Mitigation Plan

Rich Fork Mitigation Site

Davidson County, North Carolina

Yadkin River Basin
Sub-Basin 03-07-07

Submitted to:

North Carolina
Department of Environment and
Natural Resources
Ecosystem Enhancement Program

Submitted by:

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TABLE OF CONTENTS

Figures

Tables

Appendices

1.0 INTRODUCTION

The Rich Fork Mitigation Project restored 21.49 acres of riverine wetland and 3,398 linear feet and preserved 1,972 linear feet of perennial stream in the Yadkin River Basin. The project was initiated in spring of 2000 and construction was completed in the spring of 2004. The goal of the project is to re-establish an integrated wetland-stream complex that will restore ecosystem processes, structure, and composition to mitigate for wetland functions and values that have been lost as a result of anthropogenic disturbances in this region of the Yadkin River Basin. Functions that will be restored as a result of the restoration include:

- Restoration/enhancement of bottomland hardwood communities
- Restoration of floodplain/wetland interfaces
- Restoration of stream channels and drainage patterns
- Restoration of water quality functions
- Restoration of wildlife habitat
- Re-establishment of wildlife travel corridors

2.0 SUMMARY

The Rich Fork Mitigation Site is located within the Abbotts Creek watershed (USGS Hydrologic Unit 03040103 and NCDWQ sub-basin 03-07-07) and drains approximately 26.1 square miles of the Yadkin River Basin. The watershed is part of the Piedmont physiographic region and it is dominated by forest, agriculture, and urban land uses. The North Carolina Wetlands Restoration Program has identified the study drainage as a component of Priority Hydrologic Unit #3.

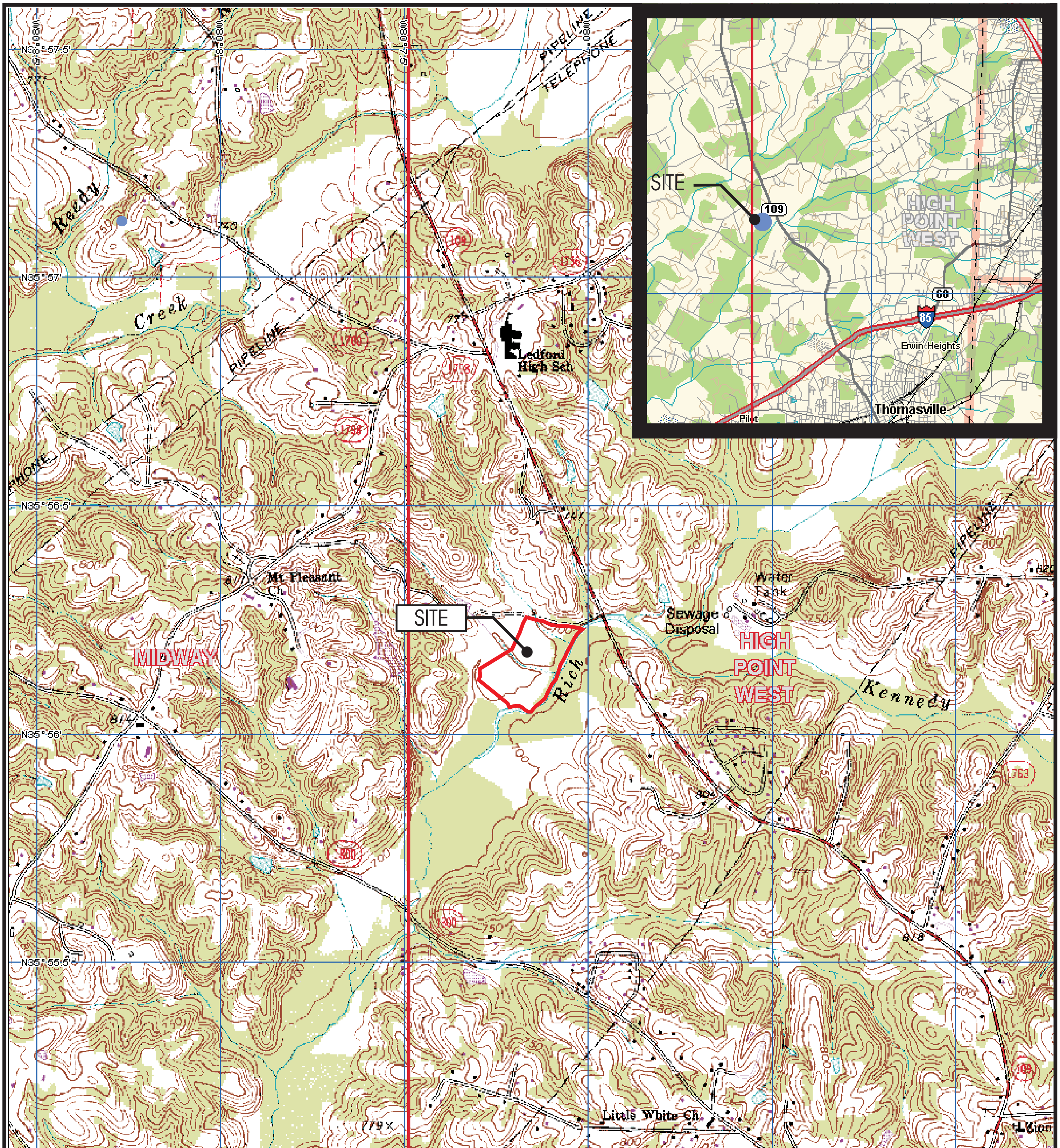
The 26.1 acre site is located downstream of SR 109 on the western floodplain of Rich Fork; west, southwest of High Point in Davidson County (Figure 1). Approximately 80% of the site was cleared, drained, and ditched for agricultural use. The remaining 20% is comprised of mature forest occupying the levee position adjacent to Rich Fork.

Historical site conditions were reviewed to understand the chronology of land use at the site and to assist in the development of an appropriate restoration strategy. Aerial photographs of the site were obtained from the Davidson County Soil and Water Conservation District for the years 1936, 1950, 1955, 1966, 1981, and 1988. During the entire period of photographic record, the site was under agricultural production, with plowed fields and drainage ditches evident. Additionally, the streams that transect the site was channelized and straightened prior to 1936.

A detailed soils evaluation was conducted to determine the distribution and extent of soil types on the site, using the Davidson County Soil Survey as a general guide. Although the county soil survey mapped the entire site as Chewacla soil, the field evaluation revealed that four soil designations and their variants occur on the site: 1) Chewacla loam (Fine-loamy, mixed, thermic Fluvaquentic Dystrochrepts); 2) Wehadkee loam (Fine-loamy, mixed, active, nonacid, thermic Fluvaquentic Endoaquepts); 3) Congaree loam (Fine-loamy, mixed, nonacid, thermic Typic Udifluvents), and 4) Udorthents. In general, Chewacla with Wehadkee inclusions account for approximately 46%, Congaree generally occurs in the levee position along Rich Fork and represents 18%, and Udorthents occupy a band adjacent to Rich Fork and the ditched stream channel on site and occupy 36% of the site.

The soil's current/historic status as hydric was evaluated to determine the extent to which wetland restoration could be achieved on the site. Resolution of this issue was achieved through agency directives and conducting detailed field evaluations. Based on these evaluations it was determined that approximately 46% of the site has hydric soils, defined as having redoximorphic features within the top 12 inches of the surface, and 36% of the site had a buried hydric soil profile. The remaining 18% is comprised of non-hydric soils. Soils in the restoration portion of the site have been determined to be Chewacla loam, Wehadkee loam, Congaree loam and Udorthents. Detailed field evaluations were conducted to identify redoximorphic features in the upper 12 inches of soil and fill areas.

Site hydrology was evaluated during field investigations, and using flood frequency and water budget analyses. Hydrology and hydraulics on the site reflect those typically found in Piedmont riparian zones. The primary hydrologic inputs to the site include seasonal groundwater and precipitation. The site is in the two-year floodplain of Rich Fork and becomes inundated under natural conditions by discharges exceeding 1000 ft^3/s. The results of the flood frequency analysis show that this discharge corresponds to a 1.007-year return period flood.



Rich Fork Mitigation Site

Figure 1: Location Map

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Site Location

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Groundwater monitoring data was collected plotted to determine the hydroperiod (duration of saturation within 12" of the ground surface) for the site and reference wetland. This evaluation indicated that the site's hydroperiod has been significantly altered when compared to that of the reference wetland. The reference wetland, exhibited on average, a groundwater elevation between 0 and 2 inches below the surface for 40 days (17% of the growing season) with relatively constant elevation. The site exhibited average groundwater elevations between 0 and 12 inches below the surface for intervals between 2 days (1% of growing season) and 12 days (4% of growing season) with rapid fluctuations. If the rapid fluctuations (drawdowns) were removed, the site would maintain a groundwater elevation averaging 5 inches below the surface for between 20 days (8% of growing season) and 30 days (12% of growing season).

Both surface water and groundwater were removed from the property via lateral drains and ditches. Two series of ditch networks drained the site. Both networks discharged into Rich Fork at the southern end of the site. They jointly had the capacity to discharge surface and subsurface water at a rate of 32 ft^3/s. These ditches depressed groundwater elevations on-site by providing a discharge path, which subsequently lowered the adjacent water table. They also decreased the extent and duration of flooding. Under these conditions, the lateral drains and the ditching of the stream channel effectively altered the hydrology of the site, decreasing the time of concentration and the amount of water available for soil saturation. The ditching system outlet also provided an artificial break in the natural stream levee and speeds drainage of the site during flood events.

Existing site hydrology was modeled by developing an annual water budget that calculates water inputs and outputs, and the change in storage on a monthly time step. The hydrographs for the average, dry and wet years show a similar pattern of seasonal water table levels. Water table recharge occurs during the late fall and winter months until a rapid water table draw down occurs as PET rates increase in the spring. During the summer, the water budget model shows the existing site is unsaturated within the upper 36 inches of soil. The proposed conditions water budget shows the annual hydrographs for the same three climatic years reflecting dry, average, and wet conditions. Without the estimated groundwater loss from the ditch network, the water table recharges earlier in the fall, maintains a shallower soil depth for a greater duration, and remains within 12 inches of the soil surface for a greater proportion of the growing season.

The site exhibited the effects of hydrologic modifications that prevent the attainment of jurisdictional hydrology, by limiting the number of consecutive days in which saturation occurs within 12" of the grounds surface. However, approximately 70% of the site had indicators of reducing conditions in the upper 12" of the soil profile. Given the extent of human induced alterations to the vegetative communities and hydrology (through draining and ditching), the restoration plan concentrated on re-establishing hydrology and vegetation in order to restore the functions and values of a bottomland hardwood community.

The restoration of the site focused on re-establishing the historic bottomland hardwood communities and associated stream network to re-establish an integrated wetland-stream complex that will restore ecosystem processes, structure, and composition to mitigate for wetland functions and values that have been lost as a result of anthropogenic disturbances in this region of the Yadkin River Basin. Specific goals and objectives for the restoration of the site include: Restoration/enhancement of bottomland hardwood communities, Restoration of floodplain/wetland interfaces, Restoration of stream channels and drainage patterns, Restoration of water quality functions, Restoration of wildlife habitat, Re-establishment of wildlife travel corridors.

Specific actions conducted to achieve the restoration goals and objectives included: Filling of lateral ditches, Recreating microtopography across the site (to enhance surface water retention and storage, to provide the necessary slope for stream restoration and to provide amphibian breeding habitat where possible), Restoration of unnamed tributaries to Rich Fork to re-establish stream/wetland interface, Re-vegetation of the site with Piedmont Bottomland Hardwood and Piedmont Levee Forest species.

Designed/Monitoring by; KCI Associates of North Carolina, PA

Construction by; KCI Environmental Technologies and Construction Inc.

3.0 SUCCESS CRITERIA

3.1 Hydrology

Groundwater elevations will be monitored to demonstrate the attainment of jurisdictional hydrology. Wetland hydrology will be considered established if well data from site indicates that the water table is within 12 inches of the soil surface for 8% of the growing season (NRCS published or locally calculated) or if overbank flooding causes extended inundation such that an area is ponded or flooded for 7 or greater days (during normal weather conditions). A "normal" year, based on NRCS climatological data for Davidson County, using the "middle 40" percent average as documented in the USACOE Technical Report "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology, April 2000". According to the USDA, NRCS Franklin County Soil Survey, the growing season is considered to extend from March 14 to November 10, yielding 241 days. Therefore success will be achieved if the water table is within 12 inches of the soil surface for 20 days during the growing season.

3.2 Vegetation

The success criteria for the planted species in the restoration areas will be based on survival and growth. Survival of planted species must be 260 stems/acre at the end of 5 years of monitoring. Non-target species must not constitute more than 20 percent of the woody vegetation based on permanent monitoring plots.

3.3 Soils

Soils in the wetland restoration area were determined to be hydric prior to during the development of the restoration plan. As soils are already considered hydric, no success criteria or monitoring was required.

3.4 Streams

Physical success will be met when inherent stability is achieved as demonstrated by less than 10% variation in monitored elements for 2 consecutive years.

Biological success will be met when the restored reaches meet or exceed the indexes calculated for the upstream reference.

4.0 MONITORING SCHEDULE

The site will be monitored for a period of five years beginning in 2004 through 2009 or until success criteria are achieved. Reports will be submitted to the NCEEP in December of each year. Monitoring will include collection of vegetative and hydrologic data, photo documentation (see "As-Built Plans" for locations) and an annual site walk through. Annual reports will be submitted to the NCEEP, documenting the monitored components i.e. hydrology, vegetation, stream profile, cross sections and will include all collected data, analysis and photographs.

4.1 Wetlands

Hydrology will be monitored through groundwater elevations to demonstrate the attainment of jurisdictional hydrology. Verification of wetland hydrology will be determined by automatic recording well data, collected within the project area and reference wetland. Automatic recording wells will be established within restoration areas at a density of 1 automatic well per 4 acres (6 wells total). One automatic recording well will be established at the reference wetland. Daily data will be collected from automatic wells over the 5-year monitoring period following implementation.

Vegetation The success criteria for the planted species in the restoration areas will be based on survival and growth. Permanent monitoring plots have been established in wetland restoration areas at a density of one plot (100 square meters) per four acres (six plots total) and systematically located to ensure even coverage. Data will be collected at each plot for: total number of stems, species, percent survival, height, estimated percent cover of all species, and evidence of insects, disease and browsing.

4.2 Streams

The project team will monitor geomorphological and biological parameters of the restored stream in accordance with ACOE and NCDENR protocols. Monitoring will follow the NCDENR guidance: *Internal Technical Guide for Streamwork in North Carolina* (Version 3.0, April 2001) and the *Interim, Internal Technical Guide: Benthic Macroinvertebrate Monitoring Protocols for Compensatory Stream Restoration Projects* (NC Division of Water Quality, 401/Wetlands Unit, May 2001).

Physical monitoring will be conducted by collecting geomorphic data on two reaches in each channel (main stem and tributary). Each reach will be twenty bankfull widths in length. Within each reach the following geomorphic elements will be collected; cross sections (one riffle and one pool), modified Wolman pebble counts, profile, and channel geometry. Permanent markers will be established for each monitoring point (profile and cross-section) with rebar and caps.

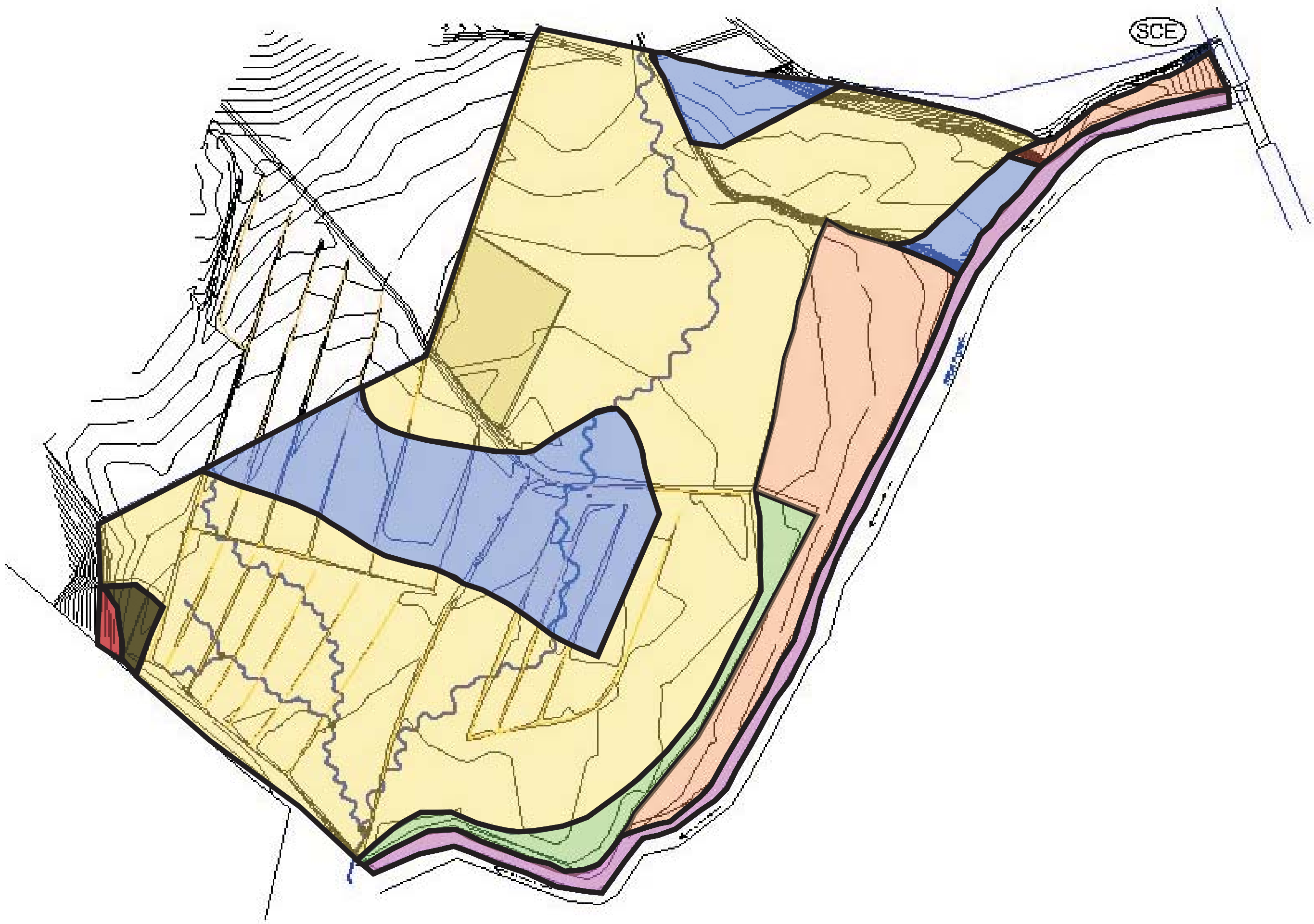
Biological monitoring will be conducted in each physical monitoring reach in accordance with DWQ protocol. In addition to the samples collected within the restored reach, a sample upstream of the restoration will be collected as a reference.

5.0 MITIGATION

Mitigation for wetland and stream impacts will be achieved through the re-establishment of the historic bottomland hardwood communities and associated stream network (Figure 2). The site is comprised of 26.1 acres of land. The restoration of this site restored 21.49 acres of Piedmont Bottomland Hardwood Forest and streams that historically occupied this landscape position. The restoration will result in 18.59 Wetland Management Units and 3,792 Stream Management Units to offset un-avoidable wetland/stream impacts in the Yadkin River Basin.

Table 1 – Stream/Wetland Management Units Developed

Community	Restoration Acres/lf	Restoration @ 1:1	Restoration Credits	Creation Acres/lf	Creation @ 3:1	Creation Credits	Enhancement Acres/lf	Enhancement @ 2:1	Enhancement Credits	Preservation Acres/lf	Preservation @ 5:1	Preservation Credits	Non-Wetland Acres	Site Total SMU	Site Total WMU
Bottomland Hardwood	17.1	=	17.1	3.9	=	1.3	0	=	0	0	=	0			18.4
Low Elevation Seep	0	=	0	0	=	0	0.31	=	0.155	0.18	=	0.036			0.191
Piedmont Levee Forest	0	=	0	0	=	0	0	=	0	0	=	0	4.72		0
Perennial Stream	3,398	=	3,398	0	=	0	0	=	0	1,972	=	394.4		3,792	
													Totals	**3,792**	**18.59**



Rich Fork Mitigation Site

Figure 2: Mitigation Type & Extent

WETLAND COMMUNITIES

- LOW ELEVATION SEEP PRESERVATION
- BOTTOMLAND HARDWOOD RESTORATION
- BOTTOMLAND HARDWOOD CREATION
- BOTTOMLAND HARDWOOD ENHANCEMENT
- STREAM PRESERVATION
- STREAM RESTORATION

UPLAND COMMUNITIES

- LEVEE FOREST RESTORATION
- LEVEE FOREST PRESERVATION

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6.0 MAINTENANCE AND CONTINGENCY PLANS

Activities will be conducted throughout the year and may include: invasive control, debris or trash removal, etc. If the monitoring of the site thereafter identifies a failure to attain specific success criteria, a remedial action plan will be developed which investigates the cause of the failure and proposes actions to rectify the problem.

Contingency and maintenance plans were developed to help ensure the proper maintenance of the restored wetlands, in order to promote the long-term success of the restoration project. Corrective actions, as detailed in Table 1, will be taken to rectify identified site problems as well as to address monitoring findings that indicate a failure to meet established success criteria.

Table 2 - Contingency Plans.

Identified Problem		Corrective Action	Timeframe
Stream	1. Localized erosion	Reestablish eroded section reseed with appropriate mix, and apply coir matting to stabilize.	Immediate.
	2. Excessive debris creating obstruction or diversion of flow.	Remove obstruction, by hand if possible. If needed, correct erosion problem.	Immediate.
Vegetation	3. Woody vegetation not meeting success criteria	Determine reason for failure, determine quantity of plantings required to replant, develop list of species to be utilized, and install in accordance with original design specifications.	Seasonally (during dormancy)
	4. Barren areas void of herbaceous vegetation.	Determine reason for failure, prepare area applying topsoil and amendments as necessary, and reseed with appropriate mix.	Immediate.
	5. Invasive Species	Hand removal of or herbicide application to invasive plants.	Immediate.

Table 3 - Re-seeding Specifications: Riverine/Non-riverine Wetlands (All areas outside top of stream banks)

Summer Mix (April 15 – October 15)		Application Rate (in Mix)	
Species		% of Mix	lbs./acre
Redtop	*Agrostis alba*	5	1.5
Purple Lovegrass	*Eragrostis spectabilis*	5	1.5
Deertongue	*Panicum clandestinum*	35	10.5
Switchgrass	*Panicum virgatum*	30	9.0
Brown Top Millet	*Pennisetum glaucoma*	25	7.5
	TOTALS	100	30.0

Winter Mix (October 15 – April 15)
Same as above except substitute Rye Grain (*Secale cereale*) for Brown Top Millet.

Table 4 - Re-seeding Specifications: Stream Zone (All areas within the top of stream banks)

Summer Mix (April 15 – October 15)		Application Rate (in Mix)	
Species		% of Mix	lbs./acre
Tussock Sedge	*Carex stricta*	*5*	*1.5*
Redtop	*Agrostis alba*	5	1.5
Purple Lovegrass	*Eragrostis spectabilis*	5	1.5
Deertongue	*Panicum clandestinum*	30	9.0
Switchgrass	*Panicum virgatum*	30	9.0
Brown Top Millet	*Pennisetum glaucoma*	25	7.5
	TOTALS	**100**	**30.0**