2004. Elevation data points were collected with the GPS on all terrain vehicles and resulted in a survey with spot elevation being taken between 70 and 80 feet apart with plus/minus one inch accuracy. Four transects were run between each pair of vee ditches. A total of 12,500 elevation points were recorded to produce the pre-construction contour map. A second kinematic GPS survey was conducted in February 2005, post earth moving restoration, and is referred to as the "as-built topo" (Figure 7 - As-built).

Figure 6 - Anadromous Fish Spawning Areas

Figure 7 - AS-built 11X17

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Plant Community - Adjacent Forest

The adjacent mature forest found to the west of Timberlake Canal was type-mapped by Quentin Bell Company as Cypress-Gum with 3,000 board feet per acre (cyph3m). This map unit grades into hardwood forest of 3,000 board feet per acre (h3m) near the pump station and includes most of forested block E15. Vegetation sampling of the forested area was conducted during the previous five years. Cypress stumps were observed in this forest which was mapped as h3m.

Timber Type Map Timberlake Farms
The Timber Type Map, December 1997, by Mr. Bell is evidence supporting historic riverine status (Figure 8 - Forest Type). The swamp floodplain forest types have been shaded to graphically depict the historic course of Little Alligator River. The H2M (hardwood, 2000 board feet per acre) forest type east of the pump station is the location of a reference monitoring location (E16BaH3M). Numerous bald cypress (*Taxodium distichum*) stumps exist, but swamp black gum (*Nyssa sylvatica var. biflora*) have dominated post logging. During forest monitoring at this site all cypress identified has been *T. distichum* not T. ascendens (Radford, et. al., 1973).

Approximately 1½ miles of CYPH3M (cypress/hardwood 3 thousand board feet to the acre) was mapped alongside the present Timberlake Canal. Between Redwing and Flicker Roads on the east side of the canal (the agricultural side) remains a 88.24 acre shrub scrub block that was drained, but not root raked for agricultural production. Cypress stumps exist in this area indicating the forest type extended across the road into the agricultural area.

Restored Plant Community - Former Ag Field

The former agricultural field has been planted with wetland seedlings. Species planted include: Bald cypress, swamp tupelo (*Nyssa sylvatica var. biflora*), water tupelo (*N. aquatica*), green ash (*Fraxinus pennsylvanica*) and a scattering of black willow (*Salix nigra*). The Roper soil series was planted with Atlantic white cedar (*Chamaecyparis thyoides*), in accordance with the Pocosin Lakes Restoration Plan of Dr. Hinesley. The Weeksville soil series was planted with four species of oaks. They were; water oak (*Quercus nigra*), swamp chestnut oak *(Q. michauxii*), willow oak (*Q. phellos*), and cherrybark oak (*Q. falcata var. pagodafolia*).

After completion of planting by the contract planting crews, quantitative sampling will be conducted to determine actual plant composition and densities in each of the permanent sample plots. The results will be compared to the planned densities and compositions. Quantitative sampling will involve establishment of a 500' grid. These monitoring plots will be permanently established for repetitive sampling and be circular 0.1 acre plots.

Figure 8 - Forest Type Map

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Sampling in the spring, following leaf out, will be for woody species only. Mortality will be determined from the difference between previous year's living planted seedlings and the current year's surviving planted seedlings. If specified minimal densities and composition are not present, remedial actions will be taken to correct the problems after consultation with the MBRT. Should any combination of the following species, loblolly pine, sweet gum and/or red maple, comprise greater than 30% of woody species within a sample plot the MBRT will be consulted to determine if corrective actions would be appropriate.

Water Level Monitoring

During Previous Monitoring

The recent, +/-1" accuracy, topographic survey has been plotted using color bands for different hydrologic regimes. These regimes are based on five years of water table monitoring. A recording well was placed in the unpumped portion of Timberlake Canal which is found north of the pump. This well has recorded wind tide changes in the canal which is directly connected to the Little Alligator River. The well location is labeled Canal North or CN on the annual monitoring plans which were submitted for Phase I restoration of the western forested area.

The well was programmed to record twice daily. The season of recording was usually March through June. High water events from northeast storms or hurricanes were not recorded. There were 926 readings taken within the five year monitoring period to statistically analyzed to determine frequency of water levels. Minimum water elevation in canal north location was 0.2 feet. This minimum occurred in 1999, 2001, and 2002 for less than 8 total readings. Average water elevation in the canal north location was 1.6 feet. The highest recorded water level is 2.4' (Table 3). This was the highest recording, as the calibration point of the monitoring device was exceeded on numerous occasions. A water mark on a tree along the canal was surveyed at 3.44 feet above NGVD29.

Table 1 - Spring Water Level at Canalnorth

	1999	2000	2001	2002	2003	5 years
min	0.2	0.7	0.2	0.2	1.1	0.2
20 percentile	1.0	1.4	1.0	1.1	2.3	1.2
30 percentile	1.1	1.6	1.1	1.2	2.4	1.3
average	1.3	1.7	1.3	1.4	2.3	1.6
70 percentile	1.4	1.9	1.5	1.6	2.4	1.9
80 percentile	1.5	2.0	1.6	1.7	2.4	2.2
maximum	2.0	2.4	2.0	2.3	2.4	2.4

Rainfall data from Plymouth Ag Extension for the monitoring period of each of these years is shown below in Table 4. Note in 1999 only May was "normal" and the other four months were all less than the 30 percentile.

Table 2 - Rainfall Recorded at Plymouth Ag Extension

	1999	2000	2001	2002	2003	30%	70%
Jan	**3.49**	4.32	**1.4**	*6.23*	**1.64**	3.54	5.04
Feb	**2.32**	**1.61**	3.31	**2.13**	*6.06*	2.32	4.01
Mar	**3.0**	**3.51**	**2.92**	*6.86*	5.1	3.62	5.46
Apr	**1.66**	*5.38*	**1.28**	3.01	*6.67*	2.29	4.45
May	3.2	*5.59*	5.14	**2.46**	*8.65*	3.02	5.53
June	*	*7.95*	*	**2.88**	**1.47**	3.74	6.01
July	*	*	*	*7.02*	7.66	3.61	5.75

Bold = drier than 30 percentile *Italics underlined* = wetter than 70 percentile
Normal print = normal range of precipitation * = monitoring period ended

A review of plotted well readings at this monitoring station, from annual monitoring reports, show water level fluctuations un-associated with rainfall. These non-rainfall fluctuations appear to be wind tides from the Little Alligator River. Mr. Kirby Ballance, of Columbia NRCS, stated the canal north of Hwy 64 was open to Little Alligator River but may not be "canoeable" due to wind throw from recent hurricane activity (pers. comm. Balance, 2002).

Hourly Water Level Data

Two additional wells were installed in the third week of May 2005. These wells were programed to record each hour and were surveyed to NGVD 1929. A new Canalnorth well was installed approximately ½ way between the pump and the entrance gate. This re-location was to avoid an instantaneous reading possibly recording a wave created by the pump if it were running when the recording occurred. The second well was installed near the boat ramp on the Little Alligator River at Newfoundland and the old highway 64 bridge. Detailed discussion of these hourly readings will be in the section on Riverine.

The last week of May and each calendar month through December 2005 water levels at Newfoundland and Canalnorth have been charted in Excel and are included as Appendix 2. Spikes on the Canalnorth line are a result of pump cycles. Canalnorth water levels elevate during periods of frequent pump cycling possibly indicating that the 72" culverts under Timberlake Road and US Highway 64 are insufficient to carry the volume and head pressure builds. September 2005 was relatively dry. Note the similarity in water elevation between the two recording sites on the September chart.

Habitats Restored

Three habitat types will be restored during the agricultural implementation. These habitats are; Stream, Riverine, and Non-riverine. Each of the three habitats are separated and discussed below with habitat specific goals, definition, success criteria, and monitoring.

Introduction

GDSRB contacted Doctors Emily Bernhardt of Duke University and Martin Doyle of University of North Carolina for academic assistance in reviewing stream and riverine components of the restoration at Timberlake. Doctors Bernhardt and Doyle inspected the site with a team of graduate students from each University on 14-16 January 2006. The results and findings are attached as Appendix 3 with their cover letter. Within their report, *Summary of Observations of Timberlake Restoration Site*, are three appendices, relevant to proposed restoration plans of GDSRB.

Dr. Doyle was on site for the 1 February 2006 inspection with the MBRT, following the test flood with the pump cut off and flap gates opened. His cover letter of 2 February 2006, is included with his *Suggestions for Restoration Plan and Success Criteria at Timberlake Restoration Site*, as Appendix 4 of this restoration plan amendment. This document addresses considerations of hydrology connectivity and the metrics of frequency of inundation.

Stream Restoration

Goals
Restore flow and hydrologic connectivity to the site.

Definition of Stream

For the purposes of this plan, intermittent and/or perennial streams on the Outer Coastal Plain are those areas with an aquatic bed elevation below the maximum elevation reached by groundwater during a year, and are connected to downstream areas by a continuous surficial channel network. (Pursuant to NCDWQ comment, references to "intermittent plus" and exclusion of ephemeral portions of streams have been deleted).

Success Criteria - Stream

Successful restoration of stream flow will entail the documentation of annual fluxes of water on and off the site by use of bi-directional flow meter recorders.

Monitoring - Stream

Dr. Doyle will install flow monitors which will record the bi-directional flow on this site to determine net flow and direction using a ISCO Doppler Velocimeter, model 2680. Initially three flow meters will installed. The first will be at the downstream outlet from the field into Timberlake Canal. The second will be at Flicker Road and the stream crossing. The third flow meter will be in the vicinity of Eagle lateral and the stream crossing (Eagle Lateral does not have a road). Additional meters may be installed once flows are detected.

Hydrologic connectivity will be determined by release of dye samples following two rainfall events annually for each of the five years of monitoring. The dye used will be Rhodamine WT. Using dye will allow visual and chemical tracking of water movement between the site and downstream areas toward Newfoundland, or in the other direction, during wind tide events. To monitor these wind tide events, dye will be released twice annually during anticipated periods of high wind tides in each of the five year monitoring period, to determine flows into the site at these times. Dye will be released at one flow meter and recorded at the next flow meter in direction of flow.

Mr. Wicker of the US Fish & Wildlife Service has suggested that he and other members of the MBRT should schedule a site visit to walk the channel during summer 2006 to determine if fish passage is currently possible between Newfoundland and the site. Additional monitoring wells will be installed along the stream course at half mile intervals, set to record each hour. These wells will be used to determine elevation of aquatic bed in relation to groundwater (non-ponded surface water) for determining the above definition. Relevant sources of expertise will be consulted to determine a macrobenthic sampling method. Sample stations will be in proximity to each of the flow meters. These macrobenthos sample results will be compared with a reference site.

The riverine wetlands adjacent to the restored stream will be monitored for seedling survival as set forth under the heading, **Riverine Wetland Restoration - Success Criteria** (below).

Riverine Wetland Restoration

Goals

Establish riverine wetlands with planted seedlings (see success criteria below).

Success Criteria - Riverine Wetlands

Vegetation Success Criteria

Riverine wetlands will be those areas inundated by the median of the five highest independent flood events during the five year monitoring period. Riverine wetlands have been planted with seedlings. Areas planted must have a minimum of

450 seedlings per acre at the end of the first growing season. After year two a minimum of 400 seedlings per acre must exist. Following year three of monitoring there shall be no less than 320 seedlings per acre. At the end of year four the minimum tree count shall be 290 seedlings per acre and finally in year five the minimum seedlings per acre, shall not be less than 260 seedlings per acre. These counts are of five year old surviving planted seedlings.

Hydrology Success Criteria

The line demarcating riverine wetland hydrology will be the elevation on the site inundated by the median of the five highest independent flood events during the five year monitoring period. GDSRB agrees that outliers and anomalous events must be accounted for, as discussed by Dr. Doyle (Appendix 7-B). In addition, GDSRB agrees that it is appropriate to quantify the volume of the flow from the new Mills Ridge Road pump station, and to take it into account in determinations with respect to site success criteria.

Acreage flooded by the median of the five highest events will be calculated, surveyed and utilized to determine riverine credits. Riverine credits will be corroborated and quantified pursuant to the monitoring scheme established herein.

Monitoring - Riverine

Vegetation monitoring will require counting surviving planted seedlings in one-tenth acre circular plots at the end of the growing season. Surviving densities will be converted to seedlings per acre and compared to the success criteria above. Vegetative sampling will be undertaken pursuant to page 15 and 17 of this plan. If initial planting effort fails and the site (or portions of the site) must be replanted, the vegetative monitoring time frame is reset to year one, only for the areas replanted.

Monitoring for the purposes of determining survival and calculating credits will not begin until all permanent hydrologic modifications have been undertaken across the site, including opening the flap gates of the pump preparatory to removal. Doctors Bernhardt and Doyle recommend monitoring surface inundation with recording devices known as "HOBO's". These will be placed on the sample grid as depicted on the topo, to determine which elevations are inundated with surface waters. Slotted well screen Infinites USA wells will be placed along the centerline of the stream at half mile intervals to determine surface elevation of flood waters. This data will be compared to elevations at each of the hobos that indicate surface flooding. This will allow for the exclusion of ponded waters that are not surficially connected to the stream.

Non-Riverine Restoration

There are two types of non-riverine habitat. The cypress-gum-ash "wet mix" in areas not lower than the elevation of the median of the five highest independent

flood events during the monitoring period will be non-riverine. On the mineral soil, Weeksville Series, an "Oak mix" was planted.

Success Criteria - Non-riverine

Vegetation

Same annual density requirements as for riverine will apply.

Hydrology

Success criteria will be saturation within 12" of the soil surface for 12.5% or greater, of the growing season

Monitoring - Non-riverine

Vegetation

Same method and survival densities as described under Riverine will apply.

Hydrology

Monitoring wells will be installed to determine duration of saturation within 12" of soil surface. Installation density will be on a grid at the rate of one well every 50 acres as suggested by the MBRT in the Restoration Plan for Timberlake Farm, Phase II Agricultural Areas, Columbia, North Carolina. This grid is shown on the topo map. (This does not include the EEP portion of the site). All wells in non-riverine areas will be installed and maintained in accordance with the document entitled, Technical Standard for Water-Table Monitoring of Potential Wetland Sites, ERDC TN-WRAP-05-02, June 2005.

Implementation

Relocation of Pump

New Pump - statistics

Mr. Joe Landino has indicated one of the existing 70,000 GPM pumps will be relocated to the vicinity of Mills Ridge Road on Timberlake Canal and powered by a diesel engine. Plans are to be provided to GDSRB from Mr. Landino and construction start upon approval of these plan drawings.

Timberlake Canal Plug

Associated with the relocation of the pump station a 300' earthen plug will be placed in Timberlake Canal between the second and third telephone poles north of Mills Ridges Road. Installation of the new pump will require a sump area greater than exists in the present canal. This sump volume will be created by widening Timberlake Canal to double its present width between the pump and Mills Ridge Road, approximately 300'. The excavated material will be used as fill in the main canal plug or as fill in lateral canals. Sheet pile bulkhead will be installed at the new site similar to that present at the existing pump.

Existing Pump

It is anticipated that by winter 2006-2007 the planted seedlings should be sufficiently established to survive the height and duration of flooding expected by opening of the existing pump flap gates, which will be welded open. The present pump station would remain for 1-3 additional years to allow vegetative replanting should densities fall below success criterion. By the third year of monitoring the present pump station will be removed, including sheet pile bulkhead.

Re-installation of Monitoring Wells in Western Forest

The western forested area should be re-monitored to determine if water elevations are altered by removal of the spoil pile adjacent to Timberlake Canal. It is anticipated that water levels may be slightly lower by virtue of connection to the restored stream, but soil saturation should remain the same. Re-connecting these wetlands of the western forest is a recommendation of Doctors Bernhardt and Doyle, *Summary of Observations of Timberlake Restoration Site* (Appendix 3).

Removal of Spoil Pile

The spoil adjacent to Timberlake Canal in the vicinity of Redwing Road would be removed for a 300' length. This would be in the area inspected by the MBRT on 1 February 2006. The existing canal will be filled with material from the new pump location to a level equal to the western forest soil surface. This is to prevent head cutting as pointed out by Mike Wicker on the MBRT site inspection. The fill will gradually slope to prevent erosion.

New Southward Flow
Flow from this point will be directed south to Eagle lateral and then east into the restored agricultural field and join with the restored stream channel. This was recommended by Doctors Bernhardt and Doyle to increase detention time and increase flow volume in the restored stream channel.

Main Bridge/Arched Culvert Construction

Four bridges (or arched culverts) will be required in Timberlake Road. These must be capable of supporting a utility company service truck. The final disposition of the tract is to Pocosin Lakes National Wildlife Refuge. Mr. David Kitts, Assistant Refuge Manager for Pocosin Lakes National Wildlife Refuge, has been contacted about bridge construction at the suggestion of Mr. Mike Wicker. Mr. Kitts indicated by phone that the refuge was removing bridges and replacing them with culverts. This was because of insurance and maintenance issues with Federal bridge inspectors. Mr. Kitts stated the only problem with new aluminum culverts were beavers.

An option other than bridges would be arched culverts. These are pre-fabricated aluminum arches requiring concrete footers poured onsite. The bottom is natural substrate as under a bridge. They can be purchased in various widths and heights. These would be wider (12-18') than a 6 foot culvert and as difficult for a beaver to dam as a bridge of similar span. The height above water level of an arched culvert will be greater than present circular culverts with height approximating normal water levels. The increased height should allow more light and be less restrictive to river herring passage than a standard culvert. No beaver dams have been observed on any of the existing culverts at Timberlake Farm. The bridge/arched culvert locations are as follows.

Bridge/arched culvert 1
By US Highway 64 and Timberlake gate. This will replace the twin 72" culverts that restrict flows and may impede fish migration. Another twin 72" culvert is presently under US Highway 64 and would need to be replaced during highway widening to increase likelihood of anadromous fish migration.

Bridge/arched culvert 2
Near Gull Road to connect to the eastern restored forest. This area is presently deep standing water, partly due to soil oxidation when drained. Vegetation, large butt swelled swamp tupelo, indicates a topographic drainage feature in this area.

Bridge/arched culvert 3
Replace the temporary twin 60" plastic culverts that were installed as part of the test flood.

Bridge/arched culvert 4
This bridge/arched culvert will allow the western forest waters, to flow under Timberlake Road, and connect to the restored stream channel. There is a possibility that re-colonizing river herring could reach the western forest through this opening.

Bridges/arched culverts for ATV's

Three permanent bridges or arched culverts, capable of handling ATV's, will be required to facilitate access during the monitoring period. The first of these crossings will be on Redwing Road east of the "white house" where the temporary steel pipe is located. The second ATV bridge/arched culvert will be on Flicker Road east of the shrub areas on either side, where the temporary steel pipe is located. The last of these bridges/arched culverts will be on Eagle Road to replace the removed single 60" culvert. This culvert will be removed to increase flows and fish access to the western forest through Timberlake Canal to the location of the spoil pile break at Redwing Road vicinity. A crossing is required here during the monitoring period to access re-installed monitoring wells.

Earthen Plugs

Eagle Lateral will not be plugged at 300' intervals as in the 2002 Restoration Plan, since Eagle lateral will now be connecting the restored stream with the western forest flows. East of the stream channel a 300' plug will be installed and the remainder of the lateral graded to create shallow water habitat.

Flicker Lateral will be plugged for 300' at alternating 300' intervals as in the 2002 Restoration Plan. This will result in approximately 2,700 linear feet of the lateral being filled. Experience at the pocosin Lakes National Wildlife Refuge has shown that tanic acid waters less than two feet deep will vegetate with aquatics. This will result in a diverse habitat and ecologically superior to open water. The resulting "pools" may be utilized by amphibians for breeding (Martof, et. al., 1980).

Several small field ditches alongside Timberlake Road will be plugged to close short circuit effect and to allow researchers access to monitoring well locations.

River Herring Release

Riverine acres would provide habitat for river herring (*Alosa aestivalis* and *A. pseudoharengus*) which have had access blocked by the pump station. Recent stock status information from NC DMF lists river herring in the Albemarle / Chowan basin as depressed.

> "Extensive Pasquotank watersheds that contain intermittent and tidally flooded wetlands, swamps, hardwood forests, shallow open waters and areas of emergent and submerged aquatic vegetation are considered very important as spawning, nursery and feeding areas for anadromous and resident fish species. Maintenance of the water quality benefits provided by these habitats is critical to fishery resources." (*Pasquotank Basinwide Water Quality Management Plan*)

This site may provide river herring habitat. The Bank Sponsor proposes to release live herring after coordination with of NC Marine Fisheries and National Marine Fisheries. However, establishing populations of river herring is not an independent success criterion, or monitoring requirement, of this plan.

Timing

Install Landino Pump

This pump should be installed by late September 2006. This will require the filling of Timberlake Canal for construction of the bulkhead area and sump for new diesel pump site. Pumped discharge from the agricultural land south of Mills Ridge Road will be through a culvert under Timberlake Road. This culvert will have a flap gate to prevent wind tides from backing across Mills Ridge Road.

Install Monitoring Wells

The western forested monitoring wells will be re-installed. Four additional wells will be placed in the stream channel and programmed to record hourly. These wells will be at approximately ½ mile intervals from the outlet bridge and present hourly well location of V-8. The purpose of these wells is to measure head pressure along the length of stream, and water elevations above the aquatic bed.

Install Bridges

The plan of the Pocosin Lakes bridges will be copied and installation begin. The exact order of bridge installation will be left to the contractor. These will begin following equipment completion of the new pump station (Summer 2006).

Re-connect Western Forest

The western forest can not be re-connected until the restoration site is separated from the agricultural lands south of Mills Ridge Road. The spoil should not be removed until all bridges are in place to allow access to monitoring wells.

Release of Credits

The standard release of 15% of each credit type, riverine, non-riverine and stream should be available upon approval of this plan, once the Bank site has been secured, financial assurances established and the flap gates opened preparatory to removal.

The estimates of riverine acres may be updated annually following collection of monitoring data, and initially are only an estimate. Elevations between 1 and 0 feet exist in the agricultural area. When the road is breached and pump removed, these areas will have, respectively, 1 to 2 feet of wind tide and precipitation driven riverine flooding. Within the present agricultural field 442.8 acres are below the 2 foot contour of which 211.8 acres are below 1.5 feet elevation. Data collection will begin when the pump is cut off in winter 2006-2007 and flap-gates opened preparatory to removal.

Implementation of this plan will result in such riverine and stream restoration credits as are corroborated and quantified pursuant to the monitoring scheme established herein. Based on elevations and present water elevation recordings, a preliminary estimate of stream footage, between the outlet into Timberlake Canal (present location of temporary plastic culverts) and the lowest elevation south of Flicker Road is approximately 7000 feet. The area below 1.25 feet elevation (magenta and dark blue on the topo map) is approximately 200 acres. The best available present estimate is that acreage at or below this elevation should be inundated 70% of the time and should be regarded as riverine. The elevations mapped as orange are above 2½ feet, and may be predicted to be non-riverine. All the acreage in between these elevations shall be subject to being corroborated and quantified pursuant to the monitoring scheme established herein.

Table 3 - Preliminary Projections of Restored Agricultural Area			
Habitat	Topo Map Colors	Elevations	Preliminary Projections Acres[1]
Riverine	magenta & dark blue	<1.25'	200 ac.
Non-riverine	orange	>2.5'	75 - 100 ac
To Be Determined	light blue - yellow	1.25' - 2.5'	456-476 ac.
[1] - Includes shrub - scrub area 2 - Does Exclude EEP Area			

Report Submittal

An "as built " plan will be submitted within 90 days of completion of planting. The plan will include a discussion of the final planting design and location of sample plots. Subsequent reports will be submitted annually to the signatory agencies, not later than 31 December of any monitoring year. These reports will contain results of hydrological and vegetational monitoring along with color photographs to document changes.

Financial Assurances

GDSRB have already planted the agricultural area with seedlings. Monitoring devices have been purchased and installed. The relocation of the pump station to Mills Ridge Road is being conducted and paid for by Mr. Landino. Remaining expenses are monitoring and removal of the existing pump station. GDSRB estimate remaining costs do not exceed $35,000. The sponsors will provide financial assurance of that amount through use of an escrow (or bond) arrangement in which bank sponsors would establish an account at the time the Corps declares the first credits to be available for debiting to insure the completion of the 5-year maintenance and monitoring scheme, with interest accruing to the benefit of the bank sponsor.

Real Estate

At the time the Corps declares the first credits to be available for debiting, from Phase II, Bank Sponsor will transfer marketable fee simple title to appropriate sections of the property to the Pocosin Lakes National Wildlife Refuge or other

area protected by the U.S. Fish and Wildlife Service, or to the Nature Conservancy by conservation easement, using the form annexed from the first easement, to hold in trust for a state or Federal Government agency to whom property will be deeded at such time as the agency is prepared to accept the transfer at the specification of the Corps or MBRT.

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