WETLAND MITIGATION PLAN

DUTCHMAN'S CREEK SITE
WAKE COUNTY, NORTH CAROLINA

The North Carolina Department of Transportation
Raleigh, North Carolina

July 1999

EXECUTIVE SUMMARY

The North Carolina Department of Transportation (NCDOT) proposes to construct the Northern Wake Expressway (R-2000) in Wake and Durham Counties of North Carolina. The Northern Wake Expressway segment extending from Ray Road (SR 1826) to Falls of the Neuse Road (SR 2030) in northern Raleigh, termed R-2000D and R-2000CB, is currently in the construction design and implementation phases. Wetland impacts associated with the Northern Wake Expressway were quantified and described in a Section 404 Permit Application approved by the U.S. Army Corps of Engineers (USACE) in October 1996. The R-2000D and R-2000CB segments of the Northern Wake Expressway will impact a total of 9.87 acres (ac) of wetlands, approximately 3800 linear feet (ft) of stream channel, and 3.8 ac of surface and open waters (ponds). Compensatory mitigation for these impacts is required.

A study was conducted in Wake and Durham Counties for the purpose of identifying and evaluating potential mitigation sites for use as compensatory mitigation. During this search, NCDOT personnel identified lower reaches of Dutchman's Creek as a degraded stream and riverine wetland system considered suitable for compensatory mitigation use. In June 1997 the Dutchman's Creek Mitigation Plan was submitted to and approved by the agencies in compliance with the permit conditions. In May, 1998, concerns with the plan were expressed by the Wake County Chapter of the Audubon Society and various owners of adjacent property and on May 7, 1998, the Wake County Chapter of the Audubon Society requested that the plan be changed to reflect their interest. NCDOT subsequently requested from the regulatory agencies and was granted a 12 month delay to revise the plan.

During the granted delay a revised mitigation plan was developed which proposed restoring 7.7 ac of shrub-scrub wetland complex, creation of 0.7 ac of littoral habitat in conjunction with 4.4 ac of open water within a 12.8 ac pond, creation of 1.6 ac bottomland hardwood forest, and preservation of 52.6 ac of piedmont floodplain wetlands for the Dutchman's Creek Mitigation Site. The result will include exposure of unconsolidated pond sediments to characteristic wetland hydroperiods and re-vegetation of portions of the Dutchmans Creek floodplain. The plan was presented to and accepted by the Wake County Chapter of the Audubon Society and adjacent land owners on April 6, 1999.

In summary, this mitigation plan describes actions that will result in 12.8 ac of shrub-scrub wetland restoration, littoral and open water habitat creation, 1.6 ac of forested wetland creation in uplands adjacent to the Dutchman's Creek floodplain, and 52.6 ac of floodplain wetland preservation. This mitigation plan is proposed to fulfill compensatory mitigation requirements for wetland and open water impacts associated with the R-2000D and R-2000CB segments of the Northern Wake Expressway.

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1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT)is constructing the Northern Wake Expressway (R-2000) in Wake and Durham Counties of North Carolina. This four- to six-lane roadway will extend for a total distance of 27.3 miles (mi) on new alignment in an arc around the City of Raleigh. The Final Environmental Impact Statement ([1]FEIS) for the Northern Wake Expressway was approved in 1990 (NCDOT 1990). The Northern Wake Expressway segment extending from Ray Road (SR 1826) to Falls of the Neuse Road (SR 2030) in northern Raleigh, termed R-2000D and R-2000CB, is currently being constructed (Figure 1).

Wetland impacts associated with the Northern Wake Expressway were quantified and described in a Section 404 Permit Application approved by the U.S. Army Corps of Engineers (USACE) in October 1996. The permit is conditioned upon final design plans and approval of compensatory mitigation strategies to off-set wetland impacts. The R-2000D and R-2000CB segments of the Northern Wake Expressway have impacted a total of 9.87 acres (ac) of wetlands, 3.80 ac of surface waters and ponds, and approximately 3800 linear feet (ft) of stream channel.[1]

A study was conducted in Wake and Durham Counties for the purpose of identifying and evaluating potential wetland mitigation sites for use as compensatory mitigation. During this search, NCDOT personnel identified lower reaches of Dutchman's Creek as a degraded wetland site that was threatened by planned residential development (Figure 1). In addition, the degraded wetland is positioned immediately above Lake Wheeler, a water supply system for the region.

In March 1997, a preliminary mitigation proposal was developed which described existing conditions at the Dutchman's Creek site and proposed preliminary alternatives for wetland restoration/enhancement. The mitigation proposal presented two alternatives for hydrology restoration/enhancement, including stream reconstruction and impoundment dam reconstruction.

On June 19, 1997 the Dutchman's Creek Mitigation Plan was submitted to and approved by the agencies in compliance with the permit conditions. In May 1998 concerns with the plan were expressed by the Wake Audubon Society and by various owners of adjacent property and on May 7, 1998, the Wake County Chapter of the Audubon Society requested that the plan be changed to better reflect their interests. NCDOT subsequently requested and was granted a 12 month delay from the regulatory agencies to revise the plan.

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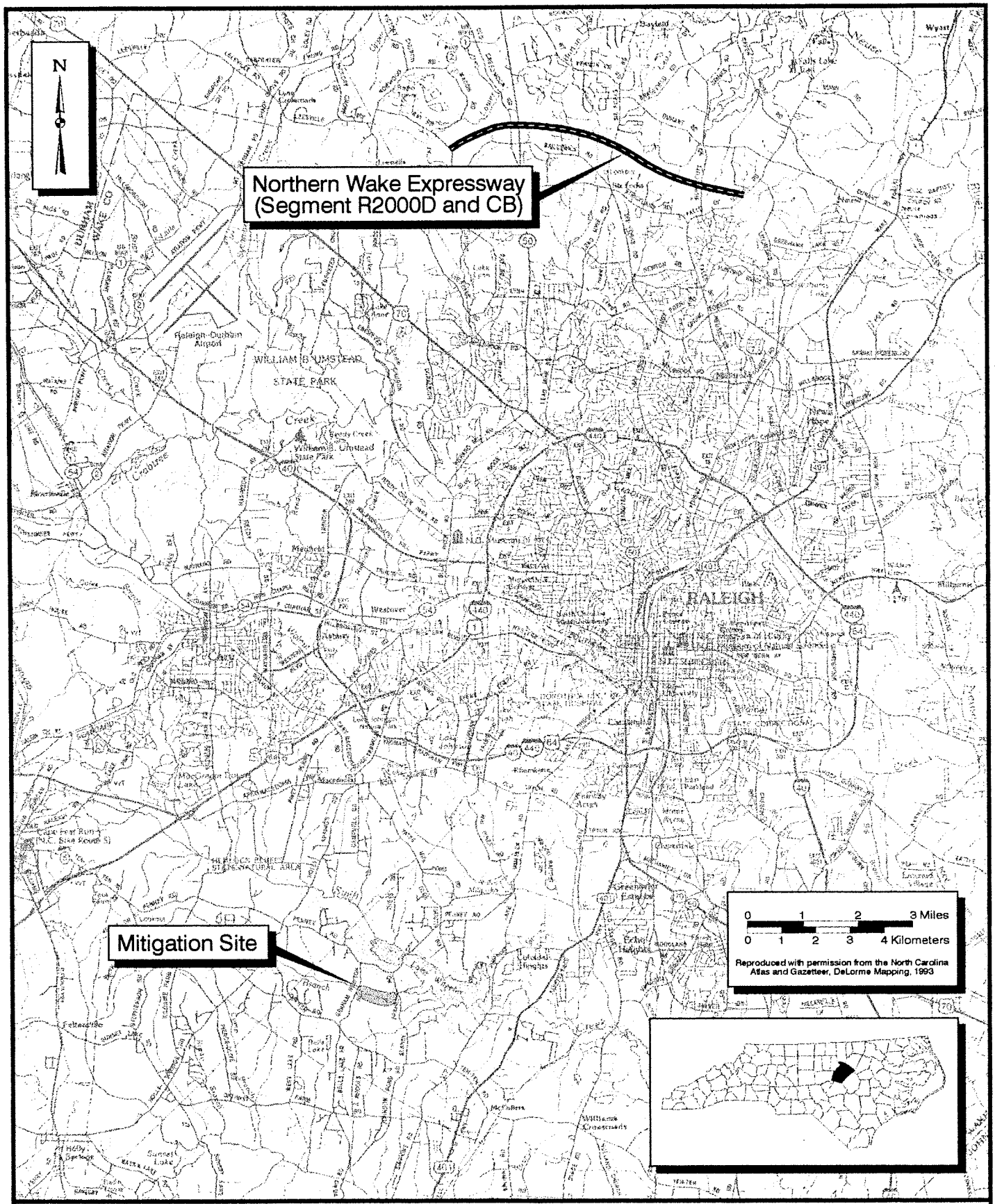
[1] Note: The impact acreage listed above are based on a review of permit applications submitted to the regulatory agencies. Based on this review, previous reports have incorrectly identified impacts as 10.2 ac of wetlands/surface waters and 3.0 ac of open waters.



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Site Location
Dutchman's Creek Mitigation Site
Wake County, North Carolina

Figure:	1
Project:	ER98006.04
Date:	July 1999

ER98006.04/01locat.cdr

A revised mitigation proposal for hydrology and plant community restoration/creation, creation, and preservation including impoundment dam reconstruction was developed during the granted delay. The proposal was presented to wetland regulatory agencies, Wake Audubon Society and adjacent property owners on April 6, 1999. Based on responses received during the presentation, a plan has been developed which utilizes dam reconstruction, restoration/creation of a shrub/scrub-emergent marsh complex, creation of a bottomland forest, and preservation of a successional bottomland forest.

2.0 METHODS

Natural resource information for the Dutchman's Creek site was obtained from available sources. U. S. Geological Survey (USGS) topographic mapping and Natural Resource Conservation Service (NRCS) soil surveys (USDA 1970) were utilized to evaluate existing landscape and soil information prior to on-site inspection. Corrected aerial photography (1997) and aerial topographic maps were prepared by NCDOT, including topographic point and contour data (1-foot intervals), roads and utility corridors, property boundaries, surface flow diagrams, Lake Wheeler jurisdictional boundaries, and NRCS soil mapping boundaries. Subsequently, ground elevation surveys were performed along seven floodplain cross-sections and the data were imported into the digital database.

Files at the North Carolina Natural Heritage Program (NCNHP) were evaluated for the presence of protected species and designated natural areas which may serve as reference (relatively undisturbed) wetlands for restoration design. Reference stream and floodplain systems were identified and measured in the field to quantify hydrodynamics. In addition, characteristic and historic natural community patterns in reference wetlands were sampled and classified according to constructs outlined in Schafale and Weakley's Classification of the Natural Communities of North Carolina (1990).

Historical aerial photographs (1954 [pre-Lake Wheeler], 1965, 1968, 1997) were obtained from available sources and utilized to identify land use patterns at the site and in the watershed. Disturbances to wetlands, such as dredging and conversion to pasture, were documented and utilized to orient restoration design. Current (1997) aerial photography (Figure 2) was evaluated to determine primary hydrologic features affecting the site and to map relevant environmental features. Soil, plant community, wetland, and surface flow units identified on the aerial photograph were verified in the field, digitized, and overlaid in the geographic information system (GIS) database.

Project scientists evaluated soil, vegetation, and hydric soil parameters at the site in order to delineate jurisdictional wetlands. Wetland boundaries were subsequently flagged and mapped using laser survey technology. Existing plant communities, surface water flow patterns, and soil patterns were also evaluated, mapped, and described by structure and composition.

Eight groundwater piezometers were installed at systematic locations within the floodplain to track groundwater fluctuations relative to rainfall events under existing conditions.

Expedited dam breach containment and dam reconstruction plans were developed according to State Dam Safety Regulations (N.C. Administrative Code: NCAC 15A,2K) and through production of conceptual engineering design plans. Dam reconstruction (lowering) design plans were oriented to prevent further wetland destruction and to restore/create areas.

N

Mitigation Site Boundary
Mitigation Area Boundary

0 200 400 Feet
0 50 100 Meters

Aerial Photograph
Dutchman's Creek Mitigation Site
Wake County, North Carolina

Figure:	2
Project:	ER98006.04
Date:	July 1999

ER98006.04/02aerial.cdr

Information collected at the site, reference ecosystem analyses, and drainage models were compiled in the GIS database and incorporated with field observations to evaluate mitigation wetlands under existing and post-restoration conditions. Subsequently, a wetland mitigation plan was developed for the Dutchman's Creek site to provide adequate compensation for unavoidable wetland impacts associated with the Northern Wake Expressway segments R-2000D and R-2000CB.

3.0 EXISTING CONDITIONS

3.1 PHYSIOGRAPHY AND LAND USE HISTORY

The Dutchman's Creek mitigation site encompasses approximately 87 ac containing riverine-influenced wetlands, feeder tributaries, and upland slopes surrounding the Dutchman's Creek stream system (Stream Index: 27-43-4.5 [DEM 1993]). The site is located between SR 1386 (Graham Newton Road) and SR 1377 (Blaney Franks Road) immediately above the confluence with Lake Wheeler, a regional water supply lake (Figure 1). Figure 2 depicts the mitigation site on current (1997) aerial photography.

The site is located within the Raleigh Belt geologic region of the Piedmont physiographic province. Physiography is characterized by moderately hilly terrain with interstream divides exhibiting dendritic, gently to moderately sloping drainage patterns (Myers *et al.* 1986). Elevations within the mitigation site range from approximately 307 ft above mean sea level (MSL) along upper reaches of the stream to approximately 282 ft above MSL at the downstream terminus (Figure 3).

The landscape in the vicinity of the mitigation site is considered susceptible to heavy erosion when disturbed due to the diverse geomorphology (Coastal marine and Piedmont alluvial), frequent dissection, and topographic characteristics of the region. The project region represents an area which supported extensive agricultural lands until the last decade. However, due to population growth in the Raleigh area, lands in the Dutchman's Creek watershed are rapidly being converted for residential and commercial use. Development in the drainage basin, accelerated overland runoff, and susceptibility due to past disturbances, threaten to induce further degradation in Dutchman's Creek bottomlands through non-point source and point-source water pollution.

Land use appears to include historic conversion of the floodplain for agricultural use, construction of an impoundment at the downstream end of the site, and proposed residential development in uplands immediately adjacent to the bottomland. Historically, the site was affected by agricultural land uses in the region. The primary channel and feeder tributaries appear to have sustained dredging and straightening in antecedent history. During this period, flood waters were reduced or eliminated, forest vegetation was cleared, and pasture fences were erected along the primary stream bank and adjacent areas of the floodplain. Use of the wetland floodplain as grassed pasture has ceased in the last decade and stream channels are undergoing a period of transition. During periods of dredging and pasture uses, the stream channel bed was most likely degrading (down-cutting). However, construction of a downstream impoundment and periodic beaver influence in the last several decades appears to have reduced stream flow velocities, promoted sediment deposition, and induced stream bed aggradation. As a result of impoundment, the floodplain's lower reach has been effectively converted into an in-stream sediment detention basin not capable of supporting bottomland forest structure.

Mitigation Site Boundary
Mitigation Area Boundary
296 Elevation above Mean Sea Level(Ft)
Lake Impoundment
Stream channels
Direction of flow
Beaver Dams

N

DUTCHMANS CREEK

RESIDENTIAL DEVELOPMENT

RESIDENTIAL DEVELOPMENT

IMPOUNDMENT BREACH

LAKE WHEELER

307

302

296

294

292

289

282

OPEN WATER

IMPOUNDMENT STRUCTURE

OUTFALL PIPE

RESIDENTIAL DEVELOPMENT

RESIDENTIAL DEVELOPMENT

ER98006.04/topog.dwg

Drawn By: PJS	Figure: 3	
Checked By: RGH	Project: ER98006.04	
Scale: 1" = 300'	Date: July 1999	

TOPOGRAPHY AND STREAM PLAN VIEW
DUTCHMAN'S CREEK MITIGATION SITE
WAKE COUNTY, NORTH CAROLINA

Eastern portions of the site are influenced by a constructed impoundment which serves to detain surface waters and maintain open water habitat in the wetland complex. The dike structure associated with this impoundment was breached, possibly by Hurricane Fran in September 1996. A temporary repair of the breach was completed in April 1998.

The site is interposed between adjacent uplands which have been subdivided into approximately 60 lots for proposed residential development. Access roads, boundary surveys, and utility lines to each lot have been constructed into the area. Seven feeder stream tributaries flow through these residential lots and extend into the Dutchman's Creek site. Stream bank erosion and the lack of characteristic stream-side vegetation (shrubs and herbs) is evident along these tributaries and along exposed segments of the Dutchman's Creek primary channel. This drainage flows into relatively stagnant open waters which do not provide pollutant recycling capacity characteristic of vegetated wetlands (Jurik *et al.* 1994, Wang *et al. 1994*).

3.2 HYDROLOGY

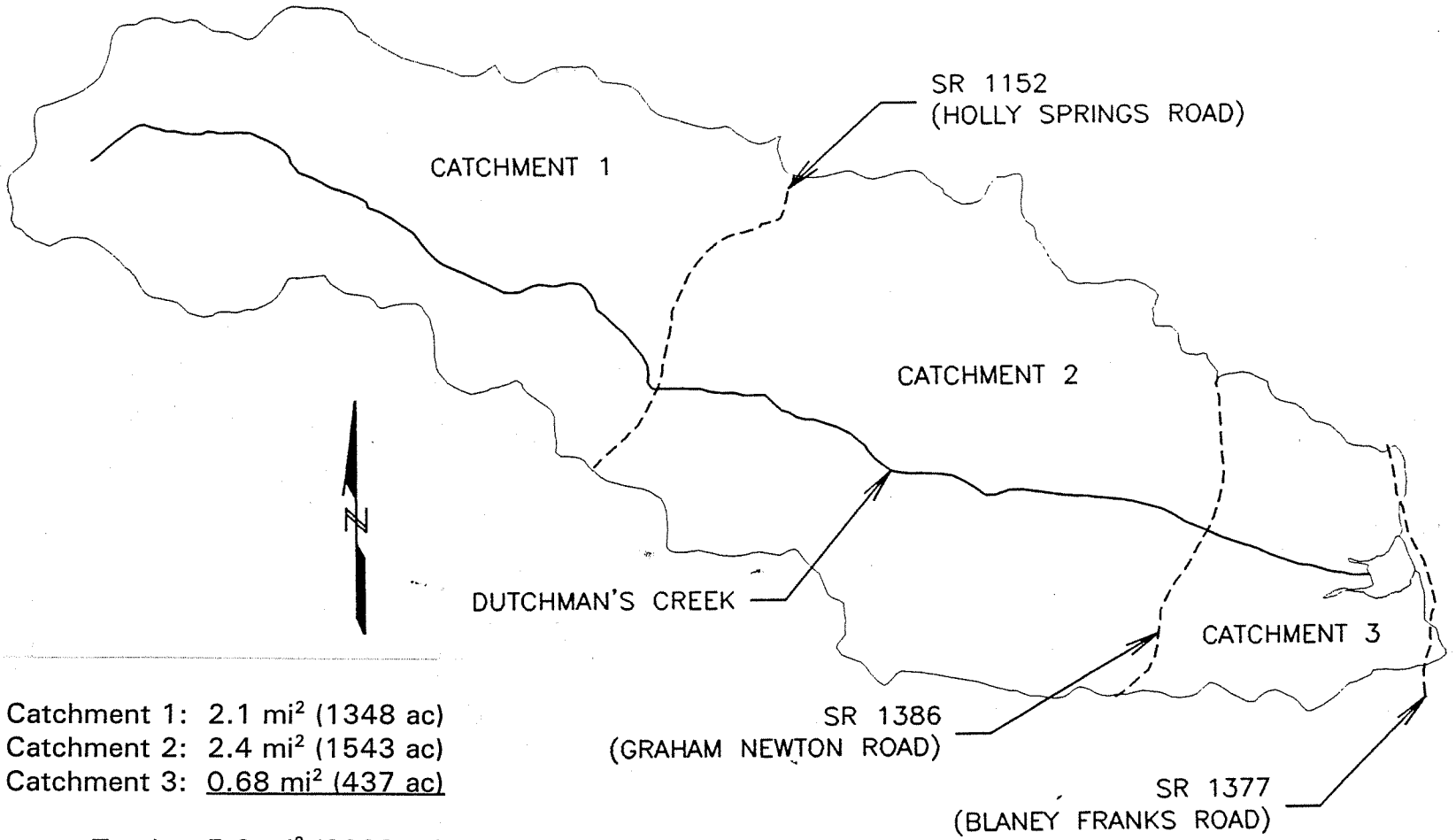
The Dutchman's Creek site represents approximately 3500 ft of third order stream channel which receives surface drainage from 2900 ft of first order tributaries extending into the system (Strahler 1952). The stream corridor services a watershed measuring approximately 5.4 square mi (3500 ac) in land area (USGS Quadrangles) (Figure 4). The Dutchman's Creek watershed has been subdivided into three catchment areas for hydrology modeling purposes.

Wetland hydrology within Piedmont bottomlands is typically driven by periodic overbank flooding in the stream channels and groundwater flow from adjacent uplands; however, past dredging activities and impoundment of water due to dams (man-made and beaver-made) have significantly altered characteristic wetland hydrodynamics within the mitigation site.

3.2.1 Impoundment Hydrology

Stream and groundwater discharging into the site currently flows into an approximately 12.8 ac open water impoundment along the eastern site periphery. The existing Dutchman's Creek dam is an earthen structure approximately 14 ft in height. The dam crest is 600 ft in length and 10 ft in width at elevation 299 ft above MSL. Seepage is evident along the toe of the dam near the existing primary spillway. The impoundment was historically drained by an outfall pipe installed at approximately 293 ft above MSL in proximity to the historic downstream channel. The normal pool elevation (293 ft) measures approximately 11 ft above the channel bed immediately below the dam structure (282 ft).

Above the dam, flow velocities are reduced or eliminated, thereby promoting stagnant open waters and sediment aggradation in the pond and in the up-stream segment. Conversely, increased flow velocities and reduced sediment transport loads immediately below the outfall pipe have induced stream bed degradation (lowering) immediately below the dam.



Catchment 1: 2.1 mi^2 (1348 ac)
Catchment 2: 2.4 mi^2 (1543 ac)
Catchment 3: 0.68 mi^2 (437 ac)

Total 5.2 mi^2 (3328 ac)

0 3000 6000
SCALE, FEET

Environmental Services, Inc. Raleigh, North Carolina	Dutchman's Creek Wake Co., North Carolina	WATERSHED MAP
EDDY ENGINEERING, P.C. P.O. BOX 61367 RALEIGH, NC 27661 (919) 518-1662 FAX (919) 518-1673	Project No. 97025	June 1997 Figure 4

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A series of beaver dams occur along the stream reach above the man-made impoundment. The largest of these dams is situated immediately above the impoundment, ranges to 5 ft in elevation, and spans the width of the primary floodplain. These secondary impoundments have further inhibited stream flow and induced semi-permanent inundation of the floodplain throughout a majority of the site.

The man-made dam was breached in 1996 along the structure's northern abutment, lowering the normal pool elevation by approximately 3 ft. As a result, the drainage canal below the impoundment breach (284 ft above MSL) received high-velocity waters which down-cut the canal to elevations which extend below the adjacent pond bed and up-stream channel (293 ft above MSL). A head-cut formed at the mouth of this breach which migrated upstream through the pond and towards the wetland area. In April 1998 a temporary repair of the breach was completed.

3.2.2 Groundwater Hydrology

Groundwater elevation data collected in May 1997 are presented in Table 1. Groundwater was encountered in the borings as part of a shallow, unconfined surficial aquifer from above the ground surface to a depth of 35 in below the surface. Surface water expression is evident within the floodplain in proximity to the large beaver dam and impoundment structure. As expected, water tables elevations decrease along drainage gradients extending from the lower floodplain towards the upstream boundary of the mitigation site. The stream channel in proximity to SR 1386 (Graham Newton Road) has been entrenched under the roadway which may serve to lower water tables along the upstream periphery of the site.

3.3 SOILS

On-site verification and ground-truthing of Natural Resource Conservation Service (NRCS) map units was conducted in May 1997. Soil boundaries were refined; subsequently, compacted areas and sediment deposition areas were mapped and evaluated. Seventeen transects were established across the study area and sampled at approximately 100-ft intervals. Soils were sampled for color, texture, and depth. Representative samples were analyzed for nutrients, pH, cation exchange capacity (CEC), and base saturation. During field investigations, no evidence of relict primary stream channels was found. Extensive sediment deposition and site conversion to pasture may have obliterated any relict main-stem channel features.

The primary soil-landform association on the mitigation site consists of the Wehadkee-Bibb-Chewacla complex associated with the primary and secondary floodplain terraces, stream levees, and feeder tributaries of Dutchman's Creek. Figure 5 depicts hydric and non-hydric soil map units within the site. Mapped soils present include the Bibb (*Typic Fluvaquents*), Wehadkee (*Typic Fluvaquents*), Chewacla (*Fluventic Dystrochrepts*), Appling (*Typic Kanhapludults*), and Cecil (*Typic Kanhapludults*) series (USDA 1970). Unconsolidated Sediments were also mapped beneath open water areas on the site.

TABLE 1

Groundwater Measurements and Water Table Elevations
Dutchman's Creek Mitigation Site

				5/21/97		5/24/97		5/27/97		5/30/97	
Piezometer	Northing	Easting	GS Elev.	GW Elev.	Depth BGS	GW Elev.	Depth BGS	GW Elev.	Depth BGS	GW Elev.	Depth BGS
PZ-1	706796.9966	2079143.0924	301.8	301.7	0.1	301.7	0.1	301.8	0.0	301.8	0.0
PZ-2	706731.4483	2079901.2774	299.3	297.3	2.0	297.1	2.2	299.3	0.0	298.6	0.7
PZ-3	706436.7167	2079828.7545	298.5	298.5	0.0	298.5	0.0	298.5	0.0	298.5	0.0
PZ-4	706523.5330	2080259.0500	297.0	296.2	0.8	296.0	1.0	296.9	0.1	296.7	0.3
PZ-5	706299.8355	2080210.3398	297.8	297.8	0.0	297.8	0.0	297.8	0.0	297.8	0.0
PZ-6	706756.6705	2078260.5122	306.4	303.3	3.1	303.0	3.4	304.8	1.6	304.0	2.4
PZ-7	706402.8582	2079071.8499	302.3	301.6	0.7	301.3	1.0	301.7	0.6	301.2	1.1
PZ-8	706237.9966	2079100.1681	306.7	NM	NM	NM	NM	304.4	2.3	304.3	2.4

BGS = below ground surface
GS Elev. = ground surface elevation in feet (ft) above mean sea level (amsl)
GW Elev = groundwater elevation in ft amsl
Depth BGS = depth of groundwater below surface in ft
NM = not measured
Note: zero (0) value = groundwater at surface or ponded on surface

Mitigation Site Boundary

Mitigation Area Boundary

Symbol	Soil Series	USDA Taxonomy
HYDRIC SOILS		
Ws	Wehadkee Sediment Complex	Typic Fluvaquents
Wb	Wehadkee and Bibb	Typic Fluvaquents
U	Unconsolidated Sediments	
SOILS WITH HYDRIC INCLUSIONS		
Ch	Chewacla	Fluvaquentic Dystrochrepts
NON-HYDRIC SOILS		
Ap	Appling	Typic Kanhapludults
Ce	Cecil	Typic Kanhapludults

N

Ap

Ap

Ap

Ap

Wn

Cm

Ch

Wb

Ce

Ws

U

Ce

Ce

Ce

Ce

Drawn By: PJS | Figure: 5

Checked By: RGH | Project: ER98006.04

Scale: 1" = 300' | Date: July 1999

ON-SITE SOIL SURVEY
DUTCHMAN'S CREEK MITIGATION SITE
WAKE COUNTY, NORTH CAROLINA

ER98006.04/Soilsur.dwg

Hydric soils are defined as "soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper soil layer" (USDA 1987). Hydric soils include the Bibb series, Wehadkee series, and Unconsolidated Sediments. These soils are poorly to very poorly drained and range in texture from sandy loam to unconsolidated silt with slow to moderately rapid permeability.

In upper reaches of the site, hydric soil types appear to mimic the modal concept for the designated soil series. However, hydric soils in proximity to the impoundment structure appear to exhibit finer particle size distributions (primarily silt) and greater accumulation of organic matter in upper soil layers. The downstream impoundment has increased sediment deposits on floodplain surfaces. Beaver activity has further impacted soil characteristics through damming activity. Extensive sediment deposition has altered the wetland landscape and encompasses approximately 27 ac of the hydric soil map units in the vicinity of the existing impoundments (Wehadkee-Sediment Complex and Unconsolidated Sediments).

Sediment deposition in these areas has been found in excess of 4 ft, resulting in buried soil profiles, increased levels of surface silts, and loss of microtopographic relief across the floodplain landscape.

Anaerobic conditions in permanently saturated or inundated soils are increased from historic conditions, leading to a decrease in decomposition rates and a subsequent increase in soil organic matter. Areas near the beaver dams were noted to have layers of organic material or loamy layers mixed with recognizable organics to depths of 30 inches.

Non-hydric soils mapping units which may contain hydric inclusions consist of the Chewacla series. Chewacla soils typically support soil saturation for brief periods, often extending for durations between 5% and 12.5% of the growing season. Portions of the Chewacla map unit appear to have sustained compaction by past conversion to pasture and subsequent grazing by cattle. Surface microtopography and woody debris accumulation are notably absent in the area and the soil supports firm, near-surface layers which may limit rooting depth for some plant species. The effective rooting depth in compacted areas is most likely less than 12 inches.

Upland areas in the mitigation site support well drained, non-hydric soils. Upland systems include relatively steep toe slopes along the southern site boundary supporting the Appling and Cecil series. These map units exhibit evidence of long term erosion as surface (A) and portions of subsurface (B) horizons are absent in some areas. However, forested communities appear to have stabilized upland soil map units.

3.4 VEGETATION

Distribution and composition of plant communities reflect landscape-level variations in topography, soils, hydrology, and past or present land use practices. Communities identified on the site include open water, shrub/emergent assemblage, shrub/scrub assemblage,

bottomland hardwood forest, dry mesic oak hickory forest, and dry mesic pine forest (Figure 6).

Shrub/emergent and shrub/scrub assemblages represent approximately 62 ac of pasture land that has been abandoned in the last decade. These communities represent early successional stages, with species composition influenced primarily by the extent of inundation present. Shrub/emergent assemblages are dominated by flood tolerant herbaceous cover including rushes (*Juncus* spp.), smartweed (*Polygonum sagittatum*), wool-grass (*Scirpus cyperinus)*, climbing hempweed (*Mikania scandens*), jewelweed (*Impatiens capensis*), false nettle (*Boehmeria cylindrica*), cattail (*Typha* sp.), and Japanese grass (*Microstegium vimineum*). Intermittent shrub and sapling elements are also present on hummocks and include groundsel tree (*Baccharis halimifolia*), black willow (*Salix nigra*), river birch (*Betula nigra*), tag alder (*Alnus serrulata*), and persimmon (*Diospyros virginiana*). In upper reaches of the site, disturbance adapted tree saplings begin to dominate including red maple (*Acer rubrum*), river birch, sweet gum (*Liquidambar styraciflua*), and loblolly pine (*Pinus taeda*) along with understory growth of switch cane (*Arundinaria gigantea*) and blackberry (*Rubus* sp.).

Remnant bottomland hardwood forest cover persists within approximately 3 ac along the outer edge and downstream of the open water impoundment. Hardwood tree species present in these fringe areas include red maple, sweet gum, river birch, green ash (*Fraxinus pennsylvanica*), American sycamore (*Platanus occidentalis*), pecan (*Carya illinoensis*), yellow poplar (*Liriodendron tulipifera*), and black willow.

Upland, dry mesic oak hickory forest and dry mesic pine forest occupy approximately 10 ac along slopes adjacent to the Dutchman's Creek floodplain. These communities support closed forest canopies comprised of tree species including mockernut hickory (*Carya tomentosa*), water oak (*Quercus nigra*), white oak (*Quercus alba*), willow oak (*Quercus phellos*), American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), and loblolly pine. Midstory and understory development is apparent and includes flowering dogwood (*Cornus florida*), horse sugar (*Symplocos tinctoria*), sourwood (*Oxydendrum arboreum*), sassafras (*Sassifras albidum*), and American holly (*Ilex opaca*).

Open water covers approximately 12.8 ac immediately above the impoundment structure. Submerged aquatic vegetation is limited in the area with emergent vegetation such as rushes and smartweed present in shallower portions of the pond.

Bottomland forest vegetation at the site was cleared and pasture grasses were maintained in a large portion of the floodplain for more than 20 years. Pasture usage ended in the last decade and disturbance adapted successional species are colonizing the site. As a result of clearing and conversion for a relatively long period of time, characteristic bottomland forest species do not appear to maintain sufficient seed sources necessary for community re-establishment.

Mitigation Site Boundary

Mitigation Area Boundary

	Area (Acres)
OPEN WATER	9
SCRUB/SHRUB ASSEMBLAGE	17
DRY MESIC OAK HICKORY FOREST	8
SHRUB/EMERGENT ASSEMBLAGE	44
BOTTOMLAND HARDWOOD FOREST	3
DRY PINE FOREST	2

N

OPEN WATER

Drawn By: PJS | Figure: 6

Checked By: RGH | Project: ER98006.04

Scale: 1" = 300' | Date: July 1999

EXISTING PLANT COMMUNITIES
DUTCHMAN'S CREEK MITIGATION SITE
WAKE COUNTY, NORTH CAROLINA

ER98006.04/plntcomm.dwg

In addition to the initial vegetation surveys by ESI, NCDOT biologists and Mr. Patrick D. McMillian have preformed aquatic and wetland plant surveys of the site. The results of Mr. McMillian are provided in Appendix A.

3.5 WILDLIFE

Existing wildlife at Dutchman's Creek consists primarily of animals adapted to open waters created by the man-made impoundment or animals adapted to transitional aquatic habitats created by beaver impoundments. The open water and unvegetated aquatic habitats at Dutchman's Creek are extensive within the adjacent Lake Wheeler and nearby Lake Benson. Therefore, wildlife guilds adapted to open water habitats are also expected to dominate the region surrounding Dutchman's Creek.

Expanses of open water above the impoundments are bordered by shallow vegetated zones which supports submergent and emergent plants. Remains of the pre-beaver forested areas are evident by the dead standing trees and new growth of water-tolerant species in these areas. Terrestrial fringes of the open water areas typically support a thicket of perennial herbs and vines. Uplands that surround the pond have been irregularly maintained by mowing or other practices that provide habitat that mimics early, old field succession. Forested wetland habitat is considered absent in the area.

NCDOT biologists surveyed the site in September 1998 for benthic Macroinvertebrates and fish. In addition, avian fauna data was supplied by the Wake County Chapter of the Audubon Society. Please refer to appendices B and C for detailed information.

3.6 JURISDICTIONAL WATERS/WETLANDS

Jurisdictional wetland areas were delineated relative to the criteria set forth in the USACE Wetlands Delineation Manual (DOA 1987). Jurisdictional wetlands and jurisdictional open waters were flagged in the field and mapped using laser survey technology. Jurisdictional wetlands and open waters, which occupy approximately 67 ac of the 87 ac mitigation area, are depicted in Figure 7. Jurisdictional wetlands occur throughout the Dutchman's Creek floodplain as water tables appear to be elevated above ground surface for prolonged periods during the growing season. Stream-side levees in uppermost reaches of the site are effectively drained by the adjacent channel and do not appear to support jurisdictional wetland hydrology.

Jurisdictional open waters (12.8 ac) occur above the impoundment dam and support standing water up to approximately 5 ft in depth. Prior to the temporary repair of the dam breach, jurisdictional wetlands and open waters within the pond and floodplain were threatened by the breach in the dike and the potential for extensive down-cutting in the upstream corridor.

Mitigation Site Boundary
Mitigation Area Boundary
Stream channels

	Area (Acres)
JURISDICTIONAL WETLANDS	57
UPLANDS	20
JURISDICTIONAL OPEN WATER	10
Total area	87

N

Drawn By: PJS | Figure: 7
Checked By: RGH | Project: ER98006.04
Scale: 1" = 300' | Date: July 1999

JURISDICTIONAL WETLANDS
DUTCHMAN'S CREEK MITIGATION SITE
WAKE COUNTY, NORTH CAROLINA

ER98006.04/juriswet.dwg

3.7 WATER QUALITY

Riverine wetlands in the Piedmont region serve as the penultimate receptor of runoff in the watershed. As a result, these systems serve important water quality functions. Streams and floodplains have evolved to filter nutrients, elements, and coarse sediments transported through the watershed from in-channel flow, riparian discharge, and overbank flood waters.

Important features within Piedmont bottomlands that assist in pollution filtration, uptake, and processing include stable forested communities, productive biological activity on wetland surfaces, and a stable (non-eroding) stream channel and floodplain (Adamus *et al.* 1991, Brinson *et al.* 1994, Rosgen 1996).

Dutchman's Creek represents a near linear, aggrading stream channel which contains an impoundment (pond) at the downstream terminus of the site. The site, under existing condition, retains particulates in excess of capacity to perform the function. The channel and impoundment are filling with sediment. Therefore, the ability of the adjacent wetlands to sustain long term riverine water quality functions is threatened. Wetland features often associated with water quality functions, including forest vegetation and soil microbial processes, are expected to be diminished. Water quality functions, such as nutrient cycling and removal of elements and compounds, may be lost or diminished as a result (Brinson *et al.* 1994).

Effective removal of the impoundment and creation of a shrub-scrub emergent marsh wetland complex will enhance water quality functions, such as chemical uptake and cycling (Guntenspergen *et al.* 1989).

Lake Wheeler, a regional water supply, is located immediately downstream of the mitigation site. Dutchman's Creek and Lake Wheeler are classified as **WS III NSW** by the N.C. Division of Water Quality (DWQ). This classification denotes waters protected as water supplies which are located in low to moderately developed watersheds. Local programs to control non-point source and stormwater discharge of pollution are required (DEM 1993). The **NSW** subclassification denotes nutrient sensitive waters which require limitations on nutrient inputs.

4.0 WETLAND RESTORATION STUDIES

The dam at the Dutchman's Creek Site will be reconstructed for two primary objectives: 1) to stop a dam breach and head-cut which threatens upstream wetlands; and 2) to lower the pool elevation and restore wetlands behind the dam. The dam will be modified to mimic natural floodway functions across the Dutchman's Creek floodplain, while serving to retain accumulated sediments from over 50 years of sediment detention. As a result, riverine (riparian) wetland restoration will be achieved within the existing open water impoundment.

Dam reconstruction design entailed: 1) delineation of the watershed for the dam; 2) evaluation of the runoff/infiltration potential of soils within the watershed; 3) estimation of future land use within the watershed; 4) hydrologic analyses to develop design hydrographs based on rainfall depth-duration-frequency data and ratios of the Probable Maximum Precipitation (PMP); 5) evaluation of the reservoir stage-storage relationship; 6) use of the U.S. Army Corps of Engineers computer program HEC-1 to develop a computer model of the watershed and reservoir for subsequent spillway routings of design floods; 7) evaluation of possible spillway systems for stage-discharge capacity; and 8) recommendations for spillway design. Structural design of the dam will be performed during construction engineering phases of this mitigation project.

Dam Regulatory Classification and Requirements

The existing dam is subject to the design and construction requirements of Title 15A, Subchapter 2K, of the North Carolina Administrative Code (NCAC 15A, 2K), and the Dam Safety Law of 1967, as amended. Under NCAC 15A, 2K, dams are classified according to height, storage capacity, and damage potential in the event of dam failure.

Dutchman's Creek Dam, as it exists today, should be classified as a Class C (high-hazard) dam due to the presence of SR 1377 (Blaney Franks Rd.) immediately downstream of the dam site. Failure of the dam in its existing state may cause serious damage to the road and possible loss of life. The presumptive spillway design storm (SDS) under NCAC 15A, 2K for a small-size, high-hazard structure is one-third of the Probable Maximum Precipitation (PMP).

Modifications proposed to the dam for wetland restoration use would lower the hazard classification to Class A (low-hazard), which would place Dutchman's Creek Dam in the exempt category of the Dam Safety Law of 1967 (as amended). After mitigation, there is little risk to SR 1377 due to dam failure. Therefore, the 100-year rainfall event is an appropriate basis for design of a structure of this size and type. Final dam reconstruction design may be dependent upon approval of a low hazard classification by the North Carolina Department of Environmental Natural Resources, Land Quality Section, Office of Dam Safety.

5.0 WETLAND MITIGATION PLAN

The Dutchman's Creek mitigation plan will include shrub-scrub wetland restoration, bottomland hardwood creation, marsh (littoral zone) and open water creation, and floodplain wetland preservation components. Restoration and creation of sustainable wetland functions will be achieved by reducing the height of the impoundment dam. Subsequently, soil modifications and wetland re-vegetation will be implemented on restored and created wetland surfaces. Approximately 7.7 ac of shrub-scrub will be restored with a 0.7 ac littoral zone and 4.4 ac of open waters created behind the existing dam. In addition, bottomland hardwood creation will be accomplished on 1.6 ac of mesic upland which will be recontoured to the adjacent floodplain wetland elevation, scarified, and reforested with characteristic bottomland forest vegetation. Additional function lift will be gained through the preservation of 52.6 ac of piedmont floodplain wetland communities within the remaining portion of the Dutchman's Creek site.

5.1 WETLAND HYDROLOGY RESTORATION

Dutchman's Creek floodplain has been influenced by numerous anthropogenic activities within the recent past. These activities have reduced or eliminated hydrological and biochemical functions of the floodplain. Restoration of these floodplain functions will be accomplished through dam reconstruction. Section 4.1 discusses dam reconstruction. Dam reconstruction components for wetland functional benefit include: 1) arresting the dam breach and head-cut in an expedited time frame; and 2) reconstructing the dam to mimic a floodplain spillway.

The impoundment dam will be lowered to an elevation of 292.5 MSL and the adjoining spillway elevation will be set at 289 MSL. The elevations of the dam and spillway will provide a stable wetland surface profile at the outfall location. The hardened spillway will be constructed and sloped over the impoundment dam extending to the stream channel below. Lowering of the impoundment dam to restored and created wetland surface will allow for a wetland hydroperiod.

The impoundment or open water area behind the dam will be drained, recontoured, and graded to establish several small pools, terraces, open water channels, and wetland surface. The installation of these landscape features will restore typical topography relief found in piedmont bottomland communities and provide suitable structural support for community diversity support. In addition, water quality will improve due to increase resident time and plant inter-action which will allow for increase plant uptake of minerals (Gunttenspengen *et al.* 1989).

5.2 WETLAND COMMUNITY RESTORATION AND CREATION

Re-vegetation of wetland shrub-scrub communities and created bottomland hardwood forested communities will provide habitat for area wildlife and allows development and expansion of characteristic wetland dependent species across the landscape. Wetland community restoration and creation will contribute to area diversity and provide secondary benefits, such

as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. Physical water quality functions enhanced through community restoration and creation include nutrient cycling, retention of particulates, removal of elements and compounds, and organic carbon transfer (Brinson *et al.* 1994).

Dam and impoundment modifications will restore wetland hydroperiods characteristic of floodplain wetlands in the Piedmont physiographic province. Target plant communities are alluvial shrub-scrub on restored wetland surfaces behind the existing dam and piedmont bottomland hardwood forest assemblages on created wetland surfaces adjacent to the southern portion the floodplain. Figures 8 and 9 depict the distribution and location of shrub-scrub and bottomland hardwood communities to be restored at Dutchman's Creek. No plantings are scheduled for the littoral zone due to the high probability of natural recruitment occurring within this zone.

Piedmont bottomland hardwood forests elements will be planted within created areas influenced by back waters. The shrubs include species with high value for sediment stabilization, rapid growth rate, and the ability to withstand hydraulic forces associated with flood events. A total of 680 trees/acre of diagnostic tree and shrub seedlings will be planted in designated areas of the floodplain to promote development of these target floodplain communities (Table 2).

Planting Plan

The planting plan consists of: 1) acquisition of available wetland species; 2) implementation of surface topography improvements; and 3) planting of selected species on-site. The species selected for planting will be dependent upon the availability of local seedling sources at the time of planting. Proposed species for planting within each specified community include the following:

Piedmont Bottomland Hardwood Forest

1) Cherrybark Oak (*Quercus pagoda*)
2) Southern Red Oak (*Quercus falcata*)
3) Green Ash (*Fraxinus pennsylvanica*)
4) Bitternut Hickory (*Carya cordiformis*)
5) Willow Oak (*Quercus phellos*)
6) Black Gum (*Nyssa sylvatica*)

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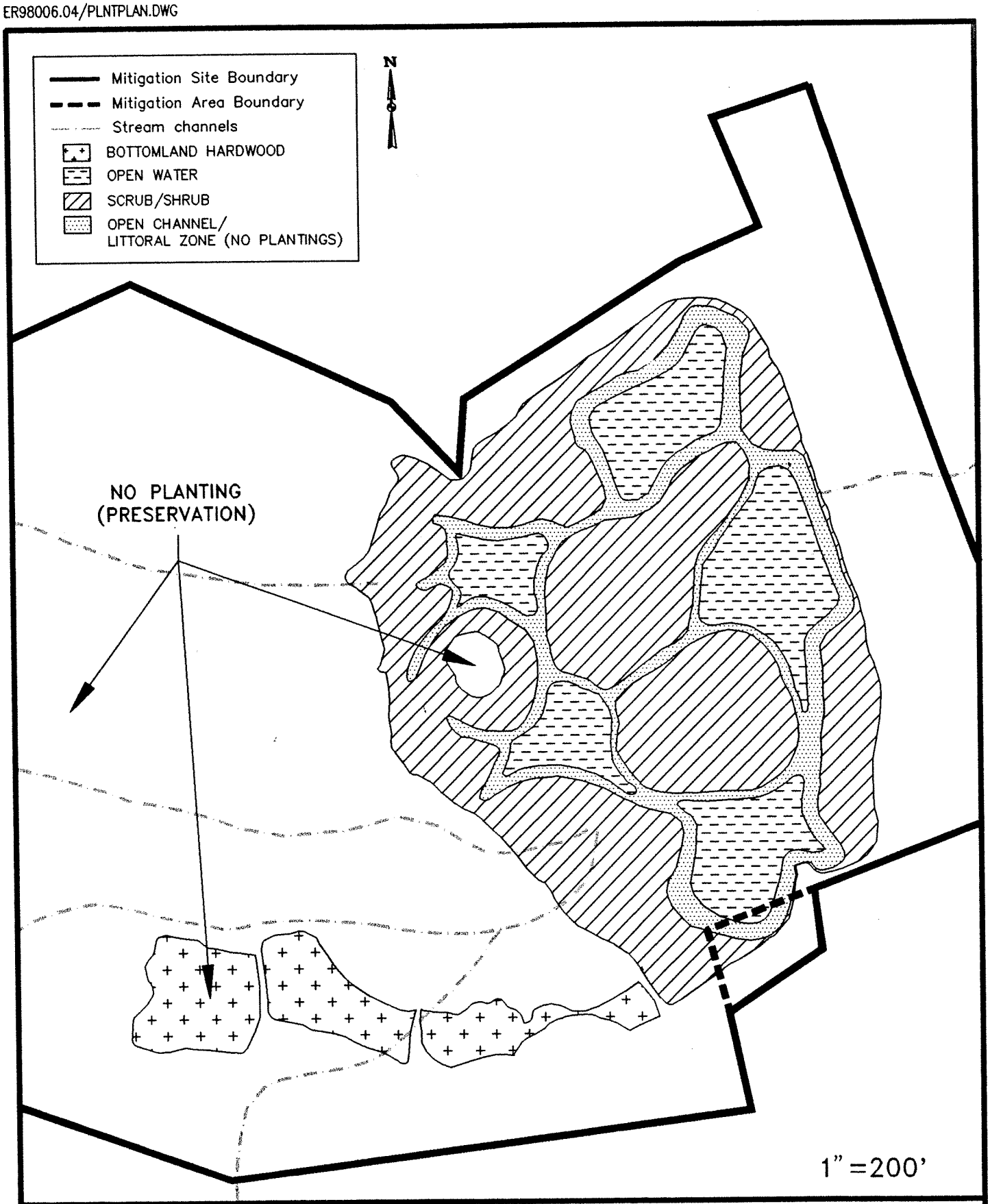

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PLANTING PLAN
DUTCHMAN'S CREEK MITIGATION SITE
WAKE COUNTY, NORTH CAROLINA

Figure: 8
Project: ER98006.04
Date: July 1999

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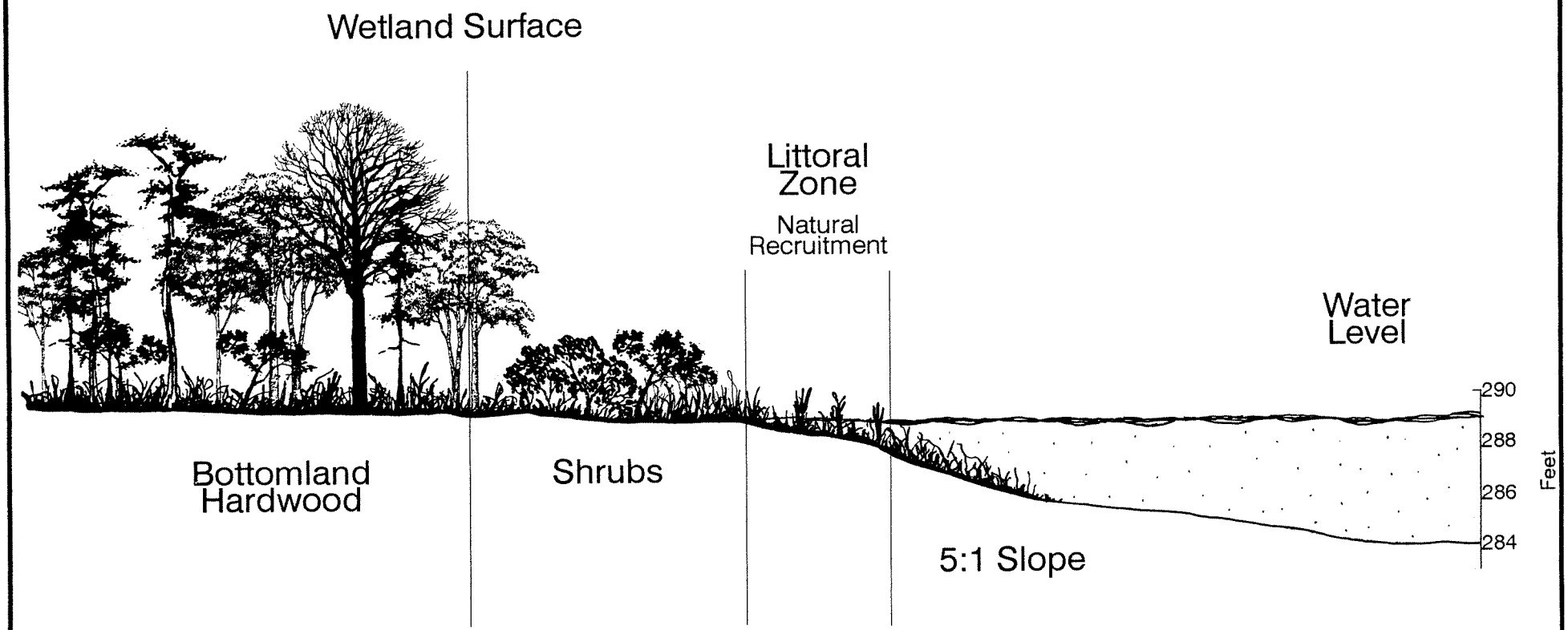

Catena
Dutchman's Creek Mitigation Site
Wake County, North Carolina

Figure:	9
Project:	ER98006.04
Date:	July 1999

TABLE 2
Planting Plan
Dutchman's Creek Mitigation Site

Vegetation Association (Planting Area)	Piedmont Bottomland Hardwood Forest	Alluvial Shrub-Scrub
Area (ac)	1.6	7.7
SPECIES	No. planted[1] (% total)[2]	No. planted (% total)
Cherrybark oak	182 (16.6)	
Southern red oak	182 (16.6)	
Green ash	182 (16.6)	
Bitternut hickory	182 (16.6)	
Willow oak	182 (16.6)	
Blackgum	182 (16.6)	
Silky dogwood		748 (14.3)
Swamp dogwood		748 (14.3)
Redosier dogwood		748 (14.3)
Tag alder		748 (14.3)
Streamco willow		748 (14.3)
Buttonbush		748 (14.3)
Sugarberry		748 (14.3)
TOTAL:	1092	5236

1:Planting densities are 680 trees/acre within each specified planting area.

2:Some non-commercial elements may not be locally available at the time of planting. The stem count for unavailable species should be distributed among other target elements based on the percent (%) distribution. One year of advance notice to forest nurseries will promote availability of some non-commercial elements. However, reproductive failure in the nursery may occur.

Alluvial Shrub-Scrub

1) Silky Dogwood (*Cornus amomum*)
2) Swamp Dogwood (*Cornus stricta*)
3) Redosier Dogwood (*Cornus stolonifera*)
4) Tag Alder (*Alnus serrulata*)
5) Streamco willow (*Salix purpurea*)
6) Buttonbush (*Cephalanthus occidentalis*)
7) Sugarberry (*Celtis laevigata*)

Bare root seedlings of tree and shrub species will be planted on 8-ft centers (680 trees/ac) within the specified map areas. Species at desired relative densities will be alternated within adjacent centers. Planting will be performed between December 1 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season. Removal or control of competing nuisance vegetation will be implemented as necessary to facilitate adequate survival of target wetland plants.

Re-vegetation of wetland shrub-scrub communities and characteristic bottomland hardwood forest will provide habitat for area wildlife and allows development and expansion of characteristic wetland dependent species across the landscape. Wetland community restoration/creation will contribute to area diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. Physical water quality functions enhanced through community restoration include nutrient cycling, retention of particulates, removal of elements and compounds, and organic carbon transfer (Brinson *et al.* 1994).

5.3 WETLAND SOIL RESTORATION

Land use practices have impacted soil characteristics on the mitigation site. Impacts include induced semi-permanent soil saturation/inundation, compaction from past conversion of the floodplain to grassed pasture, and excess sediment loading in lower reaches of the floodplain.

Soils in portions of the floodplain appear to have been compacted by past conversion to pasture and cattle activity. Relatively undisturbed wetlands of similar type to the mitigation area often exhibit complex surface microtopography. Small concavities, swales, exposed root systems, and hummocks associated with vegetative growth and hydrological patterns are usually common. Large woody debris and partially decomposed litter provide additional complexity across the wetland soil surface. Efforts to advance the development of characteristic surface roughness will be implemented on the mitigation site. Scarification of soil surfaces will be implemented in shrub and created bottomland portions of the site prior to planting with characteristic vegetation. Woody debris produced from clearing will be randomly distributed across the site.

5.4 LITTORAL ZONE - OPEN WATER CREATION

Creation of a palustrine emergent marsh and open water habitat is designed to add functional lift to the mitigation site. Establishment of a shallow sloping shelf will allow the development of an emergent community (0.7 ac) along wetland edges in conjunction with 4.4 ac of shallow water ($\leq$ 5.0 ft) habitat will provide ecotonal assemblages of shrub/marsh and marsh/open water not common within the region. In addition, water quality is expected to be improved through the development of this community (Hammer 1989).

5.5 BOTTOMLAND HARDWOOD CREATION

Bottomland hardwood creation will be accomplished on 1.6 ac of mesic upland which will be recontoured to the adjacent floodplain wetland elevation, scarified, and reforested with characteristic bottomland forest vegetation. Creation of this wetland community will provide habitat for area wildlife and enhance the development and expansion of wetland dependent species across the landscape. In addition, the creation of this community will contribute to area diversity and provide secondary benefits of cover and nesting opportunities for mammals birds, and amphibians.

5.6 WETLAND PRESERVATION

Preservation of 52.6 ac piedmont floodplain wetlands along the Dutchman's Creek channel constitutes a major component of the wetland mitigation effort at this site. Protection of remaining wetlands in conjunction with restoration and creation of adjacent systems are important water quality mechanisms. These wetland buffers also provide habitat protection for fish and aquatic organisms. The synergistic effect of restoration, creation, and preservation for area wetlands will result in increased functions for all systems on the Dutchman's Creek site.

6.0 MONITORING PLAN

Monitoring of wetland restoration and creation efforts will be performed until success criteria are fulfilled. Monitoring is proposed for two wetland components, vegetation and hydrology.

6.1 HYDROLOGY MONITORING AND SUCCESS CRITERIA

Hydrology in the restoration/creation areas will be monitored through the use of monitoring wells during each growing season for the first five years of the vegetative monitoring, or until performance criteria have been met, whichever occurs later (EPA 1990). Surficial monitoring wells will be designed and placed in accordance with specifications in U.S. Army Corps of Engineers', Installing Monitoring Wells/Piezometers in Wetlands (WRP Technical Note HY-IA-3.1, August 1993). Monitoring wells will be set to a depth 20 inches below the soil surface.

To meet the hydrology success criteria, the monitoring data must show that for each normal precipitation year within the monitoring period, the site has been inundated or saturated within the upper 12 inches of the soil for a minimum of 5% of the growing season.

If there are no normal precipitation years during the first five years of monitoring, to meet performance criteria the permittee will continue to monitor hydrology on the site until the site is shown to have been inundated or saturated as described above during a normal precipitation year.

A site may be found to meet the hydrology performance criteria on the basis of comparison of monitoring data taken from the site with monitoring data taken from an established reference site approved by the Corps. The Corps retains the discretion to find that the hydrology criteria are met if such monitoring data from the mitigation site and the reference site are substantially the same. This finding by the Corps may be made during years with or without normal rainfall.

6.2 VEGETATION MONITORING AND SUCCESS CRITERIA

Restoration monitoring procedures for vegetation are designed in accordance with EPA guidelines enumerated in Mitigation Site Type (MiST) documentation (EPA 1990) and COE Compensatory Hardwood Mitigation Guidelines (DOA 1993). A general discussion of the restoration monitoring program is provided.

After planting has been completed in winter or early spring, an initial evaluation will be performed to verify planting methods and to determine initial species composition and density. Supplemental planting and additional site modifications will be implemented, if necessary.

NCDOT will monitor the site vegetation between September and November of each year, and will document plant mortality and stress within the mitigation site. Square sample plots will be used, and will be placed randomly within the mitigation site. The permittee will continue monitoring the planting areas annually for a minimum period of five years, or until the performance criteria are met.

Performance criteria for vegetation will be based on quantitative vegetation sampling within 50 ft by 50 ft (0.05 ac) sample plots that are randomly placed within each restored or created ecosystem type. Sample plot distributions will be correlated with hydrological monitoring locations to provide point-related data on hydrological and vegetation parameters. Performance criteria for vegetation within the shrub-scrub areas and bottomland hardwood forest will be met if a minimum mean density of 320 characteristic species/acre are surviving after 3 years and a minimum mean density of 260 characteristic species/acre are surviving after 5 years from initial planting. Supplemental plantings will be performed as needed to achieve the vegetation success criteria.

NCDOT will submit yearly mitigation monitoring reports for each assessment period for five years following final site manipulation. These reports will include, at a minimum, sample plot, well and rainfall data; photographs; and problems/resolution: Yearly reports will be provided to both the Corps and the North Carolina Division of Water Quality.

7.0 DISPENSATION OF PROPERTY

NCDOT is in the process of soliciting conservation groups and natural resource agencies for final dispensation of properties. Municipal or County Parks and Recreation Departments represent a potential management group for the wetland complex. However, until an acceptable agreement can be reached with an appropriate recipient of the property, ownership of the mitigation site will remain with NCDOT. NCDOT will also remain responsible for meeting success criteria established in the mitigation plan. Deed restrictions will be included upon transfer to a recipient to insure that the property remains as conservation land in perpetuity. In addition, provisions for long-term maintenance of the floodplain spillway and bankfull notch will be established. In any event, NCDOT accepts responsibility at the present time for development, monitoring, and long term management of the site.

8.0 WETLAND MITIGATION CREDIT

Wetland efforts are designed to produce a shrub-scrub wetland complex, a forested floodplain with a closed or nearly closed hardwood canopy, and a littoral habitat in conjunction with open water habitat. Under these conditions, a shrub-scrub complex, multilayered forest, and open water system will provide diverse habitats and niches, producing a complexity of feeding and nesting habitats. Diverse wetland systems of this type are considered uncommon in the region surrounding Dutchman's Creek. The previous open expanses of water, exposed to high light and air temperatures, will be shaded with subsequent effects upon water temperatures. Aquatic insects, birds, mammals, and herptiles adapted to exposed open waters will be replaced by a diversity of wetland dependent and fringe species populations.

Wetland restoration and creation at the Dutchman's Creek site entails effective lowering of the impoundment dam, re-vegetation of shrub-scrub emergent complex, and reforestation of created bottomland. Approximately 8.4 ac of approximately 12.8 ac of open water pond will be restored to vegetated wetland status; the remaining 4.4 ac of open water will be recontoured and stabilized. In addition, contouring of uplands adjacent to the floodplain, soil ameliorations, and reforestation warrants wetland creation credit of 1.6 ac for a total of 10.0 ac of wetland restoration and creation. The preservation of 52.6 ac of piedmont floodplain wetlands will provide functional lift to the site by acting as a "ecosystem connector"; connecting the restoration and creation areas which will restore a ecosystem complex (Table 3) (Figure 10).

This mitigation plan is proposed to fulfill compensatory mitigation requirements, including a margin of safety, for wetland and open water impacts associated with the R-2000D and CB segments of the Northern Wake Expressway. Projected impacts associated with R-2000D and CB consist of 9.87 ac of wetlands, 3.8 ac of surface and open waters (ponds), and 3800 linear ft of stream channel.

Table 3
Mitigation Community Types in Acres

Mitigation Strategy	Bottomland Hardwood	Shrub-Scrub	Marsh Littoral Zone	Open Water
Restoration	0	7.7	0	0
Creation	1.6	0	0.7	4.4
Preservation	52.6	0	0	0

Mitigation Site Boundary	
Mitigation Area Boundary	
Stream channels	Area (acres)
WETLAND CREATION	1.6
WETLAND PRESERVATION	52.6
WETLAND RESTORATION	7.7
OPEN CHANNEL/LITTORAL ZONE CREATION	0.7
OPEN WATER CREATION	4.4

N

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Checked By: RGH	Project: ER98006.04	
Scale: 1" = 300'	Date: July 1999	

MITIGATION UNITS
DUTCHMAN'S CREEK MITIGATION SITE
WAKE COUNTY, NORTH CAROLINA

STATE OF NORTH CAROLINA * DEPARTMENT OF TRANSPORTATION

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APPENDIX A

AQUATIC AND WETLAND PLANT SURVEY

Report to
John Connors
North Carolina State Museum of Natural Science

Aquatic and Wetland Plant Survey
Dutchmans Branch, Wake Co., NC

Patrick D. McMillan

I. Scope of Project

Patrick D. McMillan was contacted and contracted to perform a survey of Dutchmans Branch impoundments to determine if submerged aquatic vegetation was present within what had been previously determined to be a jurisdictional body of water. Additionally areas of the pond and adjoining beaver impoundment were surveyed for emergent aquatic vegetation and floating vegetation within what had been determined to be jurisdictional water. The entire mitigation site was also surveyed for the presence of rare, endangered or otherwise sensitive and protected plant species which might be impacted by stream-restoration mitigation planning.

II. Project Location

The Dutchmans Branch Mitigation site is located in Wake Co., NC, southwest of Raleigh, just west of Blaney Franks Rd. and near the confluence of Dutchmans Branch and Lake Wheeler. The total project area is approximately 87 acres with approximately 10 acres of previously determined open water (fig. 1). The main body of open water consists of a very shallow and heavily silted in man-made impoundment, with water depths at time of survey between 0 and 4 feet. The majority of the pond is less than 2 feet in water depth.

III. Methods and Survey Details

The areas designated as open water were surveyed on 31 May 1998 for submerged and emergent vegetation via direct access by canoe. The entire surface area was visually surveyed and sampled for aquatic vegetation. Additionally, the open water beaver impoundments above the main pond were also surveyed. The occurrence of all species found within the open pond waters was noted. The general area occupied by each species was noted and the percentage cover of each species was also documented.

Following the survey of aquatic vegetation, a survey for sensitive species was performed in areas which would be most impacted by the stream-restoration mitigation.

IV. Results

The main body of open water was found to contain 2 species of submerged aquatics; *Hydrilla verticillata* and *Potomogeton diversifolius*. The dominant submerged aquatic over the entire open water area was found to be *Hydrilla verticillata*. *Hydrilla* occurred in all areas of the open water. *Potomogeton diversifolius* was found to only occur in the uppermost areas of the pond where swift flowing water from the deep beaver impoundments upstream drain into the pond itself. These areas have a firm bottom of clay. The areas which had been more heavily silted in were found to only support *Hydrilla*. The approximate areas occupied by the two species are detailed in fig. 2. The entire area of open water was found to contain one or the other species of submerged aquatic.

The percentage of total area covered by plant material itself was estimated to be between 25 to 30 percent (% cover, that is to say the percentage of the total ground area which appears to be covered by plant material when looking down at the surface area of the pond) with the vast majority of the cover

belonging to *Hydrilla*. The submerged aquatics were found to be rather evenly distributed across the open water areas and no significant area of the open water was devoid of submerged aquatics.

The beaver-constructed impoundments above the man-made pond were found to support a rich assemblage of submerged and floating/emergent species. *Hydrilla verticillata* and *Potomogeton diversifolius* were both found in the submerged vegetation category. However, *Potomogeton* was nearly as abundant as *Hydrilla* in these areas. The entire open water portions of these impoundments was found to support submerged aquatic species. Additionally the following species were found within large areas of open water: *Brasenia schreberi, Nelumbo lutea, Nymphaea odorata, Peltandra virginica* and *Polygonum* sps. The total percentage of the surface of the beaver ponds covered by submerged vegetation was over 75 percent

The entire wetland area was surveyed for sensitive species and no species which are held by federal or state law as being protected were located. Additionally, the bluff and slopes bordering the drainage were searched and no protected species were found within this area either. The possibility of sensitive species actually occurring on the upland areas is greater than within the wetland areas, as this area was not surveyed as exhaustively as the wetland.

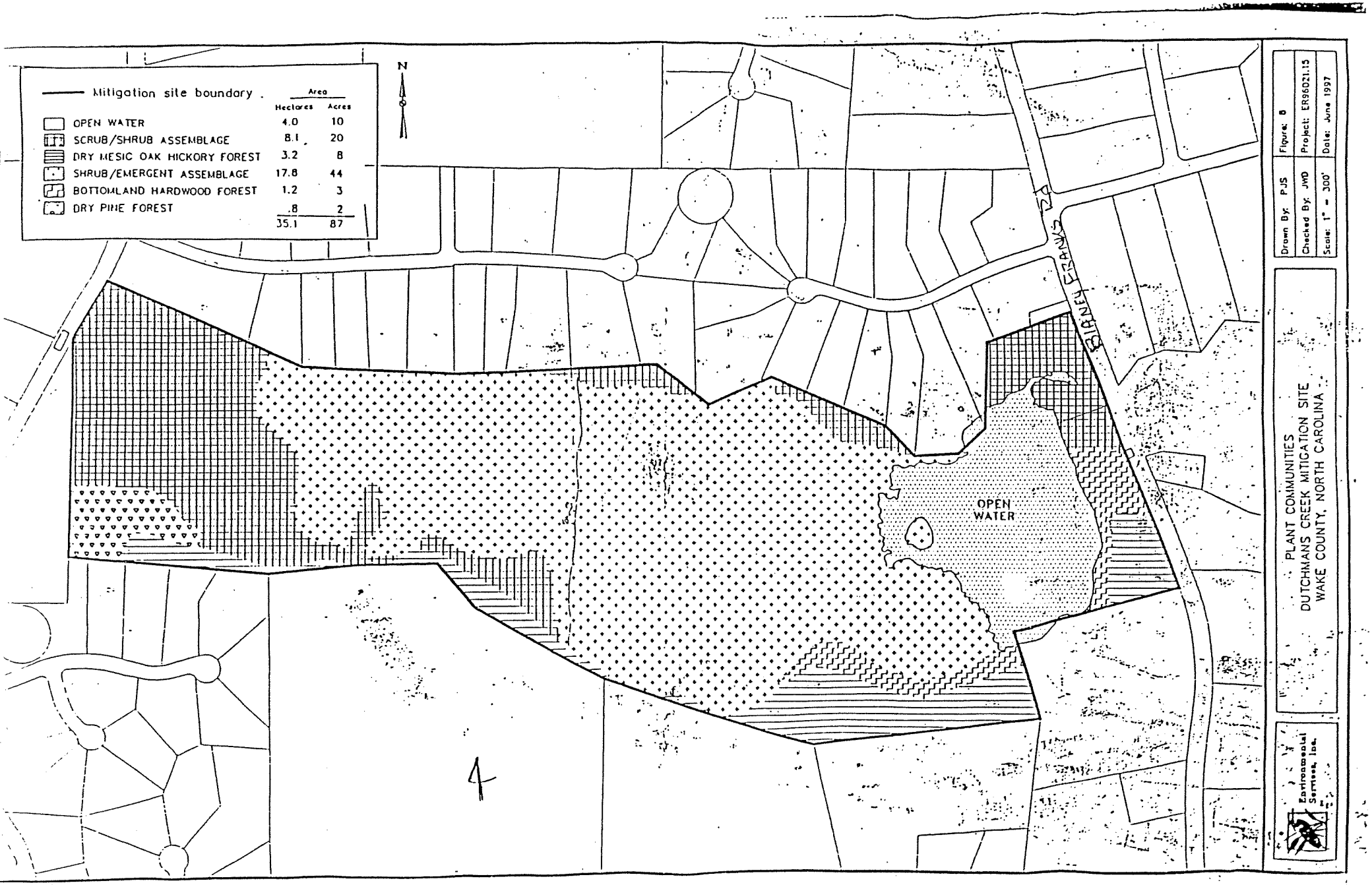
Mitigation site boundary
Area
Hectares Acres
OPEN WATER 4.0 10
SCRUB/SHRUB ASSEMBLAGE 8.1 20
DRY MESIC OAK HICKORY FOREST 3.2 8
SHRUB/EMERGENT ASSEMBLAGE 17.8 44
BOTTOMLAND HARDWOOD FOREST 1.2 3
DRY PINE FOREST .8 2
35.1 87
N
OPEN WATER
BLANEY FERRY RD
4
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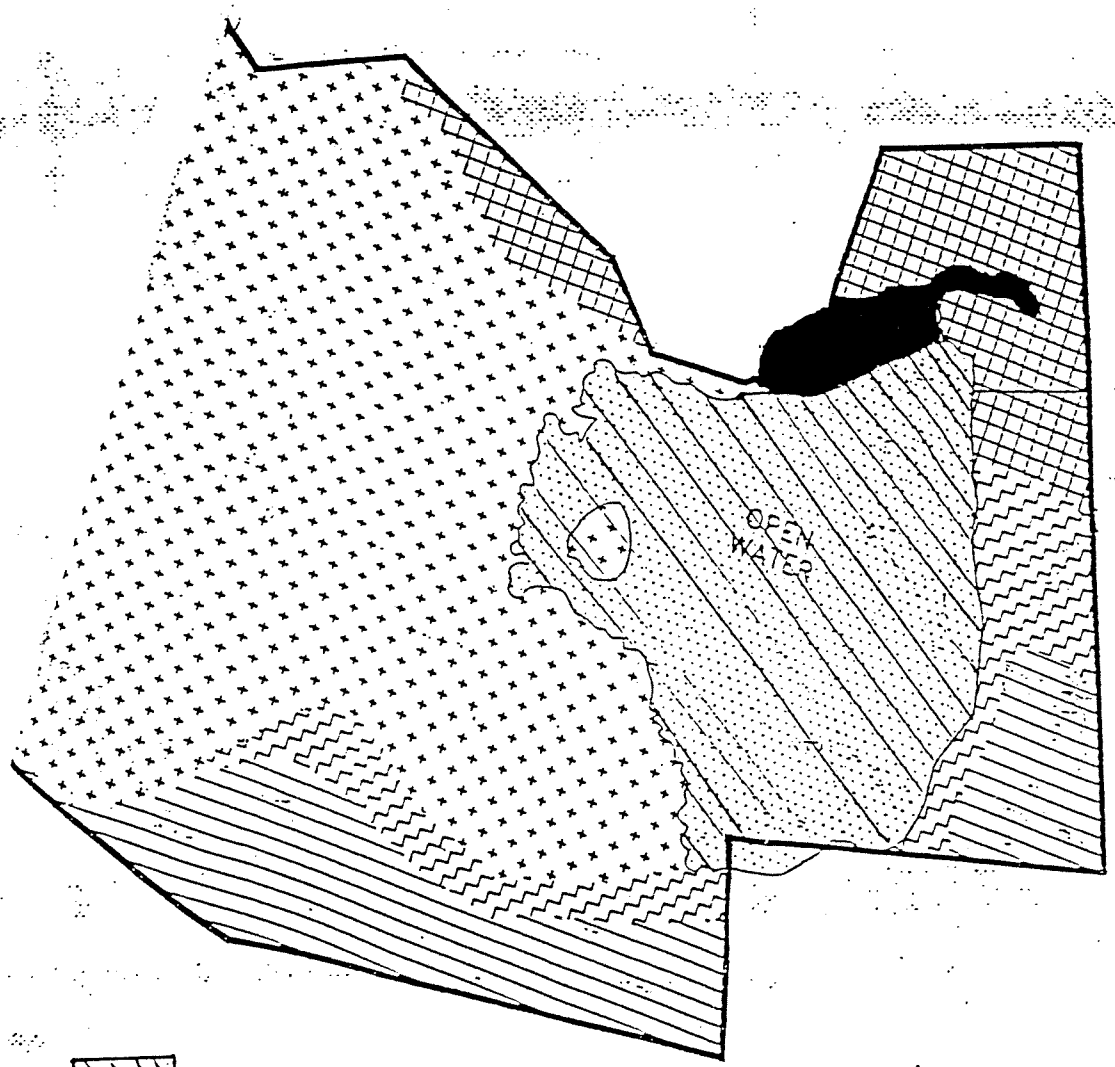
Figure: 8
Checked By: JWD
Project: ER96021.15
Scale: 1" = 300'
Date: June 1997
PLANT COMMUNITIES
DUTCHMANS CREEK MITIGATION SITE
WAKE COUNTY, NORTH CAROLINA
Environmental Services, Inc.



- AREA CONTAINING primarily Hydrilla verticillata

- AREA CONTAINING primarily Potamogeton diversifolius

APPENDIX B

MACROINVERTEBRATE AND FISH SURVEY

Dutchman's Creek Mitigation Site
Wake County

TIP No. R-2000WM
State Project No. 8.U401721

AQUATIC INVENTORY REPORT
R-2000WM

North Carolina Department of Transportation
Division of Highways
Planning and Environmental Branch
Natural Resources, Permits and Mitigation Unit

Bruce O. Ellis, CLM, Environmental Biologist

30 September 1998

1.0 INTRODUCTION

The following Aquatic Inventory Report is submitted to provide additional biological information concerning the Dutchman's Creek Wetland Mitigation Site, specifically, Dutchman's Creek. The site is located in the southern portion of Wake County.

1.2 Site Description

The Dutchman's Creek Wetland Mitigation Site is approximately 34.0 ha (84.0 ac) in area, of which approximately 3.6 ha (9.0 ac) consists of open water in the form of ponds. Dutchman's Creek (a.k.a. Dutchman's Branch) flows through the site from the west and becomes impounded in the eastern portion of the site. A detailed description of the Dutchman's Creek mitigation site which includes an examination of the channel morphology of Dutchman's Creek is presented in "Mitigation Proposal, Dutchman's Creek Mitigation Site", by Environmental Services, Inc., February 1997.

The section of Dutchman's Creek which was inventoried for this report is present within the western portion of the site, in the vicinity of SR 1386 (Graham Newton Road) (Figure 1). The study area was established approximately 30 m (100 ft) downstream of the SR 1386 bridge and extends downstream (eastward) for a distance of 100 m (328 ft). The Creek bed in this area is fairly straight and does not offer a variety of habitat. however, there is a 30 m (100 ft) section that does contain a riffle pool complex associated with minor meanders (Photos 1 and 2).

1.3 Methodology

The field survey and assessment of Dutchman's Creek was conducted on 15 September 1998 by NCDOT biologists Bruce O. Ellis, Logan Williams, Tim Savidge, Shannon Simpson, and NCDOT engineer Ed Lewis. Bruce Ellis, Logan Williams and Tim Savidge performed Macroinvertebrate and fish identification. *Gastropoda (snails) and Pelecypoda (clams and mussels) were identified by* Art Bogan, *curator of XXXX NC Museum of Natural History.*

Investigations of stream morphology, with regard to habitat assessment, were conducted in accordance with Rapid Bioassessment Protocols For Use In Streams and Rivers (RBP), (Plafkin 1986). Photographs were taken to depict the general condition and environmental surroundings of the study segment.

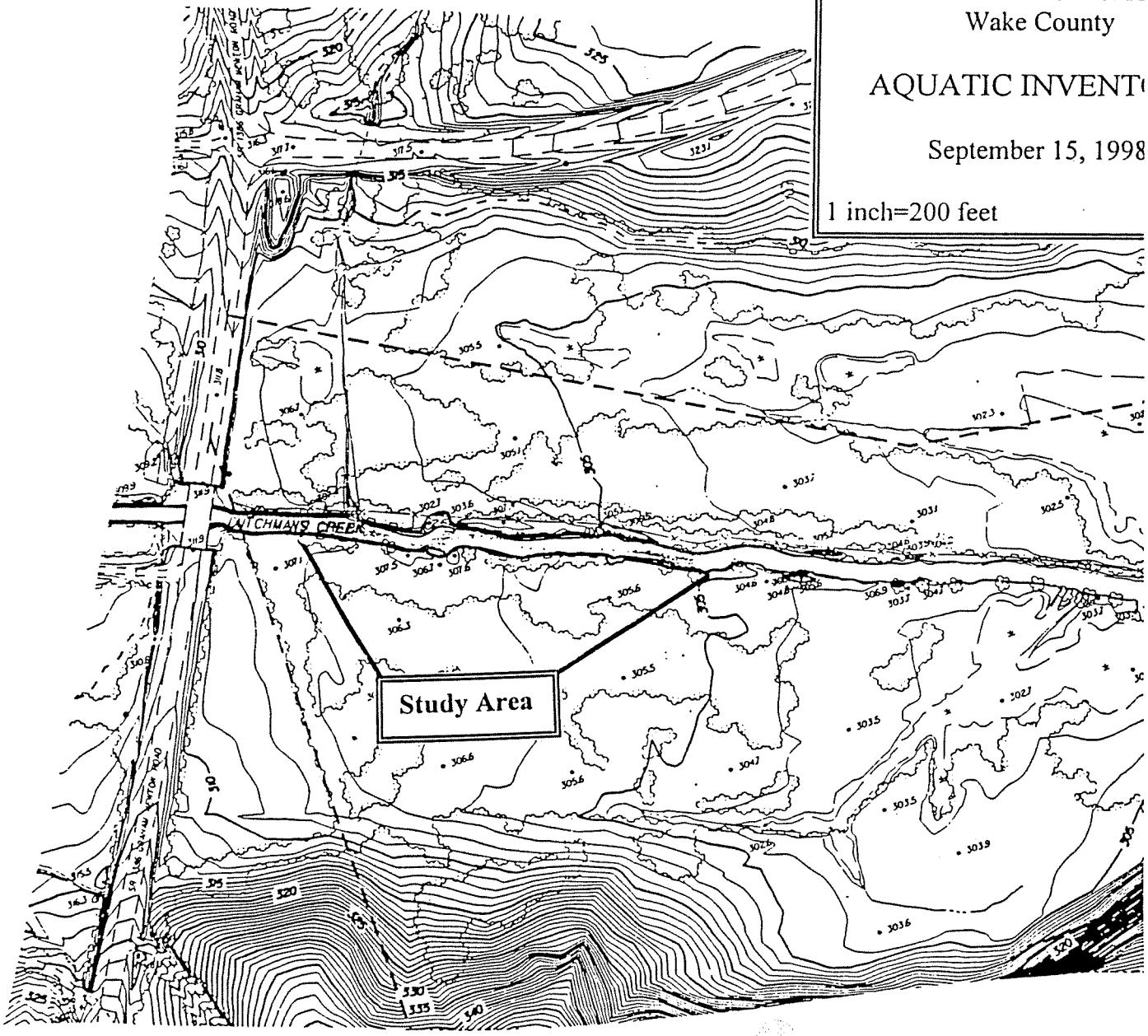
Very general water chemistry analysis was performed in the field during the macroinvertebrate collections. The following water quality parameters were examined: dissolved oxygen, total alkalinity, and pH. Water temperature was also measured during the macroinvertebrate collections.

DUTCHMAN'S CRE
MITIGATION SITI
Wake County

AQUATIC INVENT

September 15, 1998

1 inch=200 feet



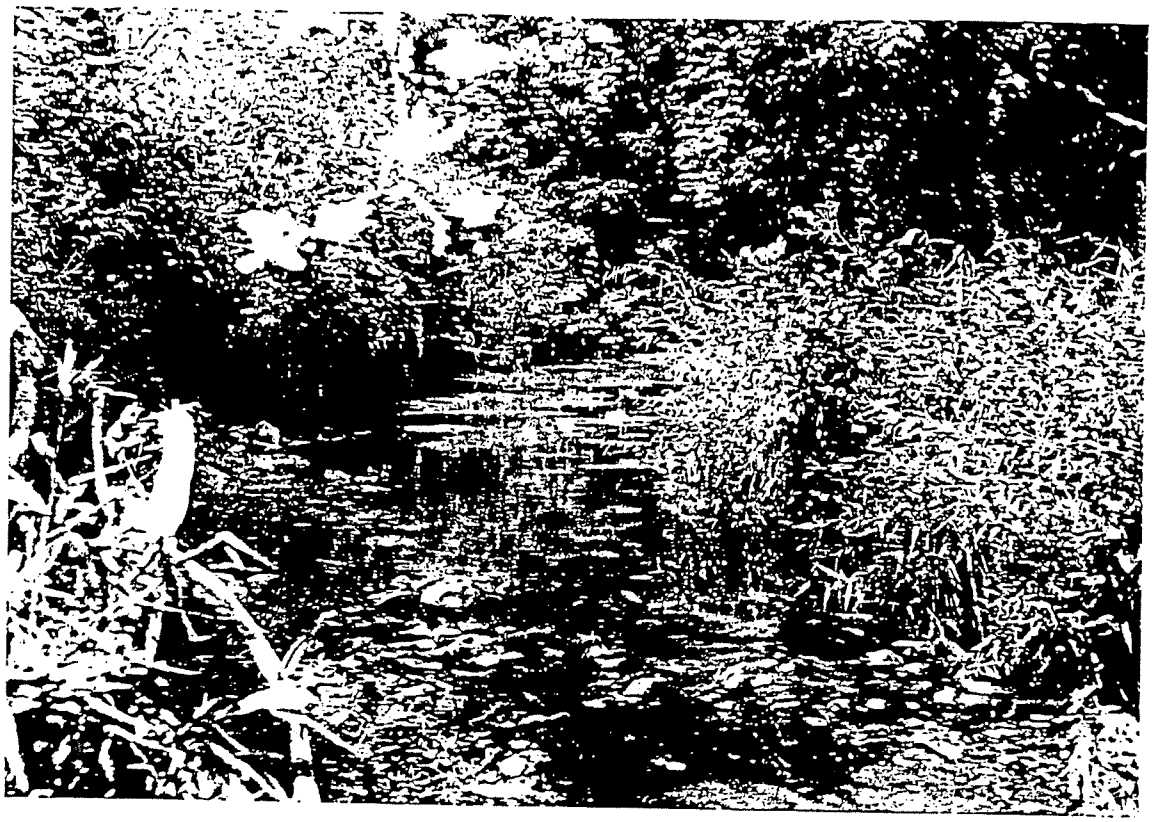


Photo 1: Dutchman's Creek looking upstream. Note small to moderate riffles and extended pool.

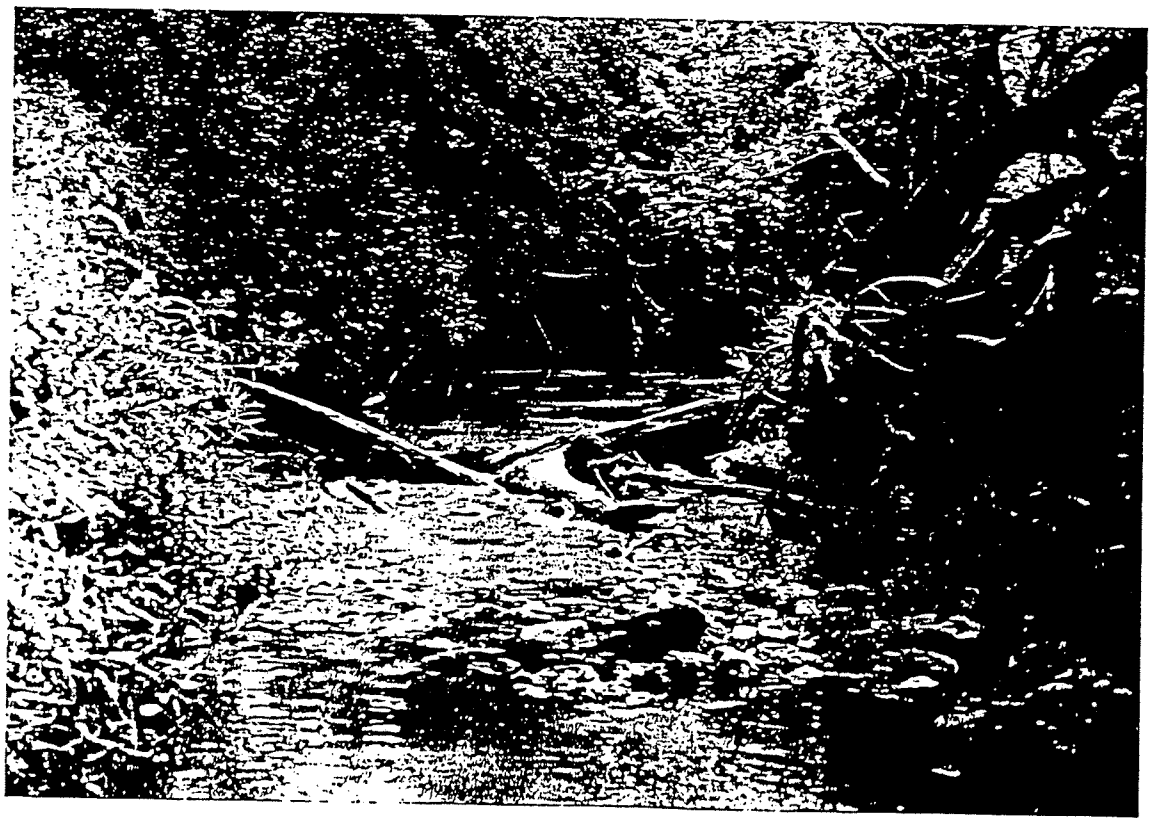


Photo 2: Dutchman's Creek looking downstream. Note snags and shoal.

All chemical analysis was performed in accordance with field test kit instructions. Dissolved oxygen content was analyzed using a modified Winkler titration. Total alkalinity was measured using an acid titration, and pH was determined by color comparison. Dissolved oxygen and total alkalinity concentrations are reported in parts per million (ppm). Temperature was recorded as degrees Celsius (°C).

Benthic macroinvertebrates were collected from selected streams using methods described in Standard Operating Procedures, Biological Monitoring [(SOPBM), NCDEHNR, 1995)]. All available habitats (riffles, pools, leaf packs, undercut banks, etc.) within the 100 m (328 ft) study segment were examined. Representative individuals of the macroinvertebrate population were preserved in 70 per cent isopropyl alcohol, and returned to the laboratory for identification.

A fisheries survey was also performed in the Dutchman's Creek sample segment. The fisheries survey was conducted by a three person team using a Coffelt Model Mark 10, Variable Voltage Pulsator electroschocker. Study area length was 100 m (328 ft). Actual collection time (30 minutes) was recorded during each sampling event to determine catch per unit effort (CPUE). All fish collected during the fishery survey were placed in temporary holding tanks and were then identified to species, counted, measured (standard fork length), and weighed. Larger specimens were weighed individually, while an aggregate weight per size class for smaller species was performed. Upon completion of data collection, the fish were returned to Dutchman's Creek.

A Scientific Fish Collection License (No. 0635), was obtained from the Wildlife Resources Commission (WRC). All fisheries data collected during the study will be forwarded to the WRC as per license conditions.

1.4 Definitions

The following are definitions of terminology and methodology utilized within this report:

Canopy Cover:	Visual estimation of the density of terrestrial vegetative cover over the stream.
Embeddedness:	The visual observation of the degree to which larger substrate particles are surrounded by fine sediments. The following categories are assigned to the per cent coverage by fine sediment (RBP): excellent 0-25, good 25-50, fair 50-75, and poor >75.
EPT:	Ephemeroptera, Plecoptera, Trichoptera
Substrate:	Material composition of the stream bottom. Substrate composition is evaluated by observation and presented in descending order of abundance.

Substrate
Particle Size: **B**oulder, > 256 mm (10 in); **R**ubble, 64.0 to 256.0 mm (2.5 to 10.0 in); **G**ravel, 2.0 to 64.0 mm (0.1 to 2.5 in); **Sa**nd 0.06 to 2.00 mm (gritty texture), **Si**lt, 0.004 to 0.06 mm (powdery texture), **C**lay, < 0.004 mm (slick texture). **Be**drock, exposed solid rock, which is free of other overlying substrate particles.

1.5 Qualifications of Principal Investigators

Bruce O. Ellis, Environmental Biologist II, NCDOT, March 199?-present.

Education: BS Agriculture/Environmental Science, Rutgers University College of Agriculture and Environmental Science.

Certification: Certified Lake Manager (North American Lake Management Society).

Experience: Biologist, Allied Biological, Inc., March 1976-April 1994. Lake and watershed management; water quality; stream bioassessment for NPDES permit requirements, and environmental impact statements, fisheries inventories, wetland delineation. Biologist. Upper Raritan Watershed Association. 1974-1976. two year bioassessment study of first and second order streams within a subwatershed of the Raritan River basin.

Expertise: Aquatic resource management; wetland delineation; Section 7 field investigations; NEPA investigations and documentation.

Organizations: North American Lake Management Society
North Carolina Lake Management Society, Director Region I
Society of Wetland Scientists

Logan Williams, Environmental Biologist II, NCDOT, January 1995-present.

Education: MS, Entomology, North Carolina State University
BA; Philosophy, North Carolina State University
AA, Agricultural Pest Control, North Carolina State University

Certification: Certified Plant Professional, NC Nurserymen Association

Experience: Apiary Inspection Supervisor, NCDA, 1984-1995.
Nature Educator, Raleigh Parks and Recreation, 1994.
Biologist, Williams Biological, 1992-1994.

Expertise: Entomology, field botany, natural history, wetland delineation; Section 7 field investigations; NEPA investigations and documentation.

Organizations: American Entomological Association
North Carolina Entomological Association
Dragonfly Society of the Americas

Tim Savidge, Environmental Specialist III, NCDOT, 1992- present.

Education:	M.S. Marine Biology/Biological Oceanography, UNC Wilmington
	B.S. Biology, (Chemistry), Guilford College.
Experience:	Biologist, NCDOT, freshwater mussel surveys, environmental impact documentation, natural resource investigations.
Expertise:	NEPA documentation; terrestrial and aquatic ecology; freshwater mussel biology; Section 7 surveys; wetland delineation.

3.0 RESULTS

The following section contains all field information and data analysis for the study reach of Dutchman's Creek. Scientific nomenclature and common names (when applicable) are provided for each animal and plant species described. Plant taxonomy generally follows Radford, *et al.* (1968) and Prescot (1964). Insect taxonomy generally follows Brigham *et. al.* (1982), and fish taxonomy follows Menhenick (1991).

Table 1: Study Area General Stream Morphology and Water Quality

MORPHOLOGY		**WATER QUALITY**	
Canopy Cover:	70 %	Temperature (°C):	25
Stream Depth (Average):	15 cm (6 in)	pH:	7.0
Stream Width (Average):	3.7 m (12.0 ft)	Dissolved Oxygen (ppm):	7.0
Substrate:	G, Sa, R, B	Total Alkalinity (ppm):	38
Embeddedness:	50 per cent Fair	EPT taxa richness:	4

On the date of the survey the Creek contained an elevated turbidity. The Secchi disc reading (a measure of transparency) was approximately 0.5 m (1.5 ft). The substrate of the Creek was covered with a fine layer of silt, especially in low velocity pool areas (Photo 3). A scraping from the larger substrate particles was collected and examined microscopically. The microscopic examination revealed that the surface of the substrate did contain considerable amounts of silt and amorphous matter. The substrate surface, especially in higher velocity riffle zones, also contained diatoms (*Cymbella* sp. and *Navicula* sp.) and filamentous algae (*Spirogyra* sp.).

The fishery survey yielded 30 individuals representing 11 different species of fish. As a group, the shiners contributed to 60 per cent of the catch. During the survey, the water of Dutchman's Creek was very turbid. The turbidity may have been instrumental in the moderately low number of individuals captured during the sampling event, since it is likely that a considerable number of fish were missed in the turbid water. However, it is anticipated that all the representative species within the stream segment were captured. The results of the fishery survey are presented in Table 2.

Photo 3: Dutchman's Creek substrate. Note turbid conditions and fine covering of silt on substrate.

Table 2: Fishery Survey Results

FISH SPECIES	NUMBER	LENGTH mm)	WEIGHT (g)	C.P.U.E.
Semotilus atromaculatus				
(creek chub)	1	150	40	2
Notropis amoenus				
(comely shiner)	6	35-45	2	12
Notropis analostana				
(satinfin shiner)	8	55-90	40	16
Notropis ardens				
(rosefin shiner)	4	40-65	2	8
Noturus gilberti				
(margined madtom)	1	55	1.5	2
Aphredoderus sayannus				
(pirate perch)	1	65	2	2
Lepomis auritus				
(redbreast sunfish)	1	85	12	2
	1	180	110	2
Lepomis gulosus				
(warmouth)	1	110	22	2
Lepomis macrohirus				
(bluegill sunfish)	1	70	3	2
	1	80	4	2
	1	120	32	2
Micropterus salmoides				
(largemouth bass)	1	210	142	2
Etheostoma olmstedi				
(tessellated darter)	2	40-45	2	4
Total	30		414.5	60

The results of the benthic macroinvertebrate study of Dutchman's Creek yielded a total of 23 separate species (Table 3). Two of the species collected, the fishing spider (*Dolomedes* sp.) and the water strider (*Aquarius* sp.) are semi aquatic and spend most of their time on the water surface. The remainder of the macroinvertebrates are truly aquatic and have either water dependent life cycles (insects) or spend their entire life (crayfish, snails and clams) on or within the various substrates of the creek.

Table3: Results of Macroinvertebrate Analysis

TAXA	TAXA
ARTHROPODA	Trichoptera
Decapoda	Hydropsychidae
Cambaridae	*Hydropyche bettenii*
Cambarus spp.	Limnephilidae
Araneida	*Neophylax* sp.
Pisauridae	Lepidoptera
Dolomedes sp. *	Noctuidae
INSECTA	*Achanara* sp.
Ephemeroptera	Coleoptera
Baetidae	Dytiscidae
Baetis sp.	*Hydaticus bimarginatus*
Heptageniidae	*Laccophilus maculosus*
Stenonema pudicum	Haliplidae
Odonata	*Peltodytes muticus*
Ansioptera	Psephenidae
Gomphidae	*Psephenus herricki*
Gomphus lividus	Diptera
Zygoptera	Chironomidae
Coenagrionidae	*Ablabesmyia* sp.
Ischnura posita	*Chironomus* sp.
Macromiidae	Gastropoda
Macromia taeniolata	Physidae
Hemiptera	*Physella* sp.
Corixidae [1]	
Nepidae	Viviparidae
Ranatra drakei	*Campeloma* sp.
Gerridae	
Aquarius sp. *	
Megaloptera	Pelecypoda
Corydalidae	Sphaeriidae
Nigronia fasciatus	*Sphaerium* sp.
Sialidae	
Sialis velata	
	Total Taxa 23

* Semi aquatic

Other incidental fauna observed on the site during the survey includes the two-lined salamander (*Eurycea bislineata*), green frog (*Rana clamitans*), bullfrog *(R. catesbiana*), northern cricket frog (*Acris crepitans*), northern water snake *(Nerodia sipedon*), and Carolina anole (*Anolis carolinensis*).

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APPENDIX C

AVIAN FAUNA DATA

Bird Species Observed at Dutchman's Creek

Species	12/20/97	4/9/98	5/9/98	6/23/98	6/27/98	7/19/98	7/22/98	8/9/98	8/12/98	8/16/98	8/23/98	8/27/98	8/29/98	9/5/98	10/2/98	10/3/98	10/11/98	10/24/98
Pied Billed Grebe	x					x	x	x								x	x	x
Great Blue Heron	x		x	x	x	x	x	x			x		x	x		x	x	
Greenbacked Heron				x	x		x											
Common Egret		x																
Great Egret								x			x		x	x		x		
White Ibis									x	x		x						
Mute Swan	x			x		x	x	x					x	x		x	x	x
Canada Goose	x	x		x	x		x						x				x	x
Mallard	x	X	x	x	x	x	x				x		x	x		x	x	x
Black Duck				x		x												
Gadwall	x																	
Green-winged Teal	x																	
Blue-winged Teal		x														x		
American Wigeon	x	x															x	
Wood Duck	x	x	x				x	x			x		x	x		x	x	x
Ringneck Duck	x																	
Bufflehead	x																	
Hooded Merganser	x																	
Turkey Vulture		x		x			x											
Sharp-shinned Hawk																x		
Cooper's Hawk	x				x												x	
Red-tailed Hawk	x		x	x	x	x	x				x		x			x	x	x
Red-shouldered Hawk	x	x															x	
Bald Eagle	x														x			
Osprey														x				
Kestrel																	x	
Bobwhite Quail			x	x	x		x				x							x
Coot	x																	x
Killdeer	x		x					x			x					x	x	x
Solitary Sandpiper			x															
Spotted Sandpiper			x															
Greater Yellowlegs		x																
Snipe	x															x		
Mourning Dove	x		x	x	x			x									x	x
Yellow-billed Cuckoo								x			x							x
Chimney Swift		x	x	x	x	x										x	x	
Ruby-throated Hummingbird							x	x			x		x					
Belted Kingfisher	x	x	x	x	x									x		x	x	x
Flicker	x		x											x				
Red-bellied Woodpecker			x	x		x		x										

Bird Species Observed at Dutchman's Creek

Species	12/20/97	4/9/98	5/9/98	6/23/98	6/27/98	7/19/98	7/22/98	8/9/98	8/12/98	8/16/98	8/23/98	8/27/98	8/29/98	9/5/98	10/2/98	10/3/98	10/11/98	10/24/98
Pileated Woodpecker																x	x	
Hairy Woodpecker		x															x	
Downy Woodpecker	x															x		x
Eastern Kingbird			x	x	x	x	x							x				x
Great Crested Flycatcher			x	x			x											x
Phoebe		x		x			x	x								x	x	x
Rough-winged Swallow		x	x															
Barn Swallow		x	x	x		x	x	x										
Purple Martin						x	x											
Blue Jay	x		x														x	x
American Crow	x		x		x		x										x	x
Common Crow		x																
Fish Crow					x												x	x
Carolina Chickadee	x		x	x													x	x
Tufted Titmouse	x		x	x													x	x
White-breasted Nuthatch																	x	
House Wren					x											x		
Winter Wren	x																	
Carolina Wren	x	x	x	x			x	x									x	x
Sedge Wren			x					x			x			x				?
Mockingbird	x		x	x	x		x	x									x	x
Catbird			x														x	
Brown Thrasher			x		x											x		x
Robin	x						x										x	
Bluebird	x		x	x														x
Blue-gray Gnatcatcher			x	x			x											x
Ruby Crowned Kinglet	x																x	
Cedar Waxwing	x												x	x		x	x	?
Loggerhead Shrike																	x	x
Starling	x																	
White-eyed Vireo		x																
Red-eyed Vireo			x	x			x	x										x
Prothonotary Warbler		x	x	x														x
Palm Warbler																x		
Yellow Warbler			x															
Yellow-rumped Warbler	x		x															
Pine Warbler	x	x	x															x
Louisiana Waterthrush		x	x	x														?
Kentucky Warbler							x											?
Common Yellowthroat		x	x	x	x	x	x	x			x		x	x		x	x	x

Bird Species Observed at Dutchman's Creek

Species	12/20/97	4/9/98	5/9/98	6/23/98	6/27/98	7/19/98	7/22/98	8/9/98	8/12/98	8/16/98	8/23/98	8/27/98	8/29/98	9/5/98	10/2/98	10/3/98	10/11/98	10/24/98
Yellow-breasted Chat				x	x											x		x
Redstart			x														x	
Bobolink													x			x		
Eastern Meadowlark		x	x			x	x							x		x	x	x
Red-winged Blackbird	x	x	x	x		x		x								x	x	x
Orchard Oriole			x	x	x	x		x										x
Northern Oriole			x															
Carolina Grackle	x																x	
Brown-headed Cowbird	x																	
Summer Tanager							x											?
Cardinal	x		x	x			x									x	x	x
Blue Grosbeak			x	x	x			x			x			x			x	x
Indigo Bunting			x	x		x	x	x			x			x		x	x	x
Goldfinch	x		x	x			x	x			x						x	x
Towhee	x			x			x	x									x	x
Savannah Sparrow	x	x														x	x	
Grasshopper Sparrow			x	x														?
Junco	x																x	
Field Sparrow	x		x	x				x					x					x
White-throated Sparrow	x	x																
Swamp Sparrow	x	x	x														x	
Song Sparrow	x	x	x								x						x	?
Black-throated Green Warbler																	x	
Nashville Warbler																	x	
Black & White Warbler																	x	