MCDONALDS POND RESTORATION SITE
2006 Annual Monitoring Report (Year 1)

Richmond County, North Carolina
EEP Project No. D04020-2
Design Firm: International Paper

December 2006

Prepared for: **NCDENR - ECOSYSTEM ENHANCEMENT PROGRAM**
1652 Mail Service Center
Raleigh, North Carolina 27699-1619

Prepared by: **ECOSCIENCE CORPORATION**
1101 Haynes Street, Suite 101
Raleigh, North Carolina 27604

Ecosystem Enhancement PROGRAM

MCDONALDS POND RESTORATION SITE
2006 Annual Monitoring Report (Year 1)

RICHMOND COUNTY, NORTH CAROLINA

PREPARED BY:

INTERNATIONAL PAPER
PROJECT MANAGER: CRAIG HEDMAN
719 Southlands Road
Bainbridge, GA 39819

AND

ECOSCIENCE CORPORATION
PROJECT MANAGER: DAVID JONES
1101 Haynes Street, Suite 101
Raleigh, NC 27604

DECEMBER 2006

EXECUTIVE SUMMARY

Introduction

In response to a Request for Proposal (RFP, No. 16-D04016) issued in December of 2003, International Paper Company (IP) proposed the establishment of the McDonalds Pond Restoration Site (hereafter referred to as the "Site") located in Richmond County, approximately 2 miles northeast of the town of Hamlet and 3 miles east of the town of Rockingham. In order to provide stream channel restoration and riverine wetland restoration, IP has removed the McDonalds Pond Dam located on Falling Creek.

The Site comprises approximately 128 acres, and includes the 17.7 acre McDonalds Pond (a.k.a Shepards Lake), portions of Falling Creek, numerous headwater tributaries and over 80 acres of forested riparian wetlands, seepage wetlands, and marsh wetlands.

The McDonalds Pond Dam was removed in a manner to minimize potential impacts to water resources both upstream and downstream of the dam. Gradual dewatering and phased dam removal were undertaken to avoid introducing sediments and pollutants into the receiving Falling Creek reaches downstream. Heavy equipment operated from or within the footprint of the former dam during dam removal operations, thereby minimizing the impact to the adjacent intact forest and wetland soil. Dam removal began with the dewatering (lowering) of the pond in the fall of 2005, followed by the clearing of trees and small bushes from the former earthen dam in February 2006. Excavation activities continued for approximately two weeks until dam removal was complete in mid-March 2006.

Monitoring Plan

First year monitoring activities began in March 2006, and will be performed for at least five-years or until success criteria are achieved. Post removal monitoring data will be compared to reference sites as well as biological baseline values collected in September 2004. Primary success criteria of the project include: 1) the successful classification of restored/enhanced reaches as functioning systems, 2) channel stability indicative of a stable stream system, 3) development of characteristic lotic aquatic communities, 4) establishment of wetland hydrology (as defined in the U.S. Army Corps of Engineers [USACE] Wetlands Delineation Manual) within the former pond footprint, and 5) vegetative success of 320 stems/acre after the third year of monitoring and 260 stems/acre after the fifth and final year of monitoring.

First Year Monitoring Results

Stream Assessment

Restored and enhanced segments of Falling Creek have developed braided, anastomosed, bifurcated, and single-threaded channels characteristic of the area. In general, restored and enhanced stream segments across the Site can be successfully classified as functioning systems and appear to have developed channel stability indicative of a stable stream system. Cross-sections located within the former pond indicate that some portions of the stream have continued to transport deposited pond sediments downstream as the channel structure shifts more toward that of the reference reaches.

Aquatic community assemblages within the former pond have clearly shifted from a characteristic lentic system to a more historically natural lotic system. Fifty-two percent (52%) of the macroinvertebrate samples taken in October 2006 (post dam removal) from restored segments of Falling Creek (within the former pond) consisted of macroinvertebrate genera predominantly found in lotic systems. Genera predominantly found in lentic systems were not present within the former pond during the October sample. Only two (2) genera of the EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]) taxa were collected within McDonalds Pond during baseline sampling (pre dam removal, September 2004) while there were sixteen (16) different EPT genera collected within the restored segments of Falling Creek (within the former pond) during October 2006.

North Carolina Division of Water Quality (NCDWQ) Habitat Assessment Forms (HAFs) were completed at multiple locations along the restored and enhanced segments of Falling Creek. The HAF scores indicate that the restored and enhanced stream segments are very similar to the reference sites with a slightly lower score primarily due to the lack of canopy trees within the former pond, which results in less stream shading and allochthonous input for in-stream habitat.

Wetland Assessment

The Site is meeting the established success criteria for vegetation based on the survival of the planted species with nearly one hundred percent (100%) survival. Only one planted stem was lost within Site vegetation monitoring plots. In addition, numerous individuals of characteristic volunteer species (predominantly *Pinus serotina* [pond pine]) were observed. Wetland hydrology at the Site is meeting the required success criteria. All four (4) on-Site groundwater gauges have registered water levels within the upper 12 inches of the soil surface for at least 28 consecutive days (Richmond County, NRCS) or 12.5 percent of the growing season.

Summary

After the first year of monitoring, the removal of the McDonalds Pond Dam has resulted in the successful restoration of lotic conditions within the former pond as well as the re-establishment of characteristic wetland hydrology within the adjacent Falling Creek floodplain. The Site is now characterized by stable functioning stream systems, historically natural lotic aquatic communities, and a developing Streamhead Pocosin/Atlantic White Cedar forest community.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

Page Intentionally Left Blank

1.0 PROJECT BACKGROUND

1.1 Location and Setting

The North Carolina Ecosystem Enhancement Program (EEP) is currently developing stream and wetland restoration strategies for the Yadkin-Pee Dee River Basin, Cataloging Unit 03040201. As a part of this effort, International Paper (IP) was selected to complete the McDonalds Pond Restoration Project located in Richmond County. The McDonalds Pond Restoration Site ('hereafter referred to as the "Site") is located approximately 2 miles northeast of the town of Hamlet and 3 miles east of the town of Rockingham between NC Route 1 and NC Route 177 (Figure 1, Appendix A).

1.2 Restoration Structure and Objectives

Falling Creek, the major drainage feature on-Site, was previously impounded by the McDonalds Pond Dam, constructed over 70 years ago. Approximately 3700 linear feet of Falling Creek and tributaries were impacted by the construction of the pond dam including streams contained within the pond footprint, as well as stream sections located both up and downstream of the pond. In addition, approximately 17.7 acres of riverine wetland were inundated with the construction of the dam. Approximately 4.2 acres of the floodplain immediately upstream of the pond were impacted by the "backwater effect" (the backing-up of water), creating marsh wetlands with saturated conditions unsuitable for historic wetland communities. An eroded pond outfall channel located at the northern extent of the dam drained adjacent wetlands and redirected historic flows of the Falling Creek floodplain.

Stream restoration efforts were achieved through the removal of the McDonalds Pond Dam resulting in the restoration of 2969 linear feet of stream. The former dam was excavated to the approximate level of the pre-existing valley contours, allowing the stream unrestricted flow through the Site. Stream restoration efforts were designed to utilize passive stream channel restoration processes, allowing the channel to reestablish naturally following the removal of the dam. Stream enhancement (Level I) was achieved through the removal of the dam and the filling of the northern outfall channel, which returned the historic hydrologic characteristics (stream volume and velocity) to 770 feet of impacted stream channel downstream of the former dam. Riverine wetland restoration was accomplished within the former 17.7 acre pond footprint through the excavation of the McDonalds Pond Dam and the establishment of native Streamhead Pocosin and Atlantic White Cedar forest communities. Additionally, the Site includes the preservation of 5800 linear feet of stream, 77.8 acres of wetland, and 25.6 acres of upland/wetland ecotone buffer.

1.3 Project Mitigation Goals

The primary project goals include 1) the restoration of a stable, meandering stream channel through the areas impacted by the McDonalds Pond Dam, 2) the restoration of historic lotic aquatic communities that represent the Site's natural range in variation, 3) the restoration of historic wetland conditions within the pond footprint, and 4) the restoration of natural wetland plant communities within their historic locations.

Additional potential benefits of the project include the restoration of wildlife functions associated with a riparian corridor and stable stream and the enhancement of water quality function in the on-Site, upstream, and downstream segments of Falling Creek and tributaries.

The specific goals of this project are to:

- Restore approximately 2969 linear feet of historic stream course, flow volumes, and patterns through the marsh wetlands, McDonalds Pond footprint, and immediately downstream of the existing dam.
- Enhance an additional approximate 770 linear feet of Falling Creek downstream of the restored stream channel extending into the gas line easement.
- Protect the headwaters of Falling Creek that are located within the Site through preservation of approximately 5800 linear feet of Falling Creek and associated tributaries.
- Restore approximately 17.7 acres of forested riverine wetlands within the McDonalds Pond footprint.
- Enhance 4.2 acres of forested riverine wetlands within the marsh wetlands located at the head of McDonalds Pond.
- Preserve 77.8 acres of forested riverine wetlands adjacent to Falling Creek and associated tributaries.
- Restore and enhance habitat for vegetation and wildlife species, characteristic of Streamhead Pocosin and Atlantic White Cedar Forests (Schafale and Weakely, 1990).
- Enhance the function and value of the Falling Creek wetland community through the preservation of 25.6 acres of buffer along the Falling Creek stream/wetland complex.

Table 1. Summary of Stream and Wetland Mitigation Units
McDonalds Pond Restoration Site / EEP Project No. D04020-2

Restoration Activities	Linear feet	Acres	Mitigation Ratios	Percentage of Mitigation Units	Mitigation Units
Stream Restoration	1,784	N/A	1:1	75	1,784
Stream Restoration (undefined channel)	1,185	N/A	1:1		1,185
Stream Enhancement (Level I)	770	N/A	1:1.5		513
Stream Preservation	5,800	N/A	1:5	25	1,160
Total Stream Mitigation Units (SMUs) Provided					**4,642**
Total SMUs Under Contract					**4,364**
Wetlands Restoration	N/A	17.7	1:1	75	17.7
Wetland Enhancement	N/A	4.2	1:2	25	2.1
Wetlands Preservation	N/A	19	1:5		3.8
Total Wetland Mitigation Units (WMUs) Provided					**23.6**
Total WMUs Under Contract					**23.4**

1.4 Project History and Background

Table 2. Project Activity and Reporting History McDonalds Pond Restoration Site / EEP Project No. D04020-2			
Activity Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	*NA	July 2005	August 2005
Final Design (90%)	*NA	July 2005	August 2005
Construction	*NA	N/A	March 2006
Temporary S&E mix applied to entire project area	*NA	N/A	March 2006
Bare Root Seedling Installation	*NA	N/A	March 2006
Mitigation Plan	*NA	June 2006	July 2006
Final Report	*NA	Oct 2006	Oct 2006
Year 1 Vegetation Monitoring	Dec 2006	Oct 2006	Dec 2006
Year 1 Stream Monitoring	Dec 2006	Oct 2006	Dec 2006

*NA – Scheduled completion dates unknown due to unanticipated project delays.

Table 3. Project Contacts McDonalds Pond Restoration Site / EEP Project No. D04020-2	
Designer International Paper	719 Southlands Road Bainbridge, GA 39819 (229) 246-3642
Construction Contractor Environmental Repair, Inc.	28723 Marston Road Marston, NC 28363 (910) 280-6043
Planting Contractor Garcia Forest Service, Inc.	PO BOX 789 Rockingham, NC 28379 (910) 997-5011
Seeding Contactor Environmental Repair, Inc.	28723 Marston Road Marston, NC 28363 (910) 280-6043
Nursery Stock Suppliers International Paper North Carolina Division of Forest Resources	6726 Highway 169 Bellville, GA 30414 (912) 739-4613 Route 1, Box 1097: County Road #3 Shellman, GA 39886 (229) 679-5640 5594 Highway 38 South Blenheim, SC 29516 (843) 528-3203 726 Claridge Nursery Road Goldsboro, NC 27530 (919) 731-7988
Monitoring Performers EcoScience Corporation	1101 Haynes Street, Suite 101 Raleigh, NC 27604 (919) 828-3433
Stream Monitoring POC	David Jones
Vegetation Monitoring POC	David Jones

Table 4. Project Background McDonalds Pond Restoration Site / EEP Project No. D04020-2	
Project County	Richmond
Drainage Area	2.5 square miles
Impervious cover estimate (%)	<5 percent
Stream Order	3rd order
Physiographic Region	Southeastern Plains
Ecoregion (Griffith and Omernik)	Sandhills
Rosgen Classification of As-built	DA5/E5
Cowardin Classification	Stream (R2UB2)
Dominant soil types	Johnston (JmA)
	Ailey (AcB, AcC)
	Candor-Wakulla Complex (CaC, WcB)
Reference Site ID	Falling Creek
USGS HUC for Project and Reference	03040201
NCDWQ Sub-basin for Project and Reference	03-07-16
NCDWQ classification for Project and Reference	WSIII
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	Yes
Reasons for 303d listing or stressor	Aquatic weeds
Percent of project easement fenced	NA

2.0 PROJECT MONITORING AND RESULTS

The monitoring results described herein document the Year-1 (2006) monitoring activities. Stream monitoring activities occurred at two (2) stream reaches that were established in April 2006. Each monitoring reach is comprised of approximately 150 foot section of stream with one (1) stream cross-section where stream profile and dimension are monitored. An approximate 575 feet of stream channel profile and eight (8) cross-sections were added to the Site monitoring activities in October 2006 (Figure 2, Appendix A). Wetland monitoring activities include vegetative sampling and groundwater gauge monitoring. Vegetative sampling was conducted in October 2006 and groundwater gauge monitoring was conducted throughout the growing season (March 27 – November 5) (NRCS 1999).

2.1 STREAM ASSESSMENT

2.1.1 Stream Channel Morphology

Stream channel cross-sectional surveys were performed at all ten (10) on-Site monitoring locations in October 2006 (Figure 2, Appendix 2). Bankfull channel parameters were largely unchanged at the two (2) cross-section locations with baseline data (Figure B-5, B-7, Appendix B). However, bankfull parameters along portions of the restored channel appear to be shifting more toward that of the reference reaches. Subsidence of surface soils has occurred at many locations within the former pond, due in part to the evaporation of newly exposed organic material and the continued shrinking/swelling of the exposed soil. Soil subsidence will likely diminish as the roots of herbaceous and woody vegetation further stabilize the soil and as the vegetation begins to provide shading for the developing forest floor. Bankfull channel parameters at the remaining eight (8) cross-section locations exhibit characteristic conditions for the Site and changes will be noted in subsequent monitoring reports. Cross-sectional channel parameters

were not generated for three (3) cross-sections where the braided/anastomosed nature of the stream is characterized by more than two (2) active channels in combination with areas of overland flow and standing water above the ground surface (XS2, XS7, and XS8). These cross-sections will continue to be surveyed and parameters will be calculated if the stream channel migrates toward two (2) or less active channels. Cross-section plots are represented in Figures B1-B10 in Appendix B. Cross-sectional parameters are summarized in Tables 5-6b. The stream channel substrate is naturally comprised of more than ninety percent (90%) sand throughout the Site. Therefore, substrate sampling was not conducted at the cross-sections and is not included with the summarized cross-sectional parameters.

Stream longitudinal profile was surveyed for approximately 900 feet within the restored channel, including the section of stream between on-Site Reach 3 and on-Site Reach 2 (Figure 2, Appendix A). Longitudinal profile data for this portion of the stream was plotted along with available As-Built conditions in Figure B-11, Appendix B. A typical riffle/pool sequence is currently absent from this portion of the stream. The Site's natural low gradient and the large amount of coarse woody debris present within the channel has produced numerous depositional features (traverse and diagonal bars) scattered among scour pools of varying sizes. As a result, longitudinal profile parameters were not generated for the stream due to the complexity and irregularity of the channel bed.

Table 5. Baseline Morphology and Hydraulic Summary
McDonalds Pond Restoration Site / EEP Project No. D04020-2

Parameter	Regional Curve Interval			Reference Stream Reach 1 (233 linear feet)			Reference Stream Reach 4 (175 linear feet)			As-Built On-Site Reach 2 (186 linear feet)			As-Built On-Site Reach 3 (293 linear feet)		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	9.6	13.5	12.7	N/A	N/A	12.7	N/A	N/A	8.6	N/A	N/A	12.0	N/A	N/A	10.9
Floodprone Width (ft)	300.0	600.0	400.0	N/A	N/A	500.0	N/A	N/A	300.0	N/A	N/A	450.0	N/A	N/A	400.0
BF Cross Sectional Area (ft^2)	9.4	18.1	16.1	N/A	N/A	14.7	N/A	N/A	7.7	N/A	N/A	11.1	N/A	N/A	10.2
BF Mean Depth (ft)	1.0	1.3	1.3	N/A	N/A	1.2	N/A	N/A	0.8	N/A	N/A	1.0	N/A	N/A	0.8
BF Max Depth (ft)	N/A	N/A	N/A	N/A	N/A	1.9	N/A	N/A	1.2	N/A	N/A	2.0	N/A	N/A	1.4
Width/Depth Ratio	9.8	10.0	9.9	N/A	N/A	10.9	N/A	N/A	11.5	N/A	N/A	11.8	N/A	N/A	12.7
Entrenchment Ratio	28.4	49.7	32.2	N/A	N/A	39.4	N/A	N/A	34.9	N/A	N/A	37.5	N/A	N/A	36.7
Wetted Perimeter (ft)	N/A	N/A	N/A	N/A	N/A	15.1	N/A	N/A	10.2	N/A	N/A	14.0	N/A	N/A	12.5
Hydraulic Radius (ft)	N/A	N/A	N/A	N/A	N/A	0.8	N/A	N/A	0.8	N/A	N/A	0.8	N/A	N/A	0.8
Pattern															
Channel Beltwidth (ft)	N/A	N/A	N/A	18.2	35.5	22.1	12.6	18.5	14.0	19.3	22.6	21.0	8.9	20.9	11.0
Radius of Curvature (ft)	N/A	N/A	N/A	18.6	46.3	21.1	4.2	27.7	6.8	10.3	24.3	15.8	4.1	18.2	13.4
Meander Wavelength	N/A	N/A	N/A	61.2	88.1	78.9	17.5	44.6	21.6	39.1	59.9	47.9	19.1	49.2	28.0
Meader Width Ratio	N/A	N/A	N/A	1.4	2.8	1.7	1.5	2.2	1.6	1.6	1.9	1.7	1.5	2.2	1.9
Profile															
Riffle Length (ft)	N/A	N/A	N/A	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Riffle Slope (ft)	N/A	N/A	N/A	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Pool Length (ft)	N/A	N/A	N/A	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Pool Spacing (ft)	N/A	N/A	N/A	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Substrate															
d50 (mm)	N/A	N/A	N/A	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
d84 (mm)	N/A	N/A	N/A	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Additional Reach Parameters															
Valley Length (ft)	N/A			N/A			N/A			N/A			N/A		
Channel Length (ft)	N/A			N/A			N/A			N/A			N/A		
Sinuosity	N/A			1.3			1.1			1.1			1.1		
Water Surface Slope (ft/ft)	N/A			0.003			0.005			0.004			0.004		
BF Slope (ft/ft)	N/A			0.003			0.005			0.004			0.004		
Rosgen Classification	N/A			E5			E5			E5			E5		
Habitat Index	N/A			NA*			NA*			NA*			NA*		
Macrobenthos	N/A			NA*			NA*			NA*			NA*		

*See document text for details.

Table 6. Morphology and Hydraulic Monitoring Summary
McDonalds Pond Restoration Site / EEP Project No. D04020-2

Parameter	Cross-Section XS1						Cross-Section XS2						XS3					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	11.7						NA*						8.4					
Floodprone Width (ft)	400.0						NA*						400.0					
BF Cross Sectional Area (ft^2)	6.4						NA*						6.2					
BF Mean Depth (ft)	0.4						NA*						0.4					
BF Max Depth (ft)	0.8						NA*						1.0					
Width/Depth Ratio	31.0						NA*						21.8					
Entrenchment Ratio	34.1						NA*						47.9					
Wetted Perimeter (ft)	12.5						NA*						9.1					
Hydraulic Radius (ft)	0.5						NA*						0.7					
Substrate																		
d50 (mm)	NA*						NA*						NA*					
d84 (mm)	NA*						NA*						NA*					

Parameter	MY-01 (2006)			MY-02 (2007)			MY-03 (2008)			MY-04 (2009)			MY-05 (2010)			MY+ (2011)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	8.9	22.6	15.6															
Radius of Curvature (ft)	4.1	24.3	13.4															
Meander Wavelength	19.1	59.9	38.0															
Meader Width Ratio	1.5	2.2	1.9															
Profile																		
Riffle Length (ft)	NA*	NA*	NA*															
Riffle Slope (ft)	NA*	NA*	NA*															
Pool Length (ft)	NA*	NA*	NA*															
Pool Spacing (ft)	NA*	NA*	NA*															
Additional Reach Parameters																		
Valley Length (ft)	N/A																	
Channel Length (ft)	N/A																	
Sinuosity	1.1																	
Water Surface Slope (ft/ft)	0.004																	
BF Slope (ft/ft)	0.004																	
Rosgen Classification	DA5/E5																	
Habitat Index	NA*																	
Macrobenthos	NA*																	

*See document text for details.

Table 6a. Morphology and Hydraulic Monitoring Summary Cont. McDonalds Pond Restoration Site / EEP Project No. D04020-2																		
Parameter	Cross-Section XS4						Cross-Section XSR2						Cross-Section XS5					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	25.2						8.7						6.1					
Floodprone Width (ft)	500.0						450.0						400.0					
BF Cross Sectional Area (ft^2)	9.0						10.0						5.7					
BF Mean Depth (ft)	0.3						1.0						0.7					
BF Max Depth (ft)	0.6						1.4						0.9					
Width/Depth Ratio	93.0						9.0						9.2					
Entrenchment Ratio	19.8						51.6						65.9					
Wetted Perimeter (ft)	25.8						10.7						7.4					
Hydraulic Radius (ft)	0.4						0.9						0.8					
Substrate																		
d50 (mm)	NA*						NA*						NA*					
d84 (mm)	NA*						NA*						NA*					

Parameter	Cross-Section XSR3						Cross-Section XS6						Cross-Section XS7					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	11.5						13.4						NA*					
Floodprone Width (ft)	400.0						350.0						NA*					
BF Cross Sectional Area (ft^2)	11.6						9.9						NA*					
BF Mean Depth (ft)	1.0						0.8						NA*					
BF Max Depth (ft)	1.6						1.6						NA*					
Width/Depth Ratio	11.3						17.9						NA*					
Entrenchment Ratio	34.9						26.1						NA*					
Wetted Perimeter (ft)	13.5						14.9						NA*					
Hydraulic Radius (ft)	0.9						0.7						NA*					
Substrate																		
d50 (mm)	NA*						NA*						NA*					
d84 (mm)	NA*						NA*						NA*					

*See document text for details.

Table 6b. Morphology and Hydraulic Monitoring Summary Cont.
McDonalds Pond Restoration Site / EEP Project No. D04020-2

Parameter	Cross-Section XS8																	
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	NA*																	
Floodprone Width (ft)	NA*																	
BF Cross Sectional Area (ft^2)	NA*																	
BF Mean Depth (ft)	NA*																	
BF Max Depth (ft)	NA*																	
Width/Depth Ratio	NA*																	
Entrenchment Ratio	NA*																	
Wetted Perimeter (ft)	NA*																	
Hydraulic Radius (ft)	NA*																	
Substrate																		
d50 (mm)	NA*																	
d84 (mm)	NA*																	

*See document text for details.

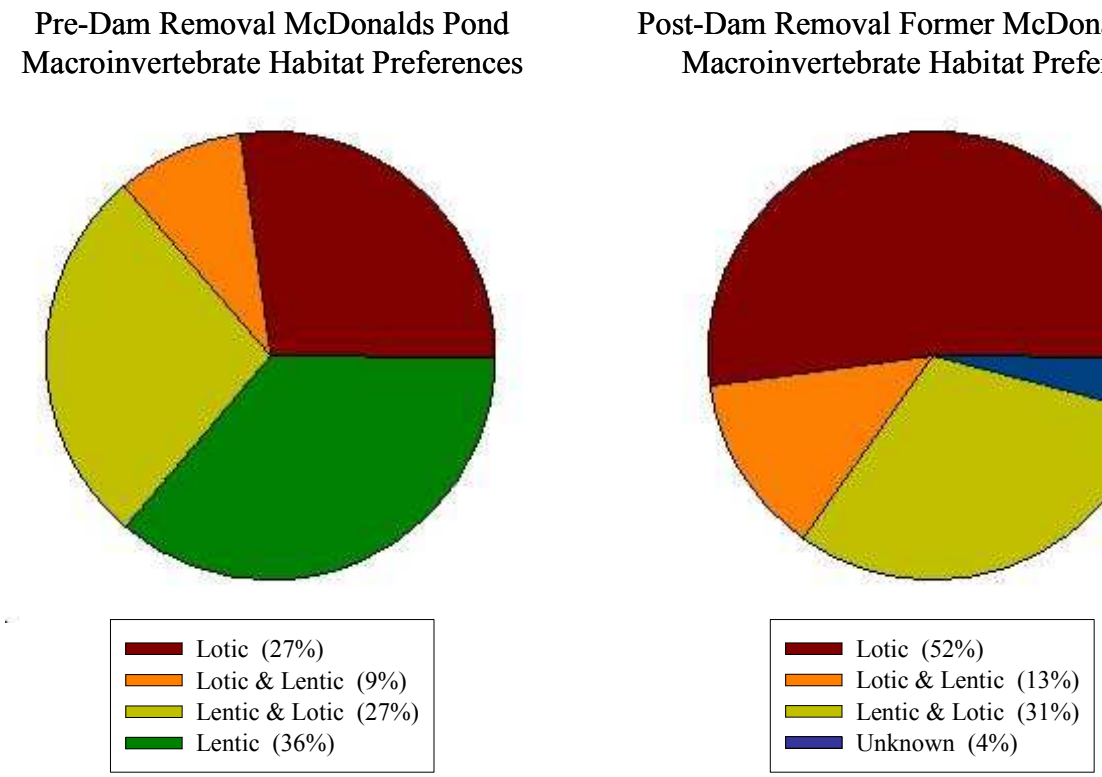
2.1.2 Aquatic Communities

Aquatic community assemblages within the former pond have shifted from a characteristic lentic system to a more historically lotic system. Fifty-two percent (52%) of the macroinvertebrate samples taken in October 2006 from restored segments of Falling Creek (within the former pond) consisted of macroinvertebrate genera predominantly found in lotic systems. Genera predominantly found in lentic systems were not present within the former pond during the October 2006 sample (Graph 1). Macroinvertebrate species richness (diversity) increased from 15 individual taxa within McDonalds Pond during baseline sampling (2004) to 35 taxa on average sampled within restored reaches of Falling Creek during first year monitoring activities (2006). In addition, sixteen (16) different EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]) taxa were collected within the restored segments of Falling Creek (within the former pond) during October 2006 as opposed to only two (2) genera of EPT taxa collected within McDonalds Pond during baseline sampling.

In general, macroinvertebrate assemblages found within the restored segments of Falling Creek (Reach 3 and Reach 2) closely resemble that of both up and downstream reference reaches (Reach 4 and Reach 1). Noticeable differences between macroinvertebrate assemblages found in on-Site versus reference reaches appear to be directly related to the amount of sunlight allowed to reach the stream and the subsequent growth of macrophytic vegetation as well as the age/stability of in-stream habitats. Compared with reference reaches, both on-Site reaches have higher occurrences of the genera *Hydropsyche* (Order – Trichoptera; Family – Hydropsychidae) and *Pseudocloeon* (Order – Ephemeroptera; Family – Baetidae) which specialize in collecting-filtering particles such as diatoms, algae, detritus, and animals while clinging to vegetation located within the stream (Merrit and Cummins 1984, Harod 1964). These genera may assist in assessing the aquatic community progression towards that of the reference reaches as the developing forest canopy begins to shade out additional sunlight and limit the growth of macrophytic vegetation.

First year aquatic community data clearly indicates an improvement in natural lotic conditions historically found within the previously impounded stream segments of Falling Creek. Baseline and Year 1 aquatic species data is provided in Appendix C.

Graph 1. Pre and Post-Dam Removal comparisons between collected benthic macroinvertebrates and their habitat preferences (Source: Merritt and Cummins 1984).



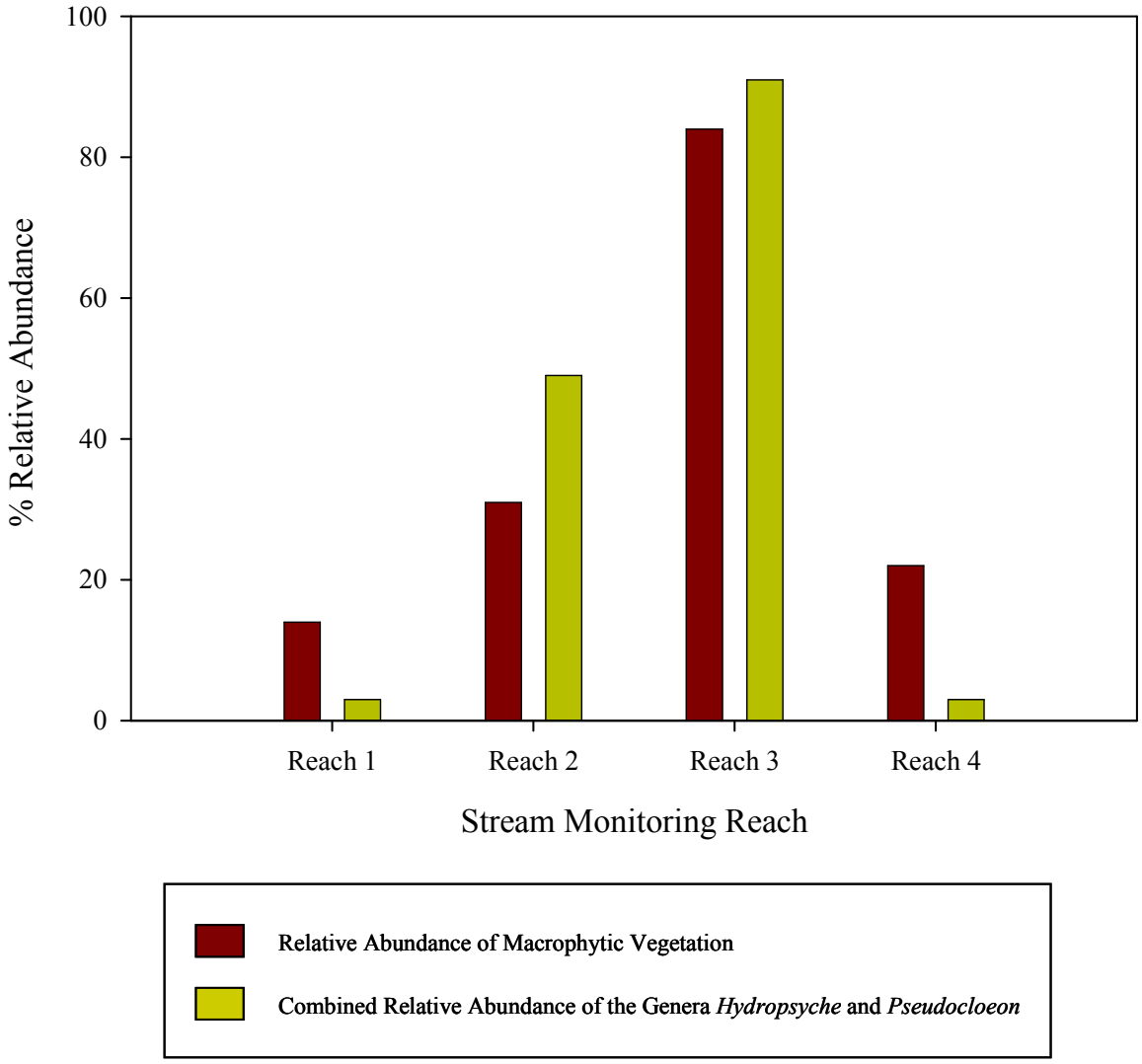
2.1.3 Habitat Assessment

North Carolina Division of Water Quality (NCDWQ) Habitat Assessment Forms (HAFs) were completed at each cross-section location across the Site (Appendix D). The scores indicate that the restored and enhanced stream segments are very similar to the reference sites but with slightly lower scores. This is primarily due to the lack of canopy trees within the former pond that would otherwise provide stream shading and allochthonous input for in-stream habitat. These scores will likely increase as the developing forest community begins to provide shading and plant material to the establishing stream systems. The HAF scores are summarized in Table 7.

Table 7. NCDWQ Habitat Assessment Form Scores McDonalds Pond Restoration Site / EEP Project No. D04020-2						
Cross-section	**Score**					
	MY1	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**
XSR1 (Reference)	98					
XSR4 (Reference)	97					
XS1	78					
XS2	80					
XS3	84					
XS4	63					
XSR2	88					
XS5	69					
XSR3	85					
XS6	65					
XS7	74					
XS8	86					

In addition, stream habitat characterizations including habitat composition and percentage representation were completed using plan-view drawings derived from total station surveys of the stream monitoring reaches (Figure 3, Appendix A). Drawings were updated in the field through visual observation and habitat composition (e.g. adjacent streambank trees, root mats/balls, stumps, coarse woody debris, leaf packs, undercut banks, etc.) was transcribed onto each drawing by hand. Drawings were digitized using GIS technology to determine rough estimates of habitat type percent representation. Graph 2 depicts the combined relative abundance of the genera *Hydropsyche* (Order – Trichoptera; Family – Hydropsychidae) and *Pseudocloeon* (Order – Ephemeroptera; Family – Baetidae) at all four (4) reaches as well as the relative prevalence of macrophytic vegetation within the channel at each reach. These data appear to be related and may serve as an indicator for assessing the on-Site aquatic communities as they progress more toward that of the reference reaches.

Graph 2. Combined relative abundance of the genera *Hydropsyche* and *Pseudocloeon* and prevalence of macrophytic vegetation within each monitoring reach.



2.2 WETLAND ASSESSMENT

2.2.1 Vegetation Assessment

Eight (8) 10 x 10 meter plots were located and the corners marked with metal fence posts painted orange (Figure 4, Appendix A). Vegetation plots were sampled in accordance with the Carolina Vegetation Survey Protocol. Planted stems (woody) were marked with flagging and the species, height, diameter, vigor and coordinate location within each plot was recorded. Volunteer species where noted and placed into height classes. The Site is currently meeting the established success criteria for vegetation based on the survival of the planted species with nearly one hundred percent (100%) survival (only one planted stem lost within Site vegetation monitoring plots). An inventory of planted stems is given in Table 8. A tally of volunteer woody species is listed in Table 8a. Vegetation plot photography is provided in Appendix E.

Table 8: Stem Counts for Planted Species Arranged by Plot McDonalds Pond Restoration Site / EEP Project No. D04020-2											
Species	**Plots**								**Initial Totals**	**Year 1 Totals**	**Survival %**
	1	2	3	4	5	6	7	8			
Trees											
Chamaecyparis thyoides	4	4	3	2	2	7	7	4	32	31	97
Liriodendron tulipifera	2	0	1	0	0	2	0	1	6	6	100
Magnolia virginiana	0	6	3	0	0	1	0	0	10	10	100
Nyssa biflora	4	6	3	6	0	2	6	2	29	29	100
Persea borbonia	0	0	0	0	0	0	1	0	1	1	100
Pinus serotina	3	3	4	1	9	2	3	7	32	32	100
Pinus teada	1	2	0	3	0	0	0	6	12	12	100

Table 8a: Stem Counts for Volunteer Species Arranged by Plot McDonalds Pond Restoration Site / EEP Project No. D04020-2									
Species	**Plots**								**Year 1 Totals**
	1	2	3	4	5	6	7	8	
Trees									
Acer rubrum	1	0	1	0	0	0	0	10	12
Cyrilla racemifllora	0	0	1	0	0	0	0	0	1
Liriodendron tulipifera	0	0	0	0	1	13	0	0	14
Magnolia virginiana	0	0	1	0	0	1	0	0	2
Pinus serotina	0	14	51	3	12	18	0	7	105
Salix nigra	0	4	0	0	0	0	3	0	7
Shrubs									
Clethra alnifolia	0	0	0	0	0	0	0	1	1
Kalmia angustifolia	0	0	0	0	0	1	0	0	1
Baccharis halimifolia	0	0	0	0	0	1	0	0	1

2.2.2 Groundwater Hydrology

All four (4) groundwater gauges located on-Site are currently meeting the wetland hydrologic success criteria. Groundwater levels were recorded within the upper 12 inches of the soil surface for approximately 98 consecutive days corresponding to approximately 43 percent of the growing season [March 27th – November 5th] in Richmond County (NRCS 1999). Groundwater gauge locations are depicted in Figure 5 (Appendix A). Groundwater gauge hydrographs are plotted on Figure F1 (Appendix F).

2.2.3 Wetland Criteria Attainment

Table 9: Wetland Criteria Attainment McDonalds Pond Restoration Site / EEP Project No. D04020-2			
GaugeID	**Gauge Hydrology Threshold Met?**	**Vegetation Plot ID**	**Vegetation Survival Threshold Met?**
Gauge1	Y	1	Y
		2	Y
Gauge2	Y	3	Y
		4	Y
Gauge3	Y	5	Y
		6	Y
Gauge4	Y	7	Y
		8	Y

3.0 REFERENCES

Harod, J.J. 1964. The Distribution of Invertebrates on Submerged Aquatic Plants in a Chalk Stream. Journal of Animal Ecology. Vol. 33, No. 2. (June 1964), pp. 335-348.

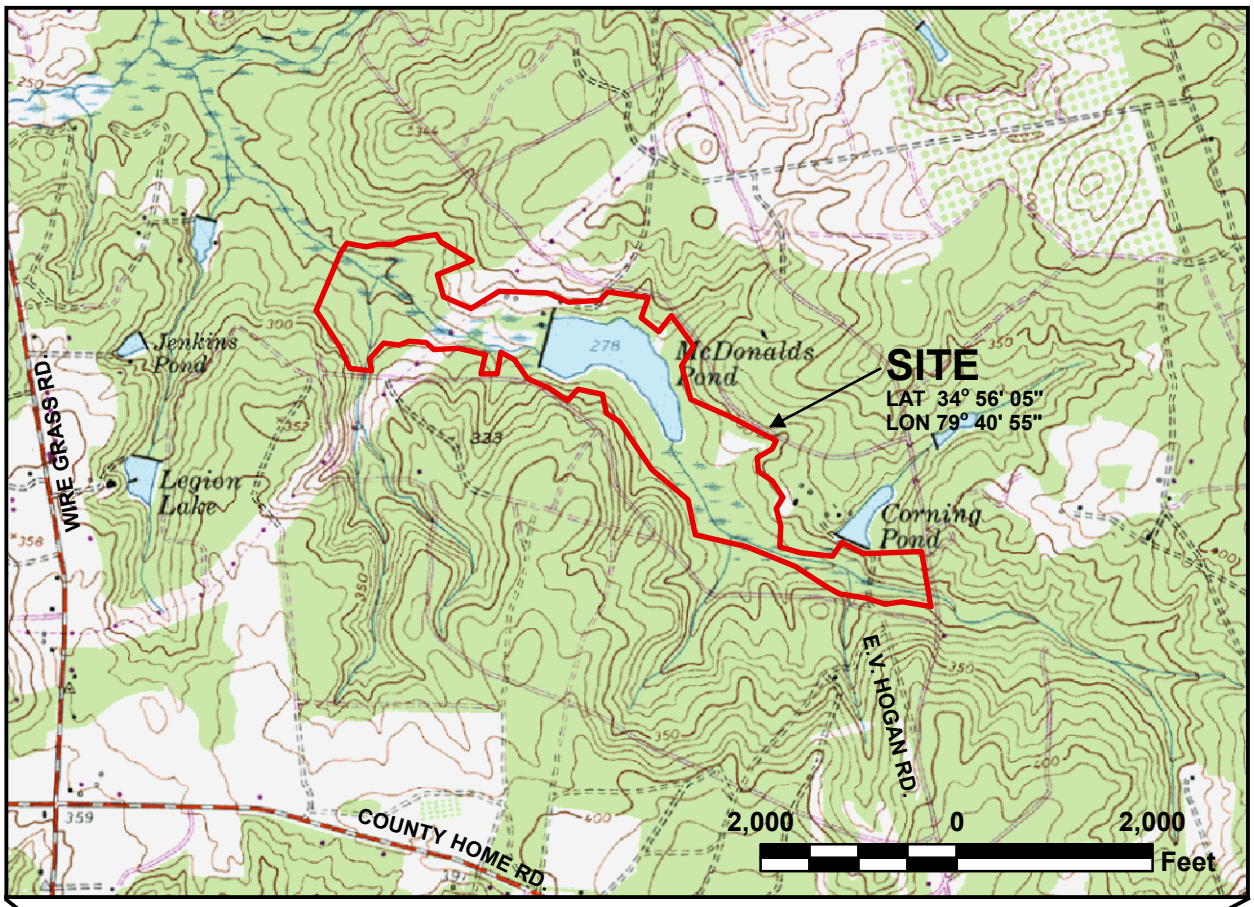
Merritt, R.W. and K.W. Cummins. 1984. An Introduction to the Aquatic Insects of North America. Kendall-Hunt Publ.

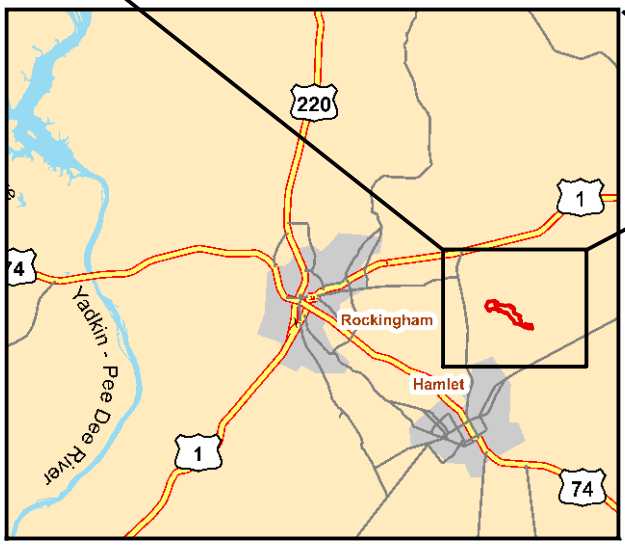
Natural Resources Conservation Service (NRCS). 1999. Soil Survey of Richmond County, North Carolina. United States Department of Agriculture.

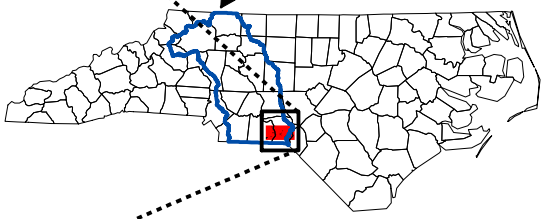
Rosgen, D. 1994. Applied Fluvial Geomorphology. Wildland Hydrology: Pagosa Springs, CO.

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

APPENDIX A: FIGURES







NAD 83

INTERNATIONAL PAPER

EcoScience Corporation
Raleigh, North Carolina

Client: Ecosystem Enhancement Program

Project:

SITE LOCATION MAP

McDONALDS POND RESTORATION SITE

EEP Project No. D04020-2

RICHMOND COUNTY, NORTH CAROLINA

Dwn By:	Ckd By:
DGJ	JWG

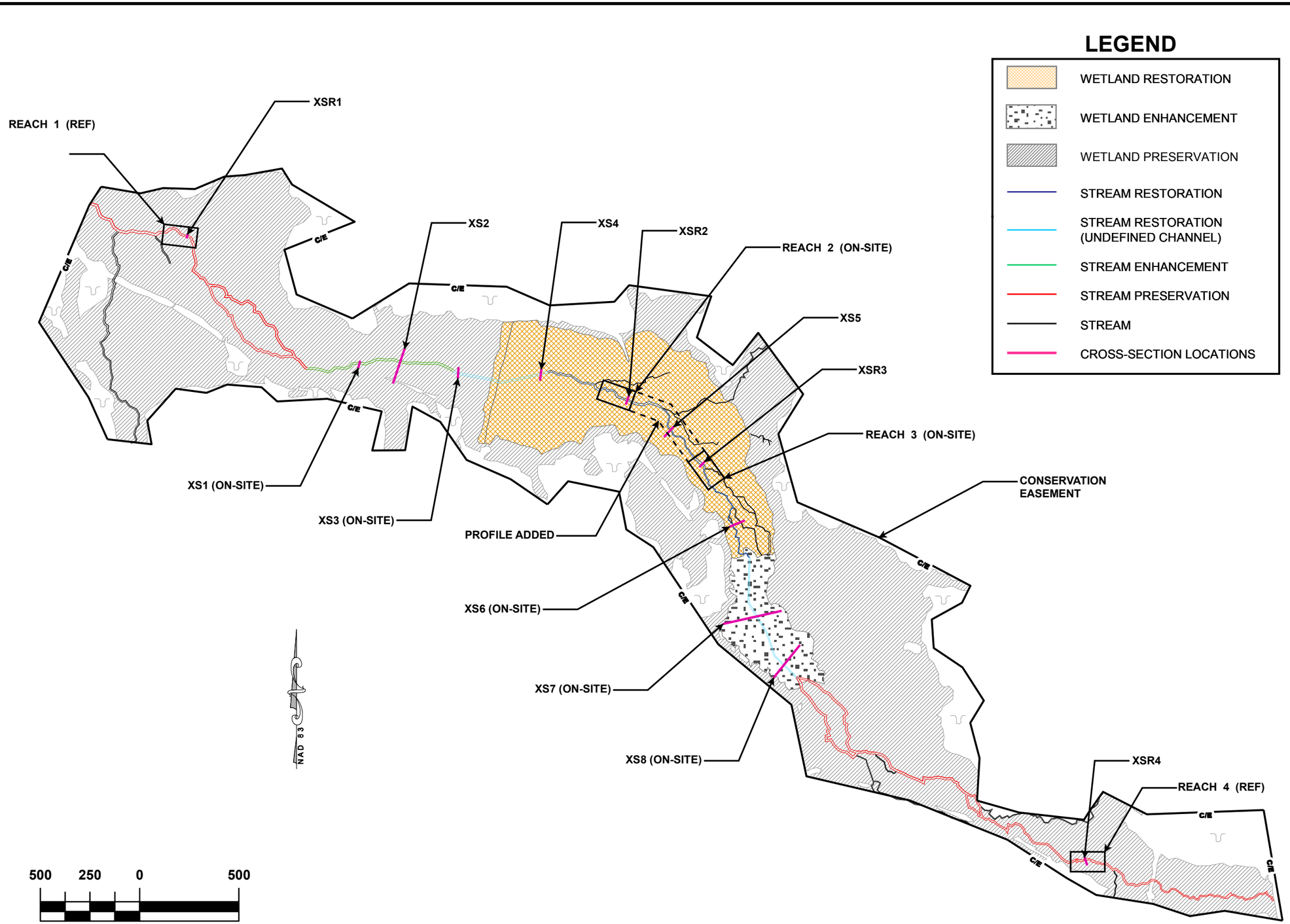
Date: DEC 2006

Scale: AS SHOWN

ESC Project No. 06-311.00

FIGURE

1



EcoScience Corporation
Raleigh, North Carolina

REVISIONS

INTERNATIONAL PAPER

Client:
Ecosystem Enhancement Program

Project:

McDONALDS POND MONITORING PLAN

RICHMOND COUNTY, NORTH CAROLINA

Title:

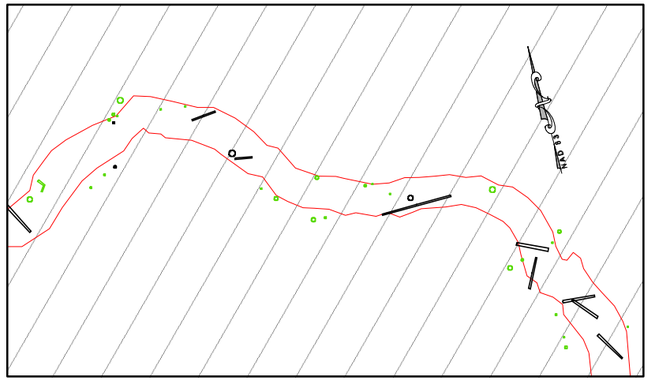
STREAM MONITORING PLAN

Dwn By:	Date:
DGJ	DEC 2006
Ckd By:	Scale:
JWG	AS SHOWN

ESC Project No.: 06-311.00

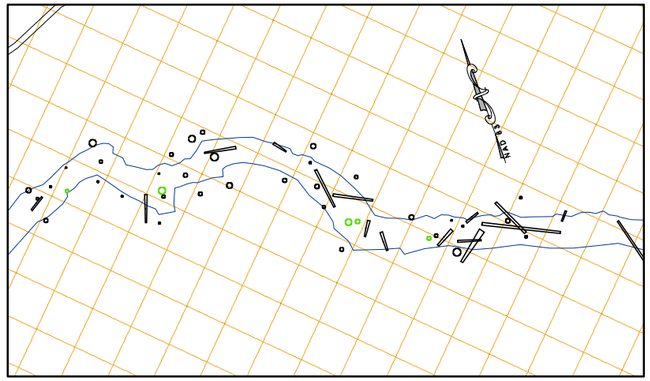
FIGURE

2



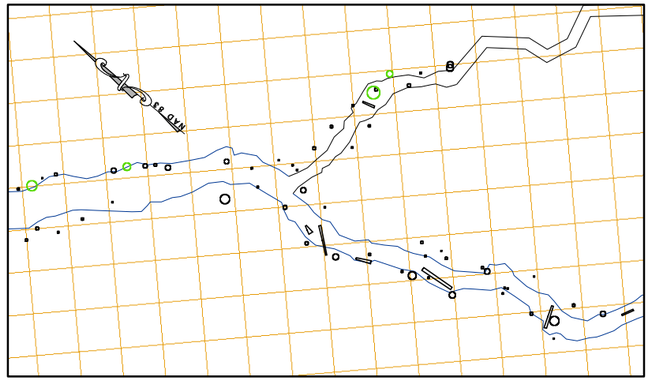
REACH 1 (REF)

1" = 40'



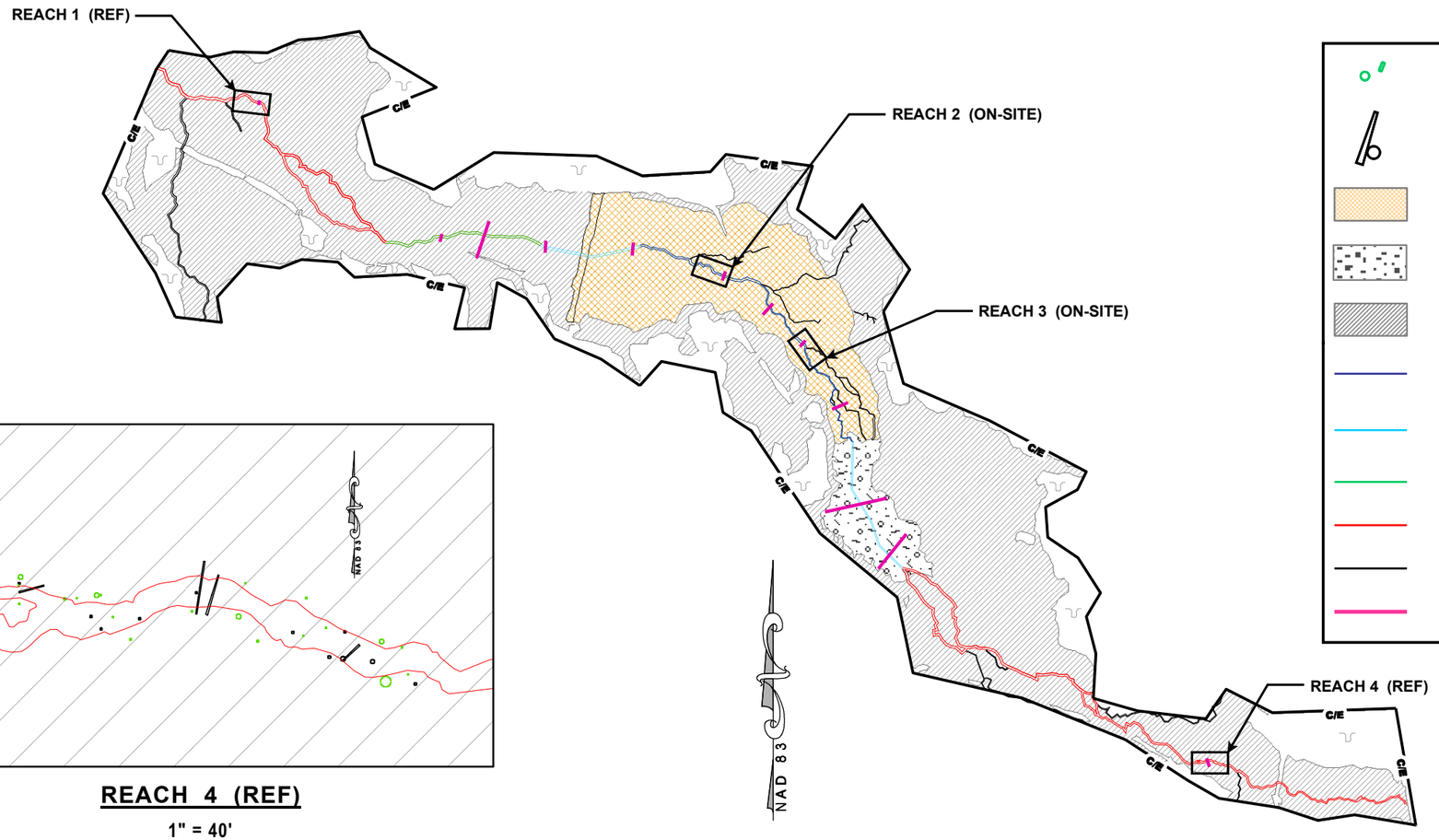
REACH 2 (ON-SITE)

1" = 40'



REACH 3 (ON-SITE)

1" = 40'



LEGEND

- TREE / ROOT
- STUMP / LOG
- WETLAND RESTORATION
- WETLAND ENHANCEMENT
- WETLAND PRESERVATION
- STREAM RESTORATION
- STREAM RESTORATION (UNDEFINED CHANNEL)
- STREAM ENHANCEMENT
- STREAM PRESERVATION
- STREAM
- CROSS-SECTION LOCATIONS

REACH 4 (REF)

1" = 40'

EcoScience Corporation
Raleigh, North Carolina

REVISIONS

INTERNATIONAL PAPER

Client: Ecosystem Enhancement Program

Project:

McDONALDS POND MONITORING PLAN

RICHMOND COUNTY, NORTH CAROLINA

Title:

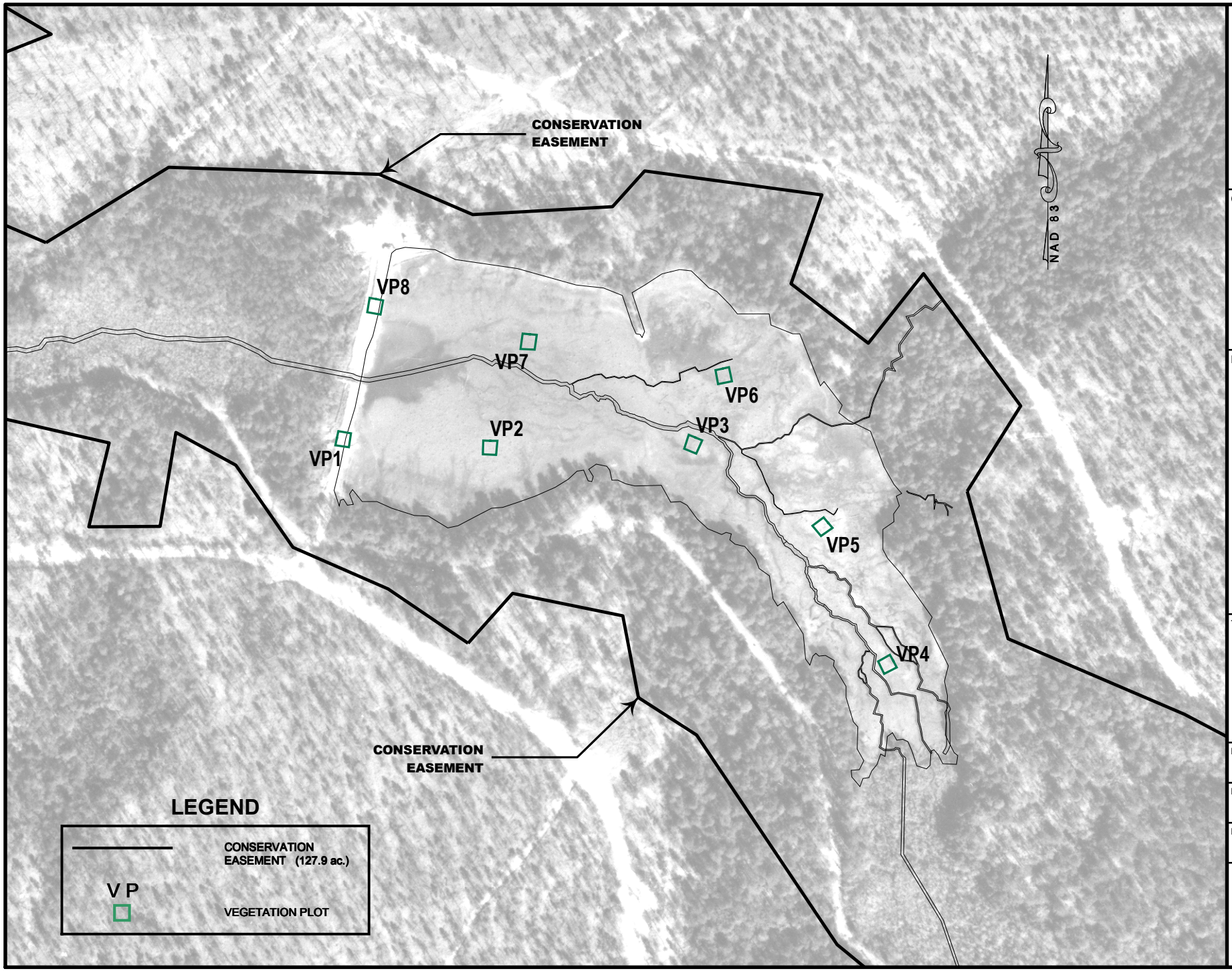
MONITORING REACH HABITAT PLAN-VIEWS

Dwn By:	Date:
DGJ	DEC 2006
Ckd By:	Scale:
JWG	AS SHOWN

ESC Project No.: 06-311.00

FIGURE

3



EcoScience Corporation
Raleigh, North Carolina

INTERNATIONAL PAPER

CLIENT:

Ecosystem Enhancement Program

PROJECT:

McDONALDS POND RESTORATION SITE

RICHMOND COUNTY, NORTH CAROLINA

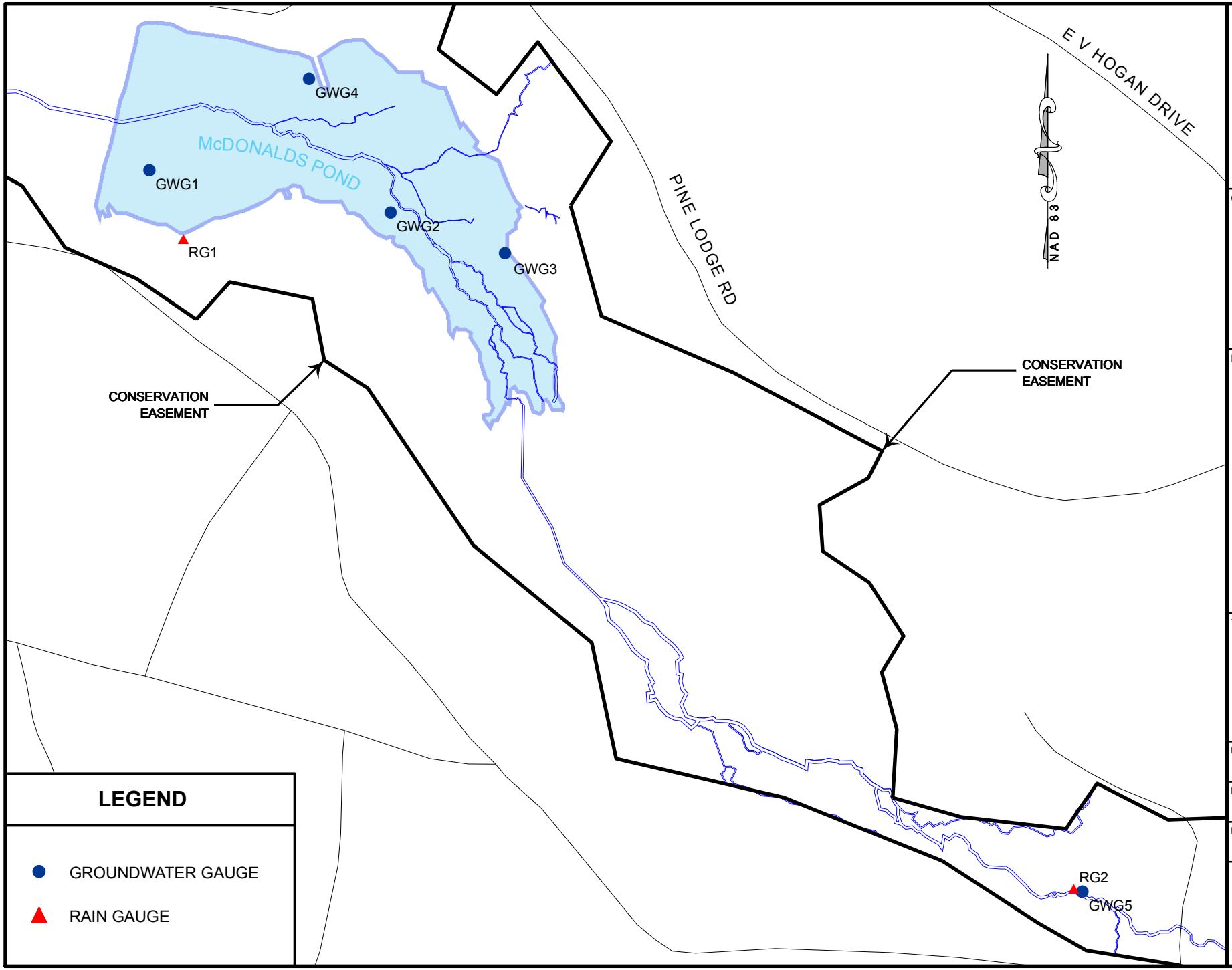
TITLE:

VEGETATION MONITORING PLOTS

Dwn By:	
DGJ	JWG
Date:	Scale:
DEC 2006	1" = 300'

ESC Project No.
06-311.00

FIGURE
4



EcoScience Corporation
Raleigh, North Carolina

INTERNATIONAL PAPER

CLIENT:

Ecosystem Enhancement Program

PROJECT:

McDONALDS POND RESTORATION SITE

RICHMOND COUNTY, NORTH CAROLINA

TITLE:

MONITORING GAUGES

Dwn By:	Ckd By:
DGJ	JWG
Date:	Scale:
DEC 2006	1" = 300'

ESC Project No.
06-311.00

FIGURE
5

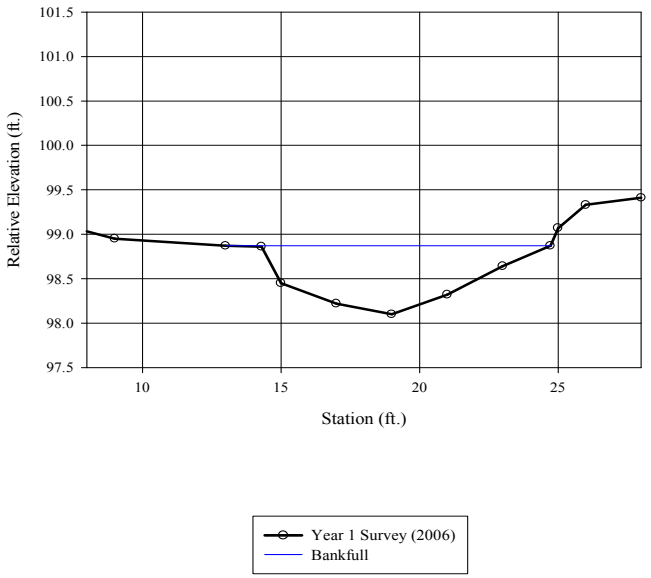
APPENDIX B: STREAM GEOMORPHOLOGY DATA

Survey Data		
Station	**Elevation**	**Feature**
0.0	99.46	BLPIN
2.0	99.63	
4.0	99.54	
6.0	99.2	
9.0	98.95	
13.0	98.87	LTOB
14.3	98.86	
15.0	98.45	
17.0	98.22	
19.0	98.1	
21.0	98.32	
23.0	98.64	
24.7	98.87	RTOB
25.0	99.07	
26.0	99.33	
28.0	99.41	
30.3	99.65	
33.0	99.48	
35.6	99.35	BRPIN

Summary Data	
BF Cross Sectional Area	6.4 sq. ft.
BF Width	11.7 ft.
BF Mean Depth	0.4 ft.
BF Max Depth	0.8 ft.
Width/Depth Ratio	31.0
Entrenchment Ratio	34.1
Classification	DA5/E5

Cross-Section XS1 - Pool

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Project	McDonalds Pond Restoration Site	**Project #**	D04020-2
	Richmond County, North Carolina	**Figure**	B-1

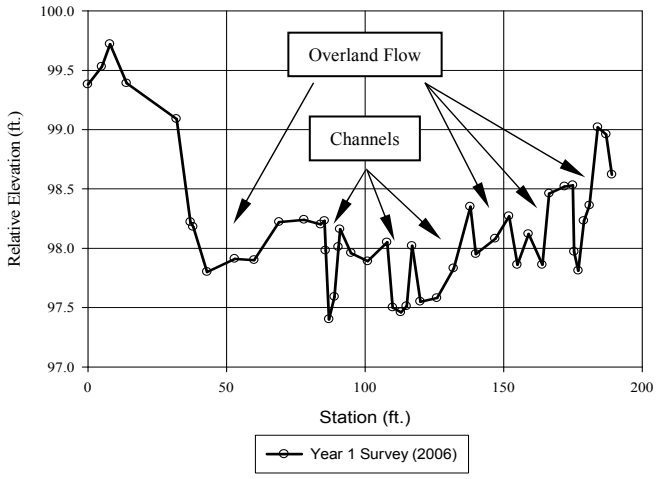
Survey Date	**Survey Weather**	**Field Team**	**Location**
Oct-06	Sunny	Jones, Andrews, Wright	XS1

Cross-Section XS2 - Braided Channels

Survey Data		
Station	Elevation	Feature
0.0	99.38	BLPIN
5.0	99.53	
8.0	99.72	
14.0	99.39	
32.0	99.09	
37.0	98.22	
38.0	98.18	
43.0	97.8	
53.0	97.91	
60.0	97.9	
69.0	98.22	
78.0	98.24	
84.0	98.2	
85.4	98.23	
85.8	97.98	
87.0	97.4	
89.0	97.59	
90.4	98.01	
91.0	98.16	
95.0	97.96	
101.0	97.89	
108.0	98.05	
110.0	97.5	

Survey Data Cont.					
Station	Elevation	Feature	Station	Elevation	Feature
113.0	97.46		164.0	97.86	
115.0	97.51		166.5	98.46	
117.0	98.02		172.0	98.52	
120.0	97.55		175.0	98.53	
126.0	97.58		175.5	97.97	
132.0	97.83		177.0	97.81	
138.0	98.35		179.0	98.23	
140.0	97.95		181.0	98.36	
147.0	98.08		184.0	99.02	
152.0	98.27		187.0	98.96	
155.0	97.86		189.1	98.62	BRPIN
159.0	98.12				

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Summary Data	
BF Cross Sectional Area	NA*
BF Width	NA*
BF Mean Depth	NA*
BF Max Depth	NA*
Width/Depth Ratio	NA*
Entrenchment Ratio	NA*
Classification	DA5

Project	McDonalds Pond Restoration Site	Project #	D04020-2
	Richmond County, North Carolina	Figure	B-2

Survey Date	Survey Weather	Field Team	Location
Oct-06	Sunny	Jones, Andrews, Wright	XS2

*See document text for details.

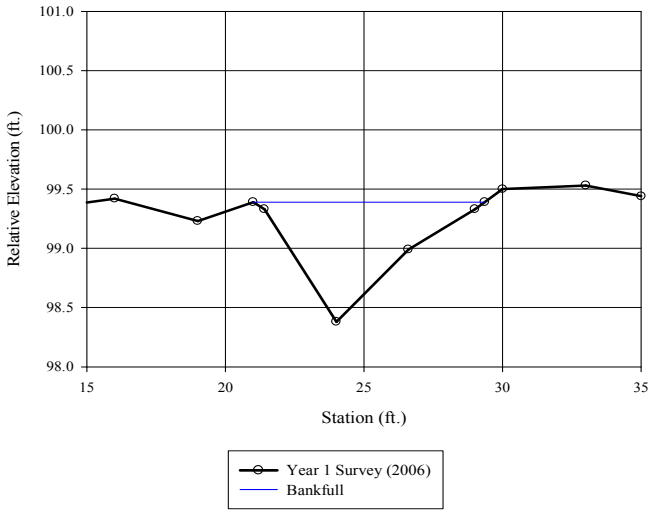
Cross-Section XS3 - Riffle

Survey Data		
Station	Elevation	Feature
0.0	99.23	BLPIN
1.0	99.34	
3.0	99.27	
6.0	99.29	
7.0	99.43	
9.0	99.32	
13.0	99.32	
16.0	99.42	
19.0	99.23	
21.0	99.39	LTOB
21.4	99.33	
24.0	98.38	
26.6	98.99	
29.0	99.33	
29.4	99.39	RTOB
30.0	99.5	
33.0	99.53	
35.0	99.44	
37.0	99.37	
39.0	99.19	
41.0	99.01	
42.0	99.09	
44.0	99.15	

Summary Data	
BF Cross Sectional Area	6.2 sq. ft.
BF Width	8.4 ft.
BF Mean Depth	0.4 ft.
BF Max Depth	1.0 ft.
Width/Depth Ratio	21.8
Entrenchment Ratio	47.9
Classification	DA5/E5

Survey Data Cont.					
Station	Elevation	Feature	Station	Elevation	Feature
46.0	99.09		56.0	99.34	
48.0	98.99		58.0	99.65	
50.0	99.23		60.0	99.4	
51.5	99.23		62.4	99.72	BRPIN
53.0	99.26				

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Project	McDonalds Pond Restoration Site	Project #	D04020-2
	Richmond County, North Carolina	Figure	B-3

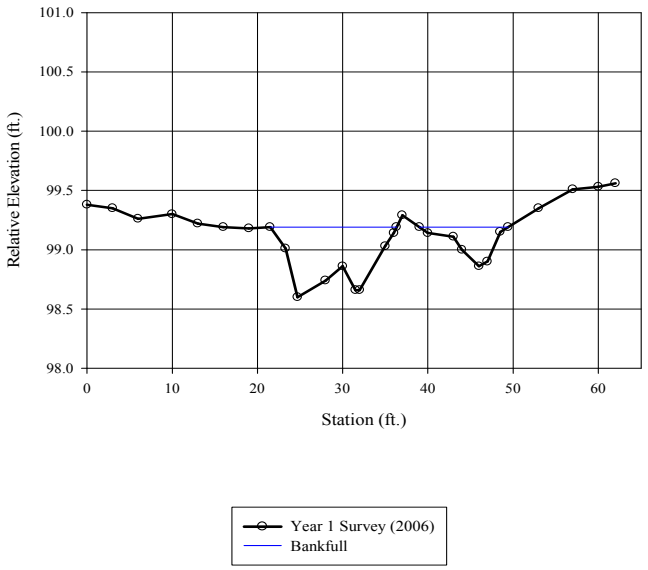
Survey Date	Survey Weather	Field Team	Location
Oct-06	Sunny	Jones, Andrews, Wright	XS3

Cross-Section XS4 - Riffle

Survey Data		
Station	**Elevation**	**Feature**
0.0	99.38	BLPIN
3.0	99.35	
6.0	99.26	
10.0	99.3	
13.0	99.22	
16.0	99.19	
19.0	99.18	
21.5	99.19	LTOB
23.3	99.01	
24.7	98.6	
28.0	98.74	
30.0	98.86	
31.5	98.66	
32.0	98.66	
35.0	99.03	
36.0	99.14	
36.3	99.19	RTOB
37.0	99.29	
39.0	99.19	LTOB
40.0	99.14	
43.0	99.11	
44.0	99	
46.0	98.86	

Survey Data Cont.					
Station	**Elevation**	**Feature**	**Station**	**Elevation**	**Feature**
47.0	98.9		57.0	99.51	XS
48.5	99.15		60.0	99.53	XS
49.4	99.19	RTOB	62.0	99.56	BRPIN
53.0	99.35				

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Summary Data	
BF Cross Sectional Area	9.0 sq. ft.
BF Width	25.2 ft.
BF Mean Depth	0.3 ft.
BF Max Depth	0.6 ft.
Width/Depth Ratio	93.0
Entrenchment Ratio	19.8
Classification	DA5/E5

Project	McDonalds Pond Restoration Site	**Project #**	D04020-2
	Richmond County, North Carolina	**Figure**	B-4

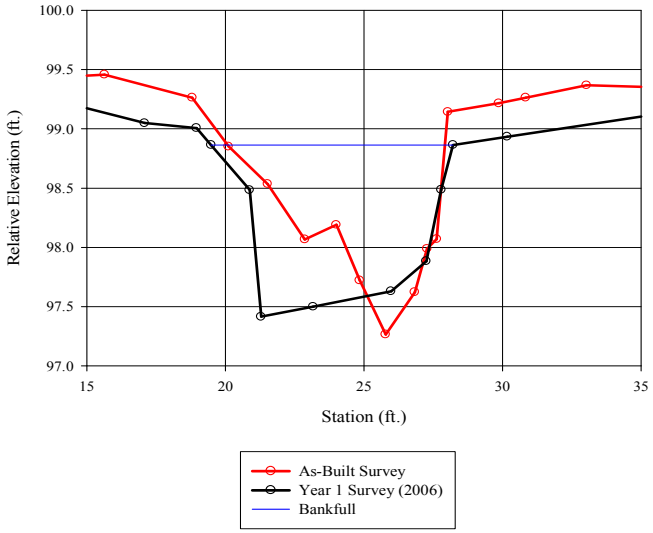
Survey Date	**Survey Weather**	**Field Team**	**Location**
Oct-06	Sunny	Jones, Andrews, Wright	XS4

Survey Data		
Station	**Elevation**	**Feature**
0.0	99.34	BLPIN
3.5	99.34	
9.1	99.38	
15.6	99.46	
18.8	99.26	LTOB
20.1	98.85	
21.5	98.53	
22.9	98.07	
24.0	98.19	
24.8	97.72	
25.8	97.27	
26.8	97.62	
27.3	97.99	
27.6	98.07	
28.0	99.14	
29.9	99.22	
30.8	99.26	RTOB
33.0	99.37	
37.6	99.34	
43.8	99.25	
46.1	99.26	BRPIN

Summary Data	
BF Cross Sectional Area	10.0 sq. ft.
BF Width	8.7 ft.
BF Mean Depth	1.0 ft.
BF Max Depth	1.4 ft.
Width/Depth Ratio	9.0
Entrenchment Ratio	51.6
Classification	E5

Cross-Section XSR2 - Riffle

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Project	McDonalds Pond Restoration Site	**Project #**	D04020-2
	Richmond County, North Carolina	**Figure**	B-5

Survey Date	**Survey Weather**	**Field Team**	**Location**
Oct-06	Sunny	Jones, Gloden	XSR2

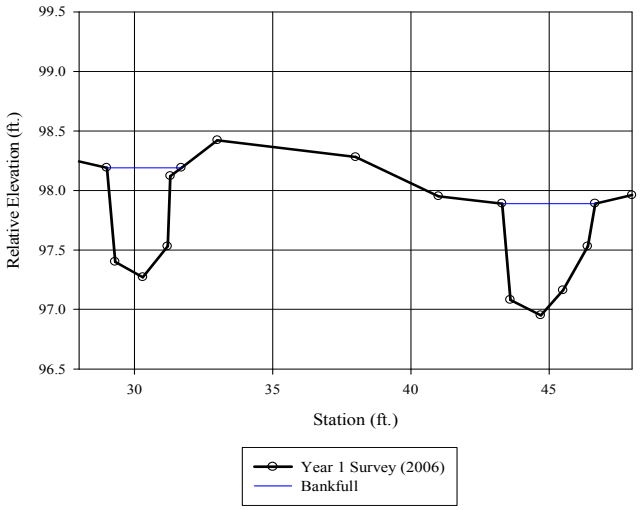
Cross-Section XS5 - Pool

Survey Data		
Station	**Elevation**	**Feature**
0.0	99.42	BLPIN
4.0	99.26	
9.0	99.01	
14.0	98.85	
19.0	98.87	
21.0	98.8	
23.0	98.68	
25.0	98.42	
27.0	98.3	
29.0	98.19	LTOB
29.3	97.4	
30.3	97.27	
31.2	97.53	
31.3	98.12	
31.7	98.19	RTOB
33.0	98.42	
38.0	98.28	
41.0	97.95	
43.3	97.89	LTOB
43.6	97.08	
44.7	96.95	
45.5	97.16	
46.4	97.53	

Summary Data	
BF Cross Sectional Area	5.7 sq. ft.
BF Width	6.1 ft.
BF Mean Depth	0.7 ft.
BF Max Depth	0.9 ft.
Width/Depth Ratio	9.2
Entrenchment Ratio	65.9
Classification	DA5/E5

Survey Data Cont.					
Station	**Elevation**	**Feature**	**Station**	**Elevation**	**Feature**
46.7	97.89	RTOB	57.0	98.59	
48.0	97.96		61.0	98.52	
50.0	98.5		69.0	98.48	
52.0	98.78		72.0	98.48	BRPIN
53.0	98.65				

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Project	McDonalds Pond Restoration Site	**Project #**	D04020-2
	Richmond County, North Carolina	**Figure**	B-6

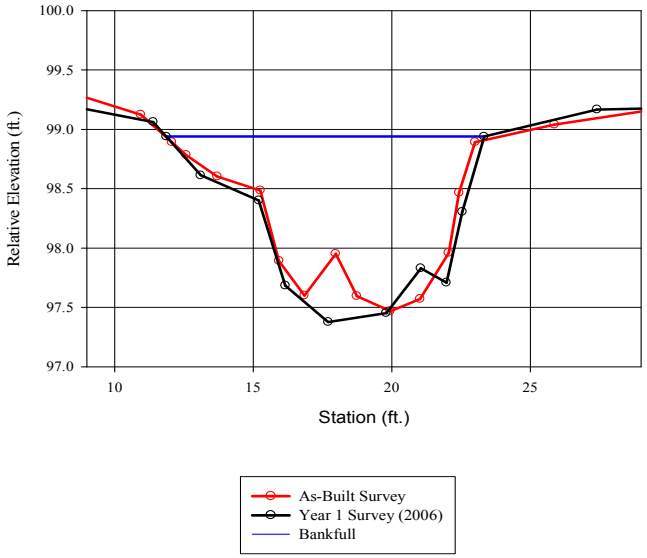
Survey Date	**Survey Weather**	**Field Team**	**Location**
Oct-06	Sunny	Jones, Andrews, Wright	XS5

Survey Data		
Station	**Elevation**	**Feature**
0.0	99.19	BLPIN
3.6	99.30	
7.4	99.39	
10.9	99.12	
12.1	98.89	LTOB
12.6	98.79	
13.7	98.60	
15.3	98.49	
15.9	97.89	
16.9	97.60	
18.0	97.95	
18.7	97.60	
20.0	97.47	
21.0	97.57	
22.1	97.96	
22.4	98.47	
23.0	98.89	RTOB
25.9	99.04	
30.9	99.22	
32.5	99.33	
33.7	99.20	
37.9	99.18	BRPIN

Summary Data	
BF Cross Sectional Area	11.6 sq. ft.
BF Width	11.5 ft.
BF Mean Depth	1.0 ft.
BF Max Depth	1.6 ft.
Width/Depth Ratio	11.3
Entrenchment Ratio	34.9
Classification	E5

Cross-Section XSR3 - Riffle

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Project	McDonalds Pond Restoration Site	**Project #**	D04020-2
	Richmond County, North Carolina	**Figure**	B-7

Survey Date	**Survey Weather**	**Field Team**	**Location**
Oct-06	Sunny	Jones, Gloden	XSR3

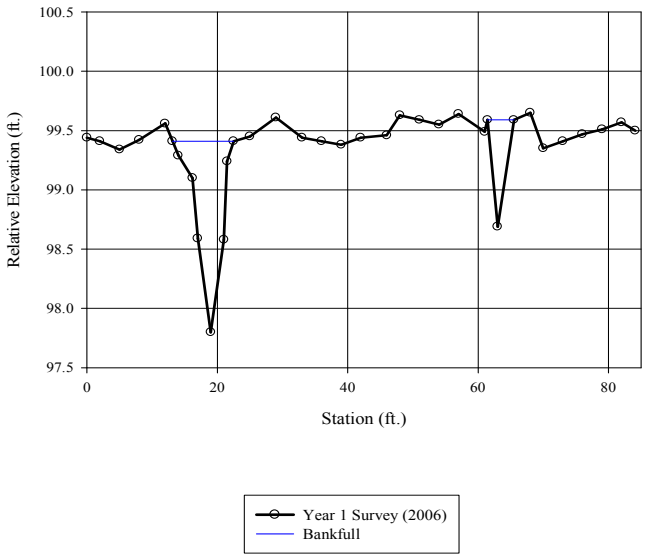
Cross-Section XS6 - Pool

Survey Data		
Station	**Elevation**	**Feature**
0.0	99.44	BLPIN
2.0	99.41	
5.0	99.34	
8.0	99.42	
12.0	99.56	
13.1	99.41	LTOB
14.0	99.29	
16.2	99.1	
17.0	98.59	
19.0	97.8	
21.0	98.58	
21.5	99.24	
22.5	99.41	RTOB
25.0	99.45	
29.0	99.61	
33.0	99.44	
36.0	99.41	
39.0	99.38	
42.0	99.44	
46.0	99.46	
48.0	99.63	
51.0	99.59	
54.0	99.55	

Summary Data	
BF Cross Sectional Area	9.9 sq. ft.
BF Width	13.4 ft.
BF Mean Depth	0.8 ft.
BF Max Depth	1.6 ft.
Width/Depth Ratio	17.9
Entrenchment Ratio	26.0
Classification	DA5/E5

Survey Data Cont.					
Station	**Elevation**	**Feature**	**Station**	**Elevation**	**Feature**
57.0	99.64		70.0	99.35	
61.0	99.49		73.0	99.41	
61.5	99.59	LTOB	76.0	99.47	
63.0	98.69		79.0	99.51	
65.5	99.59	RTOB	82.0	99.57	
68.0	99.65		84.1	99.5	BRPIN

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

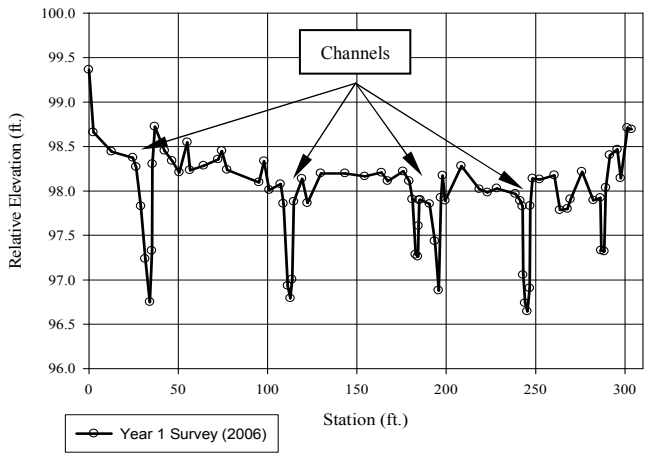
Project	McDonalds Pond Restoration Site	**Project #**	D04020-2
	Richmond County, North Carolina	**Figure**	B-8

Survey Date	**Survey Weather**	**Field Team**	**Location**
Oct-06	Sunny	Jones, Andrews, Wright	XS6

Survey Data			Cross-Section XS7 - Braided Channels					
Station	Elevation	Feature	Survey Data Cont.					
			Station	Elevation	Feature	Station	Elevation	Feature
0.0	99.36	BLPIN	107.3	98.08		228.4	98.03	
2.6	98.66		109.0	97.86		238.8	97.97	
12.8	98.44		111.3	96.93		241.4	97.89	
24.6	98.37		112.8	96.79		242.7	97.83	
26.4	98.27		113.8	97.00		243.0	97.05	
29.1	97.83		114.7	97.88		244.1	96.74	
31.6	97.23		119.3	98.14		245.4	96.64	
34.2	96.75		122.4	97.86		246.7	96.91	
35.3	97.33		129.9	98.20		247.0	97.83	
35.6	98.30		143.5	98.20		248.4	98.14	
37.0	98.72		154.5	98.16		252.3	98.13	
42.3	98.45		163.8	98.20		260.5	98.18	
46.7	98.34		167.3	98.11		263.7	97.78	
50.6	98.21		175.9	98.22		267.9	97.80	
55.1	98.55		179.3	98.11		269.6	97.90	
56.7	98.23		181.1	97.91		276.0	98.22	
64.3	98.28		182.9	97.28		282.4	97.89	
72.5	98.35		184.1	97.26		286.3	97.92	
74.5	98.45		184.6	97.61		286.8	97.33	
77.4	98.24		184.9	97.90		288.5	97.32	
95.2	98.10		185.5	97.90		289.3	98.04	
98.1	98.33		190.7	97.85		291.6	98.40	
100.9	98.01		193.6	97.44		295.9	98.46	
			195.8	96.88		297.7	98.14	
			197.0	97.92		301.4	98.71	
			198.0	98.17		303.7	98.69	BRPIN
			199.4	97.89				
			208.5	98.28				
			218.6	98.02				
			223.1	97.98				

Summary Data	
BF Cross Sectional Area	NA*
BF Width	NA*
BF Mean Depth	NA*
BF Max Depth	NA*
Width/Depth Ratio	NA*
Entrenchment Ratio	NA*
Classification	DA5

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Project	McDonalds Pond Restoration Site	Project #	D04020-2
	Richmond County, North Carolina	Figure	B-9

Survey Date	Survey Weather	Field Team	Location
Oct-06	Sunny	Jones, Gloden	XS7

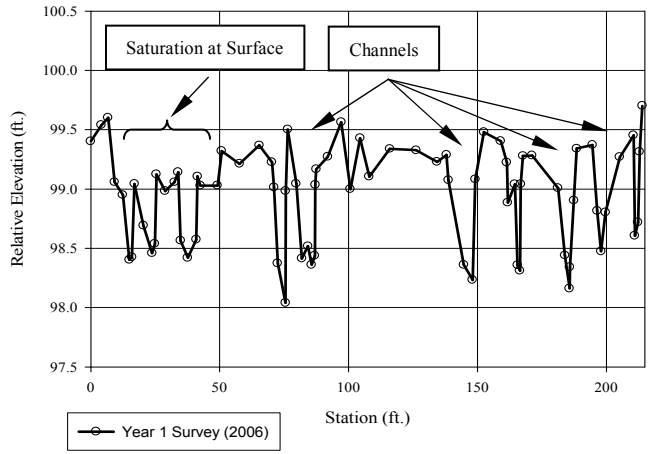
*See document text for details.

Survey Data			Cross-Section XS8 - Braided Channels					
Station	Elevation	Feature	Survey Data Cont.					
			Station	Elevation	Feature	Station	Elevation	Feature
0.0	99.40	BLPIN	65.4	99.37		161.8	98.88	
4.1	99.54		70.3	99.23		164.6	99.04	
6.7	99.60		71.1	99.01		165.6	98.36	
9.3	99.06		72.5	98.37		166.5	98.31	
12.5	98.95		75.6	98.04		166.8	99.04	
15.0	98.40		75.6	98.98		167.7	99.28	
16.0	98.42		76.4	99.50		171.2	99.28	
17.0	99.04		79.8	99.04		181.3	99.01	
20.4	98.69		81.9	98.41		184.0	98.44	
23.8	98.46		84.3	98.52		185.8	98.16	
24.9	98.54		85.7	98.36		185.9	98.34	
25.5	99.12		86.9	98.44		187.4	98.90	
28.9	98.98		87.2	99.03		188.5	99.34	
32.5	99.06		87.5	99.17		194.6	99.37	
34.0	99.14		91.9	99.27		196.5	98.81	
34.9	98.56		97.2	99.56		198.0	98.47	
37.7	98.42		100.7	99.00		199.7	98.80	
41.0	98.57		104.5	99.43		205.2	99.27	
41.4	99.11		108.1	99.11		210.6	99.45	
42.6	99.03		116.0	99.34		211.1	98.61	
49.2	99.03		126.2	99.33		212.3	98.72	
50.9	99.32		134.3	99.23		212.9	99.31	
57.7	99.21		138.0	99.29		214.0	99.70	BRPIN

Summary Data	
BF Cross Sectional Area	NA*
BF Width	NA*
BF Mean Depth	NA*
BF Max Depth	NA*
Width/Depth Ratio	NA*
Entrenchment Ratio	NA*
Classification	DA5

138.8	99.08			
144.7	98.36			
148.1	98.23			
149.2	99.08			
152.6	99.48			
159.1	99.40			
161.4	99.22			

Cross-Section Plot - Looking Downstream



Cross-Section Photo - Looking Dowstream

Project	McDonalds Pond Restoration Site	Project #	D04020-2
	Richmond County, North Carolina	Figure	B-10

Survey Date	Survey Weather	Field Team	Location
Oct-06	Sunny	Jones, Gloden	XS8

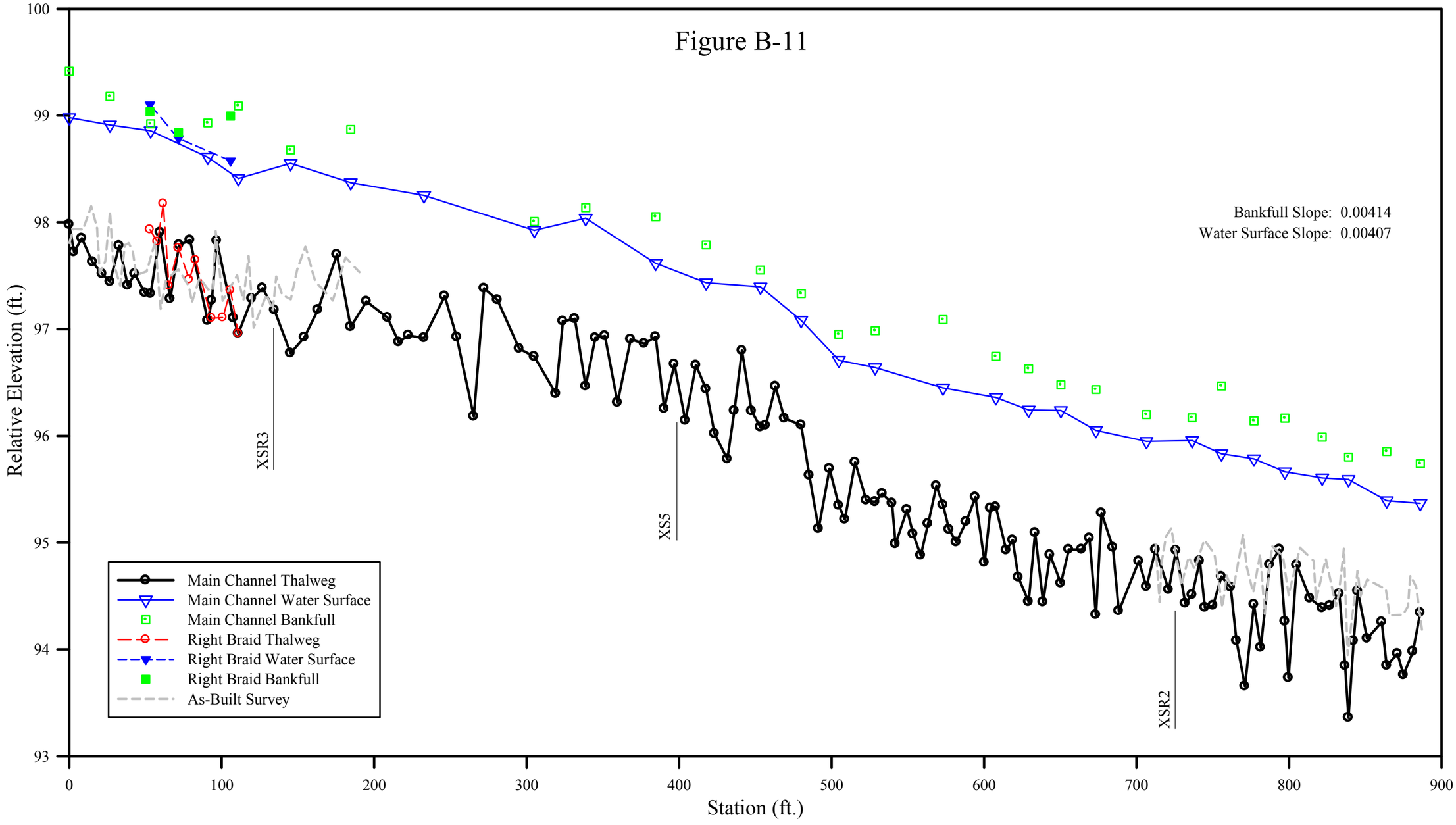
*See document text for details.

McDonalds Pond Restoration Site

Longitudinal Profile

Monitoring Year 1 (2006)

Figure B-11



Project Name:	McDonalds Pond Restoration Site
Task:	Longitudinal Profile
Date Surveyed:	Oct-06
Crew:	DGJ, MG

Station	TWG Elevation	WS Elevation	BKF Elevation	Station	TWG Elevation	WS Elevation	BKF Elevation
0.0	97.98	98.98	99.41	351.4	96.94		
3.2	97.72			359.6	96.31		
8.3	97.85			368.2	96.90		
15.3	97.63			377.2	96.86		
21.7	97.52			384.7	96.93	97.62	98.05
26.8	97.44	98.91	99.18	390.3	96.25		
32.8	97.78			396.9	96.67		
38.4	97.41			404.1	96.14		
43.1	97.52			411.1	96.66		
49.7	97.34			417.7	96.44	97.43	97.79
53.4	97.33	98.86	98.92	423.3	96.02		
59.7	97.91			431.7	95.78		
66.2	97.28			436.2	96.23		
72.1	97.79			441.3	96.80		
79.2	97.83			447.6	96.23		
90.9	97.08	98.61	98.93	453.4	96.08	97.40	97.55
93.5	97.27			456.8	96.10		
96.9	97.83			463.2	96.46		
107.7	97.10			469.1	96.16		
110.9	96.96	98.41	99.09	480.1	96.10	97.08	97.33
119.7	97.28			485.4	95.63		
126.8	97.38			491.5	95.13		
134.6	97.18			498.7	95.69		
145.2	96.77	98.55	98.68	504.8	95.35	96.71	96.95
154.2	96.92			508.7	95.22		
163.1	97.18			515.5	95.75		
175.6	97.70			522.7	95.40		
184.6	97.02	98.37	98.87	528.6	95.38	96.64	96.99
195.0	97.26			533.3	95.46		
208.8	97.11			539.7	95.37		
216.1	96.88			541.9	94.99		
222.5	96.94			549.5	95.31		
232.7	96.92	98.25	98.24	553.5	95.08		
246.3	97.31			558.5	94.88		
254.2	96.92			563.3	95.18		
265.3	96.18			568.8	95.53		
272.1	97.38			573.1	95.35	96.45	97.09
280.8	97.27			577.0	95.12		
295.1	96.82			581.8	95.00		
305.0	96.74	97.93	98.01	588.3	95.20		
319.2	96.39			594.3	95.42		
323.8	97.07			600.3	94.81		
331.7	97.10			604.3	95.32		
338.8	96.46	98.04	98.14	607.8	95.33	96.36	96.74
345.0	96.92			614.6	94.93		

Project Name:	McDonalds Pond Restoration Site
Task:	Longitudinal Profile
Date Surveyed:	Oct-06
Crew:	DGJ, MG

Station	TWG Elevation	WS Elevation	BKF Elevation
618.8	95.02		
622.5	94.68		
629.2	94.45	96.24	96.63
633.5	95.09		
638.7	94.44		
643.2	94.88		
650.4	94.62	96.24	96.48
655.6	94.93		
664.1	94.94		
669.2	95.04		
673.4	94.32	96.05	96.43
677.1	95.28		
684.5	94.95		
688.4	94.36		
701.5	94.83		
706.6	94.59	95.95	96.20
712.5	94.93		
721.1	94.56		
726.0	94.93		
732.0	94.43		
736.5	94.51	95.96	96.17
741.5	94.83		
744.9	94.39		
750.2	94.41		
755.7	94.68	95.83	96.47
761.8	94.58		
765.6	94.08		
771.1	93.66		
777.0	94.42	95.78	96.14
781.5	94.02		
787.4	94.79		
793.8	94.94		
797.3	94.26	95.66	96.16
799.7	93.73		
805.1	94.79		
813.8	94.48		
821.8	94.39	95.61	95.99
826.9	94.41		
833.1	94.52		
836.9	93.84		
839.0	93.36	95.59	95.80
842.5	94.08		
845.2	94.55		
851.3	94.10		
860.9	94.26		
864.1	93.85	95.39	95.85
871.2	93.96		
875.2	93.76		
881.3	93.98		
886.2	94.34	95.37	95.74
end profile			

Project Name:	McDonalds Pond Restoration Site		
Task:	Pattern Measurements		
Reach:	Upper (Reach 3)		
Date Surveyed:	Mar-06		
Crew:	DGJ, MG		
	Radius of Curvature	**Meander Wavelength**	**Channel Beltwidth**
	18.2	49.2	20.9
	14.7	38.0	12.1
	4.8	28.0	8.9
	13.4	25.7	10.8
	4.1	19.1	10.4
	14.8	20.4	11.0
	6.7	38.0	15.6
Min	**4.1**	**19.1**	**8.9**
Max	**18.2**	**49.2**	**20.9**
Med	**13.4**	**28.0**	**11.0**

Project Name:	McDonalds Pond Restoration Site		
Task:	Pattern Measurements		
Reach:	Lower (Reach 2)		
Date Surveyed:	Mar-06		
Crew:	DGJ, MG		
	Radius of Curvature	**Meander Wavelength**	**Channel Beltwidth**
	10.3	39.1	21.3
	12.9	41.7	19.3
	24.3	54.1	22.6
	18.8	59.9	20.6
Min	**10.3**	**39.1**	**19.3**
Max	**24.3**	**59.9**	**22.6**
Med	**15.8**	**47.9**	**21.0**

APPENDIX C: AQUATIC COMMUNITY DATA

MCDONALDS POND RESTORATION SITE BASELINE SAMPLING
BENTHIC MACROINVERTEBRATES, FALLING CREEK, SEPTEMBER 2004

SPECIES	T.V.	F.F.G.	McDonalds Pond	Upstream of Dam	Downstream of Dam
MOLLUSCA					
Bivalvia					
Veneroida					
Sphaeriidae	***8**	**FC**			
Sphaerium sp.	**7.6**	**FC**		1	
ANNELIDA					
Oligochaeta	***10**	**CG**			
Lumbriculida					
Lumbriculidae	**7**	**CG**		1	
ARTHROPODA					
Arachnoidea					
Acariformes	**5.5**		1		
Crustacea					
Isopoda					
Asellidae		**SH**			
Caecidotea sp.	**9.1**	**CG**		5	
Amphipoda					
Crangonyctidae					
Crangonyx sp.	**7.9**	**CG**		1	
Decapoda					
Palaemonidae					
Palaemonetes kadiakensis	**7.1**	**CG**	5		
Insecta					
Ephemeroptera					
Baetidae		**CG**			
Callibaetis sp.	**9.8**	**CG**	2		
Ephemeridae		**CG**			
Hexagenia sp.	**4.9**	**CG**		3	1
Heptageniidae		**SC**		1	
Stenonema modestum	**5.5**	**SC**			1
Leptophlebiidae		**CG**			
Paraleptophlebia sp.	**0.9**	**CG**	2	1	
Odonata					
Aeshnidae		**P**			
Boyeria vinosa	**5.9**	**P**		17	4
Basiaeschna janata	**7.4**		1		
Calopterygidae		**P**			
Calopteryx sp.	**7.8**	**P**		5	5
Coenagrionidae		**P**			
Argia sp.	**8.2**	**P**	1	28	1
Enallagma sp.	**8.9**	**P**	6	1	
Corduliidae		**P**			
Epicordulia princeps	**5.6**	**P**	2		
Neurocordulia alabamensis	**5**			8	1
Cordulegastridae		**P**			
Cordulegaster sp.	**5.7**	**P**		1	1
Gomphidae					
Arigomphus villosipes			1	2	
Arigomphus sp.					5

SPECIES	T.V.	F.F.G.	McDonalds Pond	Upstream of Dam	Downstream of Dam
Dromogomphus armatus	**5.9**	**P**		11	
Gomphus sp.	**5.8**	**P**		14	4
Hagenius brevistylus	**4**	**P**			1
Progomphus obscurus	**8.2**	**P**		19	
Libellulidae		**P**		2	
Celithemis fasciata		**P**	6		
Erythemis simplicicollis	**9.7**		1		
Ladona deplanata				6	
Plecoptera					
Leuctridae		**SH**			
Leuctra sp.	**2.5**	**SH**		11	52
Perlidae		**P**			
Beloneuria sp.	**0**				2
Eccoptura xanthenes	**3.7**	**P**			1
Hemiptera					
Corixidae	**9**	**PI**		1	
Gerridae		**P**			
Limnoporus canaliculatus				1	
Nepidae		**-**			
Ranatra sp.	**7.8**	**P**	1		
Veliidae		**P**			
Rhagovelia obesa		**P**			13
Megaloptera					
Corydalidae		**P**			
Chauliodes rastricornis	**8.4**	**P**	1		
Nigronia serricornis	**5**	**P**		12	
Sialidae		**P**			
Sialis sp.	**7.2**	**P**		2	
Trichoptera					
Calamoceratidae		**SH**			
Heteroplectron americanum	**3.2**	**-**			22
Hydropsychidae		**FC**		3	
Cheumatopsyche sp.	**6.2**	**FC**		11	
Diplectrona modesta	**2.2**	**FC**			16
Hydropsyche sp.	***4**	**FC**		10	
Macrostemum carolina	**3.5**	**FC**		5	
Lepidostomatidae		**SH**			
Lepidostoma sp.	**0.9**	**FC**			3
Odontoceridae		**SC**			
Psilotreta sp.	**0**	**SC**		3	1
Philopotamidae		**FC**			
Chimarra socia	**2.8**			3	
Psychomyiidae		**CG**			
Lype diversa	**4.1**	**SC**			2
Coleoptera					
Dytiscidae		**P**			
Agabus sp.	**8.9**	**P**		1	
Hydroporus sp.	**8.6**	**PI**		1	

MCDONALDS POND RESTORATION SITE BASELINE SAMPLING
BENTHIC MACROINVERTEBRATES, FALLING CREEK, SEPTEMBER 2004

SPECIES	T.V.	F.F.G.	McDonalds Pond	Upstream of Dam	Downstream of Dam
Elmidae		**CG**			
Microcylloepus pusillus	**2.1**	**SC**		1	
Promoresia elegans	**2.2**	**SC**			1
Stenelmis sp.	**5.1**	**SC**		4	
Scirtidae		**SC**		1	
Diptera					
Chironomidae			1	4	
Chironomus sp.	**9.6**	**CG**	1		
Clinotanypus sp.	***4**	**P**		3	
Conchapelopia sp.	**8.4**	**P**		12	1
Microtendipes pedellus gp.	**5.5**	**CG**		1	
Nilotanypus sp.	**3.9**	**P**		1	
Polypedilum flavum (convictum)	**4.9**	**SH**		3	
Stictochironomus devinctus		**CG**			7
Tribelos sp.	**6.3**	**CG**		5	
Xylotopus par	**6**	**SH**			1
Empididae	**7.6**	**P**			
Hemerodromia sp.	***4**	**P**		1	
Ptychopteridae					
Bittacomorpha sp.				1	
Simuliidae		**FC**			
Simulium sp.	**6**	**FC**		1	
Tabanidae		**PI**			
Chrysops sp.	**6.7**	**PI**			1
Tipulidae		**SH**			
Hexatoma sp.	**4.3**	**P**		3	1
Limnophila sp.	***$**	**P**			1
TOTAL NO. OF ORGANISMS			**32**	**232**	**149**
TOTAL NO. OF TAXA			**15**	**46**	**26**
EPT INDEX			**4**	**51**	**101**
BIOTIC INDEX			**7.42**	**6.09**	**3.23**

SPECIES	T.V.	F.F.G.	Reach 1 Reference DS	Reach 2 On-Site	Reach 3 On-Site	Reach 4 Reference US
ANNELIDA						
Oligochaeta	***10**	**CG**				
Lumbriculida						
Lumbriculidae	**7**	**CG**	3	1		1
Rhynchobdellida						
Glossiphoniidae		**P**				
Batrachobdella phalera	**7.6**	**P**			1	
ARTHROPODA						
Crustacea						
Copepoda			1			
Amphipoda		**CG**				
Hyalellidae						
Hyalella azteca	**7.8**	**CG**			1	
Insecta						
Ephemeroptera						
Baetidae		**CG**	2			
Plauditus sp.	***4**	**CG**			4	
Pseudocloeon sp.	**4**	**CG**		5	62	3
Ephemeridae		**CG**				
Hexagenia sp.	**4.9**	**CG**			3	
Ephemerellidae		**SC**				
Eurylophella sp.	**4.3**	**SC**	2	1	4	
Heptageniidae	***4**	**SC**	1	2	2	1
Maccaffertium (Stenonema) sp.	***4**	**SC**	3	10	13	10
Leptophlebiidae	***2**	**CG**		1		2
Paraleptophlebia sp.	**0.9**	**CG**			5	
Odonata						
Aeshnidae		**P**				
Boyeria vinosa	**5.9**	**P**	2	2	2	11
Calopterygidae		**P**				
Calopteryx sp.	**7.8**	**P**	2		5	22
Coenagrionidae		**P**				
Argia sp.	**8.2**	**P**		2	4	1
Enallagma sp.	**8.9**	**P**			1	
Cordulegastridae		**P**				
Cordulegaster sp.	**5.7**	**P**				2
Corduliidae		**P**				
Macromia sp.	**6.2**	**P**	1			
Neurocordulia sp.	**5**		1		1	
Gomphidae		**P**			2	
Gomphus sp.	**5.8**	**P**				1
Hagenius brevistylus	**4**	**P**				2
Progomphus sp.	**8.2**	**P**		13	7	1
Libellulidae		**P**		2		
Plecoptera						
Leuctridae		**SH**			3	
Leuctra sp.	**2.5**	**SH**	8	8	12	16
Perlidae		**P**				
Acroneuria sp.	***1**	**P**	1			1

SPECIES	T.V.	F.F.G.	Reach 1 Reference DS	Reach 2 On-Site	Reach 3 On-Site	Reach 4 Reference US
Acroneuria lycorias	**2.1**	**P**	3			
Perlesta placida sp. gp.	**4.7**	**P**				2
Perlinella sp.	***2**	**P**	1			
Hemiptera						
Veliidae		**P**				
Rhagovelia obesa		**P**	1		15	6
Megaloptera						
Corydalidae		**P**				
Nigronia serricornis	**5**	**P**	4			3
Sialidae		**P**				
Sialis sp.	**7.2**	**P**			1	
Trichoptera						
Hydropsychidae		**FC**				
Diplectrona modesta	**2.2**	**FC**	2		2	76
Hydropsyche sp.	***5**	**FC**	3	44	29	
Hydroptilidae		**PI**				
Hydroptila sp.	**6.2**	**PI**			2	
Oxyethira sp.	**2.2**	**PI**			1	
Lepidostomatidae		**SH**				
Lepidostoma sp.	**0.9**	**FC**				10
Leptoceridae		**CG**				
Oecetis sp.	**4.7**	**P**			1	
Odontoceridae		**SC**				
Psilotreta sp.	**0**	**SC**				1
Philopotamidae		**FC**				
Chimarra aterrima	**2.8**	**FC**	7	5	14	
Chimarra sp.	**2.8**	**FC**		5	6	
Psychomyiidae		**CG**				2
Lype diversa	**4.1**	**SC**				5
Coleoptera						
Elmidae		**CG**				
Ancyronyx variegata	**6.5**	**SC**	4			
Microcylloepus pusillus	**2.1**	**SC**	1			
Promoresia elegans	**2.2**	**SC**			1	
Stenelmis sp.	**5.1**	**SC**	4			1
Gyrinidae		**P**				
Gyrinus sp.	**6.2**	**P**			4	
Staphylinidae		**P**	1			
Diptera						
Ceratopogonidae		**P**	1			
Chironomidae						
Ablabesmyia mallochi	**7.2**	**P**	2		1	1
Chironomus sp.	**9.6**	**CG**			2	
Cladotanytarsus sp.	**4.1**	**FC**				7
Clinotanypus sp.	***6**	**P**	1			
Conchapelopia sp.	**8.4**	**P**	2	11	13	7
Cricotopus bicinctus	**8.5**	**CG**			1	
Cricotopus tremulus	***8**	**CG**			2	

SPECIES	T.V.	F.F.G.	Reach 1 Reference DS	Reach 2 On-Site	Reach 3 On-Site	Reach 4 Reference US
Cricotopus trifascia	**2.8**	**CG**			3	
Cryptochironomus sp.	**6.4**	**P**		1	1	1
Diamesa genus P	**8.1**	**CG**			1	
Microtendipes rydalensis gp.					6	
Nilotanypus sp.	**3.9**	**P**			1	
Parachaetocladius sp.	**0**	**CG**				1
Paracladopelma sp.	**5.5**	**CG**				1
Parametriocnemus sp.	**3.7**	**CG**	3	1	2	1
Pentaneura sp.	**4.7**	**CG**			1	
Procladius sp.	**9.1**	**P**				1
Rheocricotopus tuberculatus	**5.1**	**CG**			2	3
Rheotanytartsus exiguus gp.	**5.9**	**FC**		2	9	
Rheotanytarsus sp.	**5.9**	**FC**				1
Stelechomyia perpulchra	**5**	**CG**		1		
Tanytarsus sp.	**6.8**	**FC**		1		
Thienemanniella xena	**5.9**	**CG**			1	
Tvetenia paucunca	**3.7**	**CG**		1		
Xylotopus par	**6**	**SH**		10	1	
Zavrelia sp.	**5.3**	**CG**			3	1
Empididae	**7.6**	**P**				
Neoplasta sp.	***6**	**P**				1
Simuliidae		**FC**				
Simulium sp.	**6**	**FC**	3	5	24	10
Tipulidae		**SH**				
Hexatoma sp.	**4.3**	**P**	2			1
Tipula sp.	**7.3**	**SH**	1		1	
TOTAL NO. OF ORGANISMS			**73**	**134**	**283**	**217**
TOTAL NO. OF TAXA			**31**	**23**	**48**	**37**
EPT index			**11**	**9**	**16**	**12**
EPT abundance			**33**	**81**	**163**	**129**
BIOTIC INDEX Assigned values			**4.64**	**5.63**	**5.03**	**4.49**

APPENDIX D: NCDWQ HABITAT ASSESSMENT FORM: COASTAL PLAIN

3/06 Revision 7

Habitat Assessment Field Data Sheet
Coastal Plain Streams

TOTAL SCORE_____

Biological Assessment Unit, DWQ
Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream_____Location/road: _____(Road Name_____)County_____

Date_____**CC#**_____Basin_____Subbasin_____

Observer(s)_____ Type of Study: ☐ Fish ☐Benthos ☐ Basinwide ☐Special Study (Describe) _____

Latitude _____Longitude _____Ecoregion: ☐ CA ☐ SWP ☐ Sandhills ☐ CB

Water Quality: Temperature_____^{0}C DO _____mg/l Conductivity (corr.) _____µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location. Check off what you observe driving thru the watershed in watershed land use.

Visible Land Use: _____%Forest _____%Residential _____%Active Pasture _____% Active Crops
_____%Fallow Fields _____% Commercial _____%Industrial _____%Other - Describe:_____

Watershed land use ☐ Forest ☐ Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream_____ Channel (at top of bank)_____ **Stream Depth**: (m) Avg_____Max ____
☐ **Width variable** ☐**Braided channel** ☐**Large river >25m wide**
Bank Height (from deepest part of channel to top of bank): (m)_____

Flow conditions : ☐High ☐Normal ☐Low
Channel Flow Status
Useful especially under abnormal or low flow conditions.

A. Water reaches base of both banks, minimal channel substrate exposed	☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Turbidity: ☐Clear ☐ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes) ☐Green tinge
Good potential for Wetlands Restoration Project?? ☐ YES ☐ NO
Details_____

_____

☐Channelized ditch
☐Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐Recent overbank deposits ☐Bar development ☐Sewage smell
☐Excessive periphyton growth ☐Heavy filamentous algae growth

Manmade Stabilization: ☐N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Weather Conditions:_____**Photos:** ☐N ☐Y ☐Digital ☐35mm

Remarks:_____
TYPICAL STREAM CROSS SECTION DIAGRAM ON BACK

I. Channel Modification

	Score
A. Natural channel-minimal dredging.....	15
B. Some channelization near bridge, or historic (>20 year old), and/or bends beginning to reappear..	10
C. Extensive channelization, straight as far as can see, channelized ditch.....	5
D. Banks shored with hard structure, >80% of reach disrupted, instream habitat gone.....	0

Remarks_____ Subtotal____

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >50% of the reach is snags, and 1 type is present, circle the score of 16. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **R**are, **C**ommon, or **A**bundant.

____**Sticks** ____**Snags/logs** ____**Undercut banks or root mats** ____**Macrophytes** ____**Leafpacks**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>50% Score	30-50% Score	10-30% Score	<10% Score
4 or 5 types present.....	20	15	10	5
3 types present.....	18	13	8	4
2 types present.....	17	12	7	3
1 type present.....	16	11	6	2

No substrate for benthos colonization and no fish cover.....0

☐ No woody vegetation in riparian zone Remarks_____ Subtotal_____

III. Bottom Substrate (silt, clay, sand, detritus, gravel) look at entire reach for substrate scoring.

	Score
A. Substrate types mixed	
1. gravel dominant.....	15
2. sand dominant.....	13
3. detritus dominant.....	7
4. silt/clay/muck dominant.....	4
B. Substrate homogeneous	
1. nearly all gravel.....	12
2. nearly all sand	7
3. nearly all detritus.....	4
4. nearly all silt/clay/muck.....	1

Remarks_____Subtotal_____

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow.

	Score
A. Pools present	
1. Pools Frequent (>30% of 100m length surveyed)	
a. variety of pool sizes.....	10
b. pools about the same size (indicates pools filling in).....	8
2. Pools Infrequent (<30% of the 100m length surveyed)	
a. variety of pool sizes.....	6
b. pools about the same size.....	4
B. Pools absent	
1. Deep water/run habitat present.....	4
2. Deep water/run habitat absent.....	0

Subtotal_____

Remarks_____ Page Total_____

V. Bank Stability and Vegetation	Score	Score
A. Banks stable or no banks, just flood plain		
1. little or no evidence of erosion or bank failure, little potential for erosion	10	10
B. Erosion areas present		
1. diverse trees, shrubs, grass; plants healthy with good root systems.....	9	9
2. few trees or small trees and shrubs; vegetation appears generally healthy.....	7	7
3. sparse vegetation; plant types and conditions suggest poorer soil binding.....	4	4
4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....0	0	

Total_____

Remarks_____

VI. Light Penetration (Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead).

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Subtotal____

Remarks_____

VII. Riparian Vegetative Zone Width

Definition: A break in the riparian zone is any area which allows sediment to enter the stream. Breaks refer to the near-stream portion of the riparian zone (banks); places where pollutants can directly enter the stream.

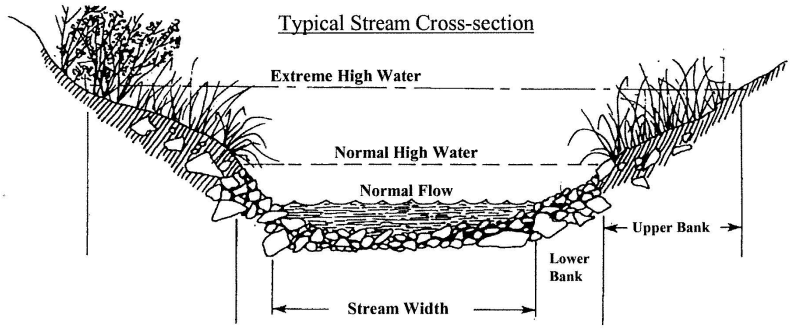
	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. zone width > 18 meters.....	5	5
2. zone width 12-18 meters.....	4	4
3. zone width 6-12 meters.....	3	3
4. zone width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. zone width > 18 meters.....	4	4
b. zone width 12-18 meters.....	3	3
c. zone width 6-12 meters.....	2	2
d. zone width < 6 meters.....	1	1
2. breaks common		
a. zone width > 18 meters.....	3	3
b. zone width 12-18 meters.....	2	2
c. zone width 6-12 meters.....	1	1
d. zone width < 6 meters.....	0	0

Total_____

Remarks_____

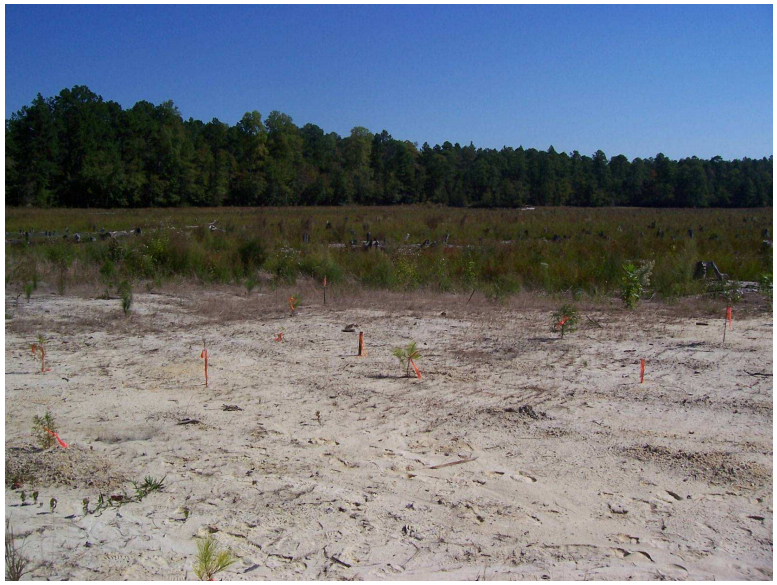
Page Total_____

TOTAL SCORE _____



This side is 45º bank angle.

APPENDIX E: VEGETATION MONITORING PLOT PHOTOS



Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

Vegetation Plot 7

Vegetation Plot 8

APPENDIX F: GROUNDWATER GAUGE HYDROGRAPHS

McDonalds Pond Restoration Site

Groundwater Gauge Hydrographs

Monitoring Year 1 (2006)

Figure F-1