

**Gillespie Golf Course (Mile Run Creek)
Stream Restoration
Greensboro, North Carolina
Annual Monitoring Report
Monitoring Year 2005**



Monitoring Year: 2005
Measurement Year 2
As-Built Date: 2004
NCEEP Project Number 144

February 2006

**GILLESPIE GOLF COURSE (MILE RUN CREEK) STREAM RESTORATION
2005 MONITORING REPORT**

CONDUCTED FOR THE NORTH CAROLINA DEPARTMENT
OF
ENVIRONMENT AND NATURAL RESOURCES

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I. EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Gillespie Golf Course Stream Restoration Site includes 2,634 linear feet of Mile Run Creek and 3,436 linear feet of a tributary within the City of Greensboro, Guilford County, North Carolina. The site was constructed between February 2003 and March 2004. The following report provides the Year 2, 2005 Monitoring information.

Overall, the project is doing well with a few minor erosion areas and several sections where coir matting has pulled away from the bank. Additionally, a beaver dam has been constructed on Mile Run Creek and is currently about 1-foot in height. The problem areas need to be watched and remediation options developed if they get worse.

The vegetation monitoring of the site revealed an average tree density of 209 trees per acre. This average is below the minimum criteria of at least 320 stems per acre after 3 years. The low density can be attributed to mowing of portions of the vegetation plots by golf course personnel. Seedlings from natural recruitment are very low. Additional plantings are needed to restore the density to at least 320 stems per acre to meet mitigation requirements.

II. PROJECT BACKGROUND

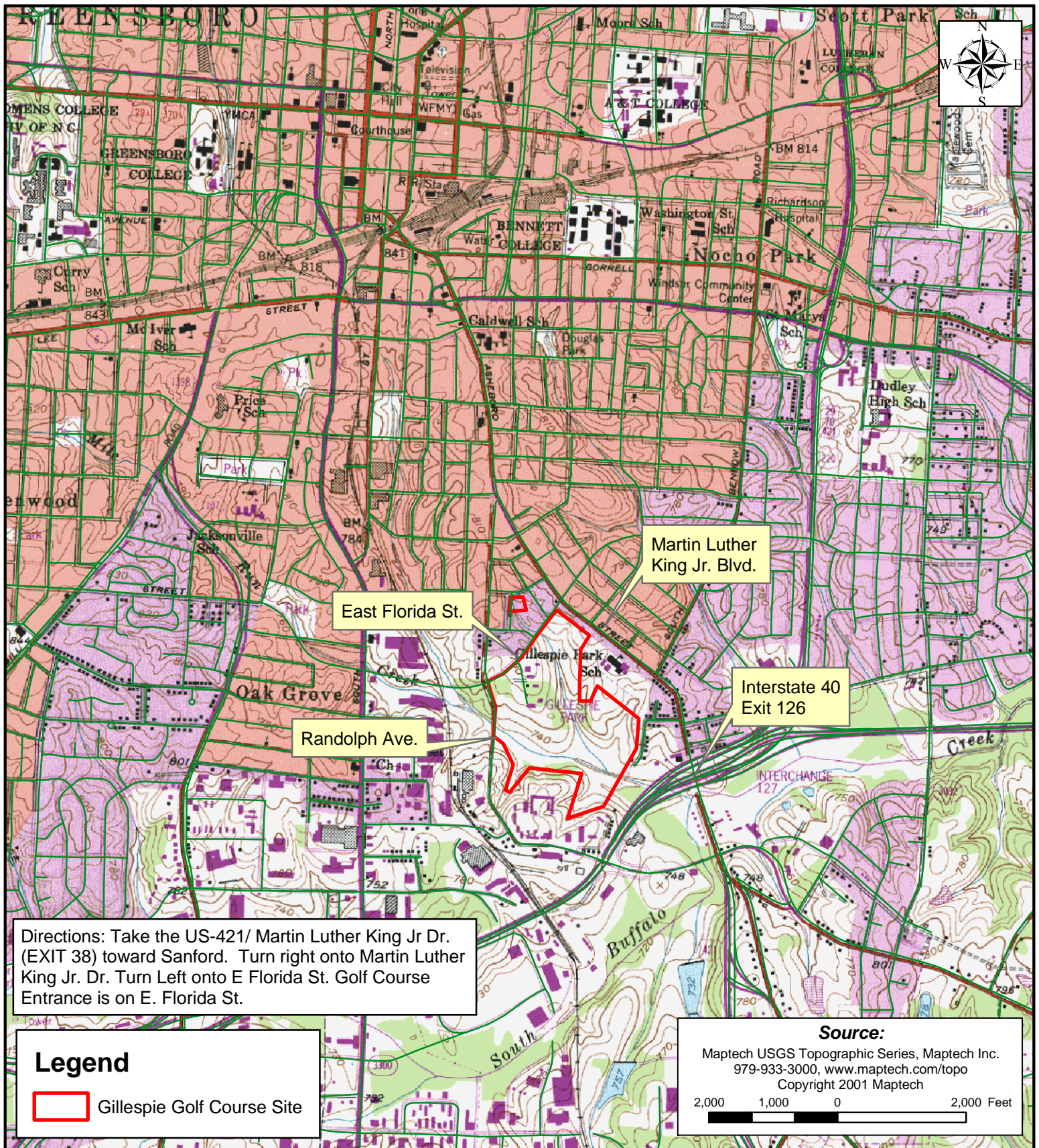
A. Location and Setting

The Gillespie Golf Course Stream Restoration Site includes 2,634 linear feet of Mile Run Creek and 3,436 linear feet of an unnamed tributary. The site is located in the City of Greensboro near the intersection of Interstate 85 and North Carolina Highway (NC-22) in Guilford County, North Carolina See **Figure 1**.

B. Structure and Objectives

Mile Run Creek and its unnamed tributary are located in Gillespie Golf Course, a community park in the City of Greensboro. The stream channels had low sinuosity and varying levels of incision due to historic channelization. The alternative of creating a stable meandering channel with bankfull stage located at the existing floodplain elevation was evaluated. However, in these streams, topographic and development restrictions did not allow for a new channel pattern to be established. The existing incised channels were enhanced by excavating new floodplain benches at the bankfull stage and installing structures to improve bed features and control channel grade.

The mitigation plan consisted of a Priority 3 restoration of Mile Run Creek and 936 linear feet of the unnamed tributary. Stream bank stabilization was also performed on 2,225 linear feet of the unnamed tributary. Instream structures, including root wads, double wing deflectors, and rock vanes were used to stabilize eroding streambanks and improve the channel profile and bedform of Mile Run Creek. Seven rock cross vanes were constructed to stabilize the channel of the unnamed tributary and forested buffers of varying widths were planted to stabilize the stream banks.



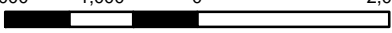
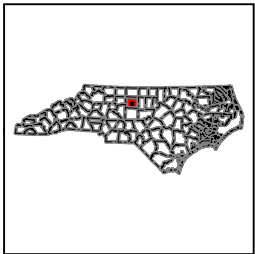
Directions: Take the US-421/ Martin Luther King Jr Dr. (EXIT 38) toward Sanford. Turn right onto Martin Luther King Jr. Dr. Turn Left onto E Florida St. Golf Course Entrance is on E. Florida St.

Legend

 Gillespie Golf Course Site

Source:
 Maptech USGS Topographic Series, Maptech Inc.
 979-933-3000, www.maptech.com/topo
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2,000 1,000 0 2,000 Feet

**FIGURE 01
VICINITY MAP**

Gillespie Golf Course Stream Restoration Site
 Greensboro, North Carolina
 Guilford County

Map Produced: February 2006

Table I. Project Mitigation Structure and Objectives Table Gillespie Golf Course Stream Mitigation Site/Project No. 144					
Project Segment/Reach ID	Mitigation Type	Approach	Linear Footage	Stationing	Comment
Mile Run Crk. Reach 1	Enhancement	Priority 3	484	0+00 to 26+34.26	Instream structures and buffers
UT Reach GR2	Enhancement	Priority 3	250	17 +00 of Mile Run	Instream structures and buffers
UT Reach GR3a	Stabilization	Bank Stabilization	461	NA*	Instream structures and buffers
UT Reach GR3b	Enhancement	Priority 3	225	NA	Instream structures and buffers
UT Reach GR4	Stabilization	Bank Stabilization	1425	NA	20 to 50 foot buffer
UT Reach GR5	Stabilization	Bank Stabilization	800	NA	20 to 50 foot buffer

* No stationing was provided for these reaches.

C. Project History and Background

Table II. Project Activity and Reporting History Gillespie Golf Course Stream Mitigation Site/Project No. 144			
Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion Date
Restoration Plan	NA*	NA	February 2005
Final Design - 90%	NA	NA	NA
Construction	NA	NA	March 15, 2004
Temporary S&E mix applied to entire project area	NA	NA	NA
Permanent seed mix applied to reach/segments 1,2,&3	NA	NA	NA
Containerized and B&B plantings	NA	NA	March 15, 2004
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	NA	NA	February 2005
Year 1 Monitoring	NA	April 2005	April 2005
Year 2 Monitoring	NA	October 2005	December 2005
Year 3 Monitoring	Fall 2006		
Year 4 Monitoring	Fall 2007		
Year 5 Monitoring	Fall 2008		

* Historical project documents necessary to provide this data were unavailable at the time of this report submission

Table III. Project Contact Table Gillespie Golf Course Stream Mitigation Site/Project No. 144	
Designer POC	Buck Engineering 8000 Regency Parkway, Suite 200 Cary, NC 27511 Mr. Mike Rooney (919) 463-5490
Construction Contractor POC	LJ, Incorporated Point of Contact - Mr. Arden Reiser P.O. Box 3188 Mooresville, North Carolina 28117 (704)799-2670
Planting Contractor POC	NA*
Seeding Contractor POC	NA
Seed Mix Sources	NA
Nursery Stock Suppliers	NA
Monitoring Performers	Earth Tech 701 Corporation Center Drive, Suite 475 Raleigh, NC 27607 Mr. Ron Johnson (919) 854-6210
Stream Monitoring	Ron Johnson
Vegetation Monitoring	Ron Johnson
Wetland Monitoring	NA

* Historical project documents necessary to provide this data were unavailable at the time of this report submission

**Table IV. Project Background Table
Gillespie Golf Course Stream Mitigation Site/Project No. 144**

Project County	Guilford
Drainage Area	
Mile Run Creek	2.2 sq mi
Tributary GR2	0.002 sq mi
Tributary GR3	0.04 sq mi
Tributary GR4	0.13 sq mi
Tributary GR5	0.04 sq mi
Drainage impervious cover estimate (%)	> 20 %
Stream Order	
Mile Run Creek	2nd order
Tributary GR2	1st order
Tributary GR3	1st order
Tributary GR4	1st/2nd order
Tributary GR5	1st order
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Rosgen Classification of As-Built	C5
Cowardin Classification	NA
Dominant Soil Types	Chewacla sandy loam Enon fine sandy loam
Reference site ID	E5, Ut Lake Jeanette (Guilford), McClintock 1 & 2 (Mecklenburg); B4c, DuHart (Gaston), Silas (Forsyth), Morgan (Orange)
USGS HUC for Project	03030002
USGS HUC for Reference	Ut Lake Jeanette 03030002, McClintock 03050103, DuHart 03050102, Silas 03040101, Morgan 03030002
NCDWQ Sub-basin for Project	030602
NCDWQ Sub-basin for Reference	Ut Lake Jeanette 030602, McClintock 030834, DuHart 030836, Silas 030704, Morgan 030606
NCDWQ Classification for Project	C, NSW
NCDWQ Classification for Reference	Ut Lake Jeanette-WSIII,NSW; McClintock C, DuHart WS-V ,Silas C, Morgan WS-II, HQW, NSW, CA
Any portion of any project segment 303D listed?	No
Any portion of any project segment upstream of a 303D listed segment?	Yes, Mile Run Creek is above South Buffalo Creek
Reasons for 303D listing or stressor	Impaired biological stressor, stressor not identified, Urban runoff - storm sewers
% of project easement fenced	None



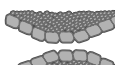



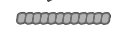




Feature	Northing	Easting
BLP	836829.139	1768059.154
X1LPIN	836721.241	1768240.768
X1RPIN	836661.439	1768188.143
X2LPIN	836547.636	1768574.703
X2RPIN	836455.535	1768498.907
X3LPIN	836450.01	1768663.792
X3RPIN	836379.164	1768627.222
X4LPIN	836373.669	1768866.661
X4RPIN	836308.929	1768847.733

Begin Longitudinal Profile

OLPH AVE

MATCHLINE - FIGURE 2b

Legend

	Photopoint		Vegetation Plot
	Double-Wing Deflector		Cross-Vane
	Root Wad		Outlet Basin
	Single-Arm Deflector		Constructed Riffle
	Easement		J-Hook
	Golf Greens And Fairways		

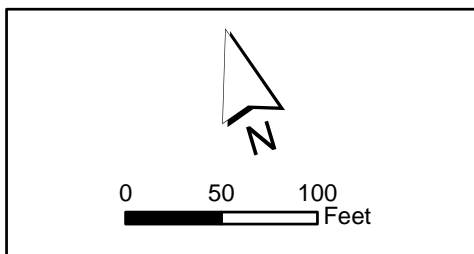
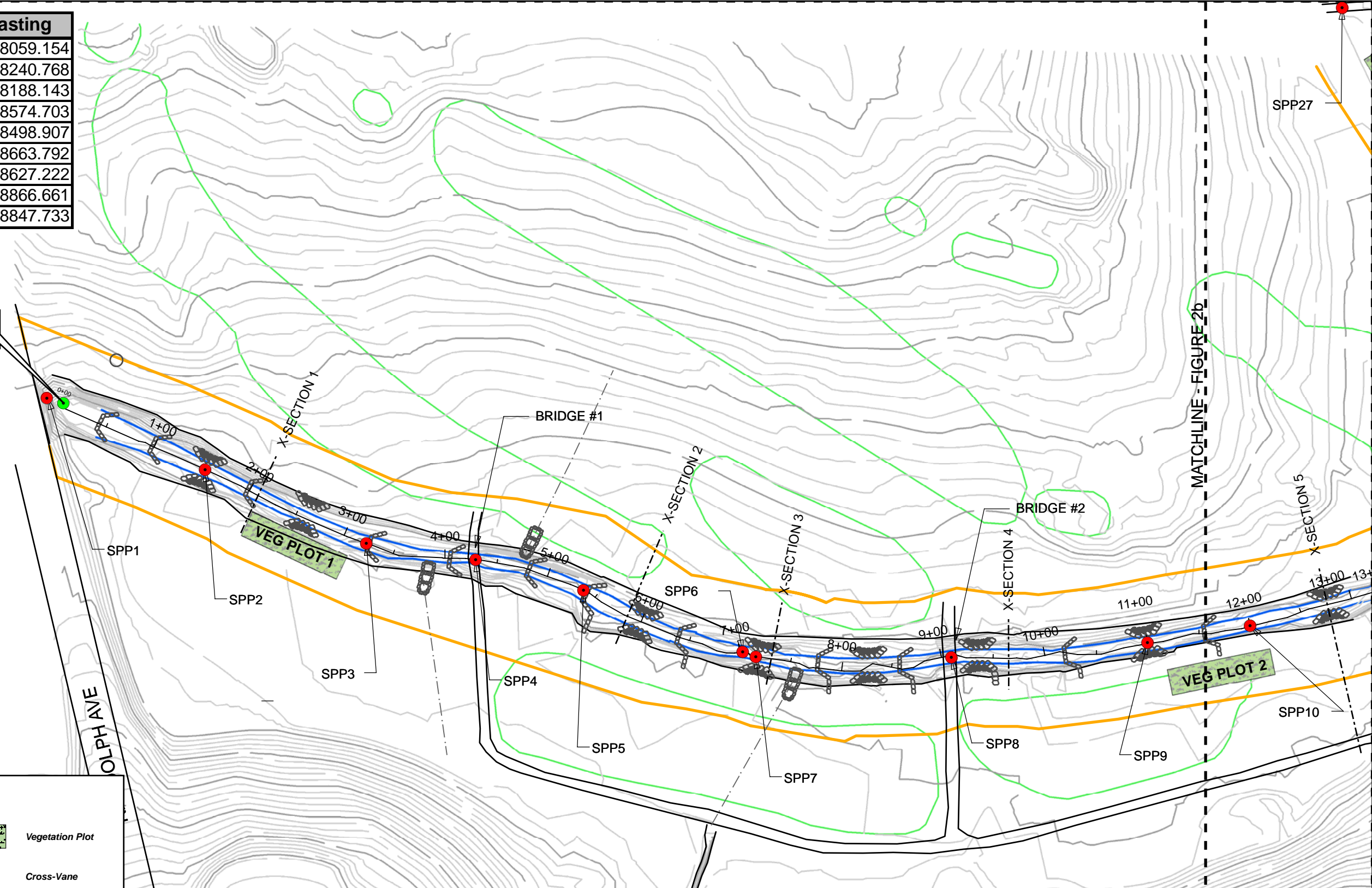
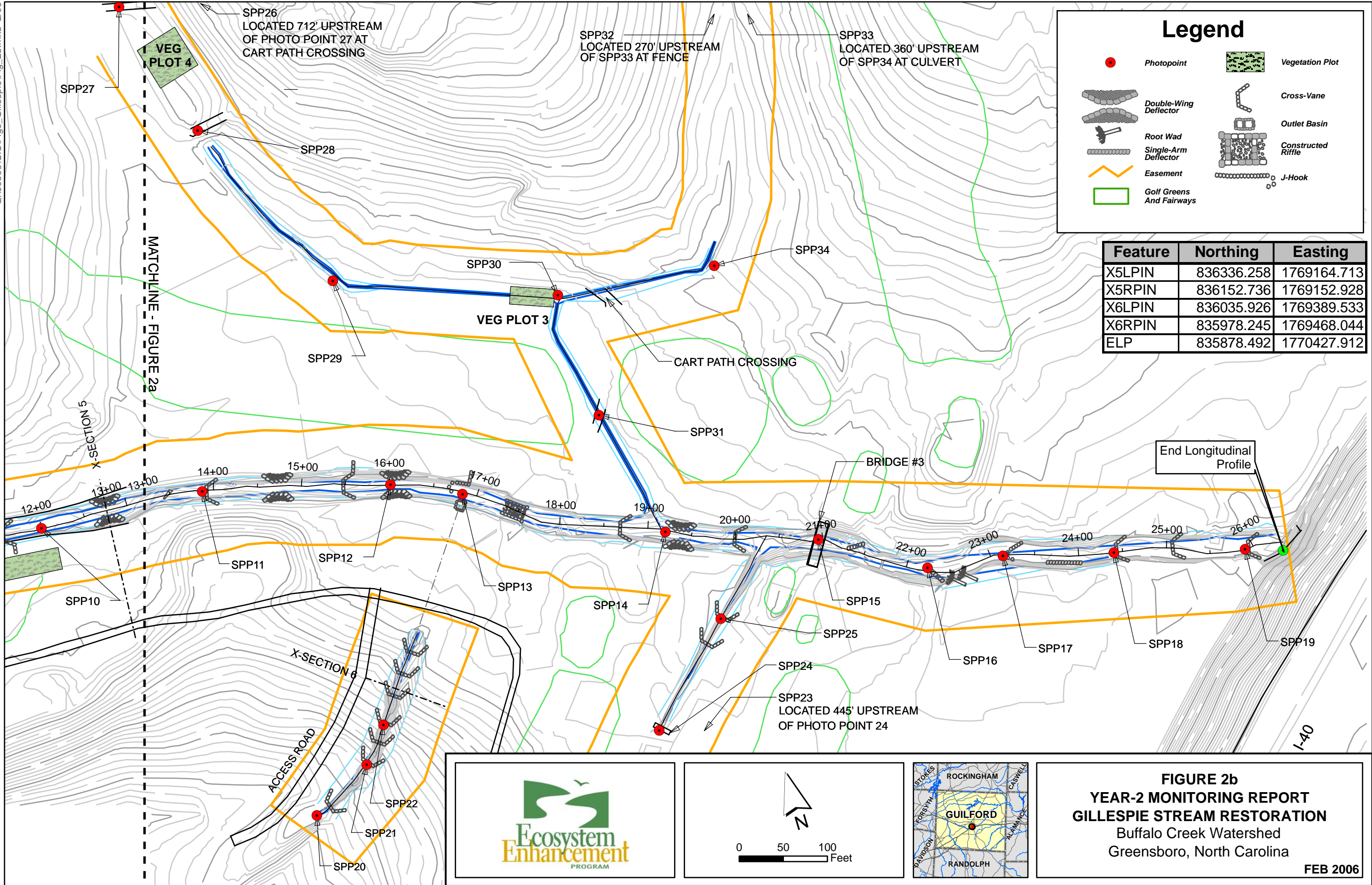


FIGURE 2a
YEAR-2 MONITORING REPORT
GILLESPIE STREAM RESTORATION
 Buffalo Creek Watershed
 Greensboro, North Carolina
 FEB 2006





Legend

- Photopoint
- Vegetation Plot
- Double-Wing Deflector
- Cross-Vane
- Root Wad
- Outlet Basin
- Single-Arm Deflector
- Constructed Riffle
- Easement
- J-Hook
- Golf Greens And Fairways

Feature	Northing	Easting
X5LPIN	836336.258	1769164.713
X5RPIN	836152.736	1769152.928
X6LPIN	836035.926	1769389.533
X6RPIN	835978.245	1769468.044
ELP	835878.492	1770427.912

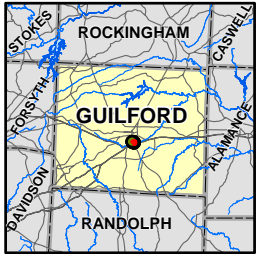
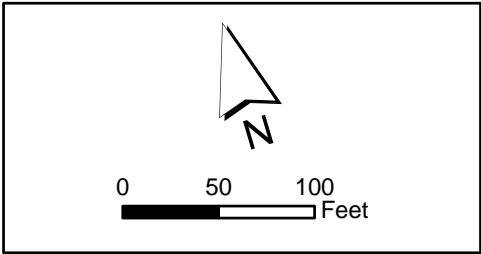


FIGURE 2b
YEAR-2 MONITORING REPORT
GILLESPIE STREAM RESTORATION
 Buffalo Creek Watershed
 Greensboro, North Carolina
 FEB 2006

III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

1. Soil Data

Series	Max Depth (in.)	% Clay on Surface	K	T	OM %
Chewacla sandy loam	80	5-35	0.28	5	1-4
Enon fine sandy loam	75	5-35	0.28-0.37	4	0.5-2

2. Vegetative Problem Areas

Several areas with minimum vegetation were observed on June 9, 2005 and five exotic and invasive species were observed within the plots during the vegetation sampling. These include autumn olive (*Elaeagnus umbellata*), common wormwood (*Artemisia vulgaris*), mimosa (*Albizia julibrissin*), multiflora rose (*Rosa multiflora*), and Chinese privet (*Ligustrum sinense*). Areas with extensive populations of invasive exotic vegetation are depicted in Appendix A-4 Vegetation Problem Area Plan View.

Mowing has been a problem at all vegetation plots since the implementation of the restoration project. Plot 4 was reported as completely mowed in the April 2005 Year 1 Monitoring Report. This plot had apparently recovered as of the Year 2 vegetation monitoring site visit. Mowing was noted at the remaining 3 plots during this (Year 2) monitoring period. Plots 1 and 2 had been mowed 2 feet along the length of the plots and Plot 3 had been completely mowed this year. Mowed areas are depicted in Appendix A-4.

Feature/Issue	Station # /Range	Probable Cause	Photo #
Mowing	Vegetation Plot #1	Partially mowed (2 ft)	VPA 1
	Vegetation Plot #2	Partially mowed (2 ft)	
	Vegetation Plot #3	Completely mowed	
Invasive/Exotic Populations	Vegetation Plot #4 area	Multiflora rose	NA
	0+00	Porcelain berry	
	1+00 to 4+00	Mimosa, wormwood, multiflora rose	
	10+00 to 13+00	Autumn olive	
	19+00 to 21+00	Chinese privet	
	Reach 3	Chinese privet	

3. Stem Counts

Stem counts were conducted on November 1, 2005. The complexity of the planting plan required the establishment of four vegetation survival plots that were designed to monitor varying vegetation planting types.

- Plot 1 monitors bare root trees and live stakes.
- Plot 2 monitors shrubs, live stakes, and perennial plantings.
- Plot 3 monitors live stakes and perennial plantings.
- Plot 4 monitors shrubs on both sides of the channel.

Plots 1 and 2 are 100 feet in length and 25 feet in width along the right bank of the channel. The vegetation monitored in these plots includes planted bare root trees and live stake plantings. The remaining two plots span both channel banks. Plot 4, a shrub plot, is 50 feet in length and 50 feet in width and Plot 3 is 50 feet in length and 25 feet in width. All plots are adjacent to the fairways and greenways of the golf course.

The plots were originally marked with wooden stakes. The original corner stakes were often missing or found lying within the buffer. It appears that some corners are now within the maintained fairway by approximately two feet with the upper portion of the plot away from the stream having been mowed.

- Plot 1 had been mowed approximately 2 feet along the edge, reducing the unmowed portion of the vegetation plot to 23 feet X 100 feet.
- Plot 2 had been mowed approximately 2 feet along the edge, reducing the unmowed portion of the vegetation plot to 23 feet X 100 feet.
- Plot 3 had been completely mowed. However, because of topography the lower portion of some stems remained. Earth Tech was able to count stems in an area about 15 feet X 50 feet.
- Plot 4 had been previously mowed as reported in the April 2005 document but still had living stems present at the time of the November 2005 vegetation survey.

In addition to percentage of survival of planted stems, an estimate of total stems per acre is provided. The number of stems per acre is based upon extrapolating the number of stems per plot to stems per acre. This allows a useful assessment of the current conditions and will help decide if further action is necessary.

Of the original total of 223 live stakes, 63 were counted for Year 2, resulting in a 28% survival rate. Plot 3 was most heavily mowed in 2005 and only stems less than 1 foot tall were visible (see Appendix A-2 for photo). It is recommended that this mowing of the buffer be addressed or the plot should be removed from further monitoring. Of the original 162 shrubs that were planted only 56 remain which is 35% of the original number. This large decrease of shrubs necessitates additional plantings in order to restore the density to a level that meets mitigation requirements. In general, the mortality of greater than 25% of the original planting of live stakes and shrubs necessitates additional plantings according to the guidelines set forth in the mitigation plan of February 2005.

The vegetation monitoring of the site revealed an average tree density of 209 trees per acre in Plot 1. The total number of tree stems per acre has dropped below the required 320 stems/acre after 3 years needed to meet mitigation requirements. If the size of Plot 1 is adjusted to account for the mowing, the density of stems in the unmowed portion of the plot is 227 trees per acre, also below the required 320 trees/acre. Natural recruitment of seedlings is also very low. Additional plantings are needed to restore the density to

at least 320 trees per acre to meet mitigation requirements according to success criteria set forth in the mitigation plan of February 2005.

The total number of shrubs has also been reduced to 35% of the original number planted. It appears that aggressive mowing soon after planting has been the main contributor to the low survival of shrubs. The number of shrub stems per acre is 505 in Plot 2 and 470 in Plot 4. If the size of the plots is adjusted to account for the mowing, the density of shrub stems in the unmowed portion of the plots is 549 and 511 stems per acre respectively.

Table VII. Stem Counts for Each Species Arranged by Plot Gillespie Golf Course Stream Mitigation Site/Project No. 144								
Species	Plots				Initial Totals	Year 1 Totals	Year 2 Totals	Survival %
	1	2	3	4				
Trees								
<i>Nyssa sylvatica</i>	2	0	0	0	NA*	NA	2	NA
<i>Betula nigra</i>	3	0	0	0	NA	NA	3	NA
<i>Quercus phellos</i>	2	0	0	0	NA	NA	2	NA
<i>Platanus occidentalis</i>	5	0	0	0	NA	NA	5	NA
Total	12				31	10	12	39
Live Stakes								
<i>Cornus amomum</i>	9	10	11		NA	NA	30	NA
<i>Salix sericea</i>	10	10	13		NA	NA	33	NA
Total	19	20	24		223	112	66	30
Shrubs								
<i>Aronia arbutifolia</i>		3		11	NA	NA	14	NA
<i>Viburnum nudum</i>		0		1	NA	NA	1	NA
<i>Symphoricarpos orbiculatus</i>		12		10	NA	NA	22	NA
<i>Ilex verticillata</i>		2		2	NA	NA	4	NA
<i>Ilex glabra</i>		10		3	NA	NA	13	NA
<i>Viburnum dentatum</i>		2		0	NA	NA	2	NA
Total		29		27	162	77	56	35

* Historical project documents necessary to provide this data were unavailable at the time of this report submission

4. Vegetation Plot Photos

Photos of the vegetation plots are located in Appendix A.

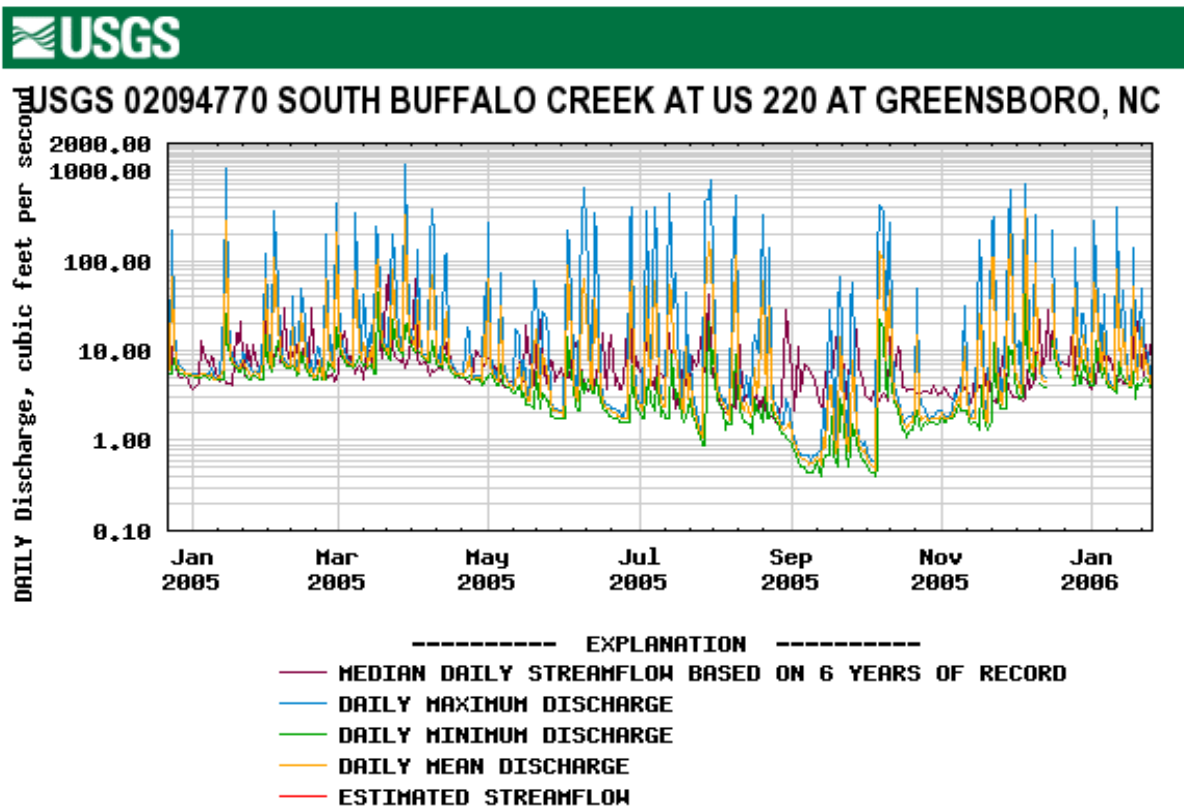
B. Stream Assessment

Earth Tech personnel performed an initial site visit at Gillespie Golf Course on June 9th, 2005. During the field visit notes were made regarding the condition of the stream restoration project. Cross section and longitudinal surveys were performed on November 2 and 3, 2005. Six cross sections and approximately 6,070 linear feet of stream were surveyed. Photographs were taken at all permanent photo points. A bed material analysis was not performed since this is a sand/small gravel stream. No significant coarsening is expected over time. The photographs show that vegetation is generally growing well and is a good combination of woody and herbaceous growth although aggressive mowing has continued in the vicinity of Plot 3 and reduced the height and diversity by killing some of the trees and shrubs and narrowing the

buffer. Overall, the project is doing well with a few minor erosion areas or areas of minimal vegetation. It does appear that the double-wing deflectors are increasing the flow to a degree such that increased erosion of the banks immediately downstream of the deflectors is occurring. Additionally, a beaver dam has been constructed at Station 10+90 and is currently 1 foot tall. Construction and maintenance of this beaver dam is expected to continue and increase ponding behind it unless removed. At this time, no repairs are recommended. The problem areas need to be watched and if the problems worsen over time, then solutions need to be discussed to assess the reason for the problem and potential options to fix the areas. Vegetative problem areas are described in Table VI and stream problem areas are described in Table X.

No crest gauges are installed at this site to document bankfull events. Therefore, potential occurrence was extrapolated based on USGS stream gauge discharge data for South Buffalo Creek at US 220 (approximately 2 miles southwest of project site) with a drainage area of 15.4 square miles. Bankfull events were determined by comparing the stream discharge [cubic feet per second (cfs)] against the drainage area on the urban piedmont regional curve. According to the urban piedmont regional curve a bankfull event occurs on a stream with a 15.4 mi² drainage area when the discharge is between 1,538 and 1,704 cfs. Based on USGS data no bankfull events occurred in 2005. However, there may have been one bankfull event on December 10, 2004 when the maximum discharge reached 1,700 cfs for one day. Two high flow events were recorded for 2005. On January 14 and March 28 maximum discharge was recorded at 1,040 and 1,140 cfs respectively.

Figure 3. USGS Stream gauge discharge data for South Buffalo Creek at US 220.



Provisional Data Subject to Revision

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
2004	12-10-2004	Proximal USGS gauge resource	NA
2005	None	Proximal USGS gauge resource	NA

Table IX BEHI and Sediment Export Estimates only apply to Monitoring years 3 and 5 so were not performed this year.

Feature/Issue	Station # /Range	Probable Cause	Photo #
Aggradation/Bar Formation	18+60	Cross-vane buried by sandbar	SPA 1
	20+50	Central bar has formed	
Bank scour	03+50	Minor toe undercutting	SPA 2,3
	05+00 to 5+50	Left bank is vertical and undercut	
	05+80	Bare bank where matting has washed away	
	07+40	Right bank is vertical and bare to 1.5 feet above toe	
	07+95	Right bank is vertical and bare downstream of cross-vane	
	08+00 to 8+30	Right bank is vertical and bare near double-wing deflectors	
	10+50	Right bank is vertical and bare	
	11+00 to 13+00	Right bank is intermittently bare	
	14+50	Right bank is vertical and bare to 3 feet above toe	
	15+20 to 15+50	Right bank is vertical and bare to 3 feet above toe, downstream of X-vane	
	15+50 to 16+00	Right bank is vertical and bare to 5 feet above toe, from X-vane to double-wing deflector	
	15+50 to 16+00	Left bank is vertical and bare to 5 feet above toe	
	16+00 to 17+00	Matting is detached, bank is vertical	
	18+25	Right bank is vertical and bare downstream of J-hook	
	19+50 to 20+00	Right bank is vertical and undercut, matting is detached	
	21+00	Left bank is eroded upstream of golf cart bridge	
22+00 to 22+30	Right bank is vertical and bare to 3 feet above toe		
23+00 to 23+10	Right bank is vertical and bare to 5 feet above toe		
25+00 to 26+00	Right bank is vertical and bare to 6 feet above toe		
Debris/beaver dam	10+90	Beaver dam	SPA 4
	21+00	Small debris jam under golf cart bridge	
	23+50	Fallen tree in channel, debris accumulation	
Engineered Structures	00+50	Gap in left arm of cross-vane	SPA 5,6
	23+50 to 24+50	Bank is washing out behind rock toe protection	
	25+00	Bank is washing out behind rocks on right bank	

**Table XI. Categorical Stream Feature Visual Stability Assessment
Gillespie Golf Course Stream Mitigation Site/Project No. 144
Reach GR1/ (2634 ft.)**

Feature	Initial	MY-01	MY-02	MY-03	MY-04
A. Riffles	100%	98%	96.2%		
B. Pools	100%	95%	NA		
C. Thalweg	100%	100%	NA		
D. Meanders	100%	100%	NA		
E. Bed General	100%	100%	NA		
F. Vanes/J Hooks etc.	100%	100%	95.8%		
G. Wads and Boulders	100%	100%	100%		

Note: The Year 1 estimates are Earth Tech's estimate based upon review of text within the Buck Engineering Year 1 Monitoring Report.

C. Wetland Assessment

There is no wetland restoration associated with this site. Table XIV is not applicable to this project.

**Table XII. Baseline Morphology and Hydraulic Summary
Gillespie Golf Course Stream Mitigation Site/Project No. 144
Reach GR1 (2634 feet)**

Parameter	USGS Data			Regional Curve Interval			Pre-Existing condition			Project Reference Stream			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension																		
BF Width (ft)				27	35.9	31.6	27.2	44.4	29.2	9.1	12.6	10.6	NA	NA	27	24	28.5	26.3
BF Cross Sectional Area (ft ²)				96	106	101	61.5	112.8	88	14.2	21.8	20.5	NA	NA	74	49.9	85.5	52.3
BF Mean Depth (ft)				2.7	3.6	3.1	1.9	3.9	2.9	1.6	2.0	1.6	NA	NA	2.7	1.9	3.4	2.2
BF Max Depth (ft)							3.8	5.4	4.7	NA	NA	NA	NA	NA	3.4	2.9	5.7	3.4
Width/Depth Ratio							7.2	19.3	9.9	5.0	8.0	6.0	NA	NA	10	7.3	13.9	11.15
Entrenchment Ratio							>2.5	>3.9	>3.1	NA	NA	NA	3.0	3.6	NA	2.1	9.4	3.75
Wetted Perimeter (ft)							34.6	49	35	NA	NA	NA	NA	NA	NA	28.4	34.3	30.7
Hydraulic radius (ft)							1.72	3.05	2.42	NA	NA	NA	NA	NA	NA	1.66	2.70	1.83
Pattern																		
Channel Beltwidth (ft)							NA	NA	NA	32	45	NA	NA	NA	NA	NA	NA	NA
Radius of Curvature (ft)							NA	NA	NA	18	30	NA	NA	NA	NA	NA	NA	NA
Meander Wavelength							NA	NA	NA	35	69	NA	NA	NA	NA	NA	NA	NA
Meander Width ratio							NA	NA	NA	2.7	5.7	NA	NA	NA	NA	NA	NA	NA
Profile																		
Riffle length (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Riffle slope (ft/ft)							NA	NA	NA	0.0066	0.011	NA	NA	NA	NA	NA	NA	NA
Pool length (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pool spacing (ft)							NA	NA	NA	NA	NA	NA	54	108	NA	NA	NA	NA
Substrate																		
d50 (mm)							NA	NA	1	0.28	0.5	0.4	NA	NA	NA	NA	NA	NA
d84 (mm)							NA	NA	20	2.5	10	3.5	NA	NA	NA	NA	NA	NA
Additional Reach Parameters																		
Valley Length (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Channel Length (ft)							NA	NA	2877	NA	NA	NA	NA	NA	1867	NA	NA	NA
Sinuosity							NA	NA	1.09	1.3	2.4	NA	NA	NA	1.1	NA	NA	NA
Water Surface Slope (ft/ft)							NA	NA	0.0028	NA	NA	NA	NA	NA	0.0028	NA	NA	NA
BF slope (ft/ft)							NA	NA	NA	NA	NA	NA	NA	NA	0.0025	NA	NA	NA
Rosgen Classification							NA	NA	E5/C5	E5	E5	E5	NA	NA	E5	NA	NA	NA
Habitat Index							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

*Historical documents necessary to provide this information were unavailable at the time of the report submission.

**Table XII Continued. Baseline Morphology and Hydraulic Summary
Gillespie Golf Course Stream Mitigation Site/Project No. 144
Reach GR2 (250 feet)**

Parameter	USGS Data			Regional Curve Interval			Pre-Existing condition			Project Reference Stream			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension																		
BF Width (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	7.2	7.2	7.2
BF Cross Sectional Area (ft ²)							NA	NA	NA	NA	NA	NA	NA	NA	NA	4.6	4.6	4.6
BF Mean Depth (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6	0.6	0.6
BF Max Depth (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8	0.8	0.8
Width/Depth Ratio							NA	NA	NA	NA	NA	NA	NA	NA	NA	11.2	11.2	11.2
Entrenchment Ratio							NA	NA	NA	NA	NA	NA	NA	NA	NA	3.1	3.1	3.1
Wetted Perimeter (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	8.4	8.4	8.4
Hydraulic radius (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	0.55	0.55	0.55
Pattern																		
Channel Beltwidth (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radius of Curvature (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Meander Wavelength							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Meander Width ratio							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Profile																		
Riffle length (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Riffle slope (ft/ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pool length (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pool spacing (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Substrate																		
d50 (mm)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
d84 (mm)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Additional Reach Parameters																		
Valley Length (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Channel Length (ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sinuosity							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Surface Slope (ft/ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BF slope (ft/ft)							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rosgen Classification							NA	NA	NA	NA	NA	NA	NA	NA	NA	E5b	E5b	E5b
Habitat Index							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos							NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

*Historical documents necessary to provide this information were unavailable at the time of the report submission.

**Table XIII. Morphology and Hydraulic Monitoring Summary
Gillespie Golf Course Stream Mitigation Site/Project No. 144
Reach GR1 CS 1-5 (2634 feet)
Tributary CS 6 (250 feet)**

Parameter	Cross Section 1			Cross Section 2			Cross Section 3			Cross Section 4			Cross Section 5			Cross Section 6		
	2+09 Pool			5+86 Riffle			7+31 Riffle			9+65 Pool			12+76 Riffle			Trib 2 Riffle		
Dimension	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2
BF Width (ft)	24.9	25.4	25.9	26.7	26.3	24.2	24.0	26.8	36.9	28.5	30.1	29.8	26.3	27.1	25.0	7.2	7.4	7.3
Floodprone Width (ft) (approx)	235	235	235	56	66	>60	52	63	>90	262	262	262	115	115	>185	22	22	18.2
BF Cross Sectional Area (ft ²)	85.5	91.0	87.3	52.3	61.4	46.3	51.9	79.6	87.1	82.6	79.7	99.0	49.9	51.6	55.0	4.6	2.8	3.3
BF Mean Depth (ft)	3.4	3.6	3.4	2.0	2.3	1.9	2.2	3.0	2.4	2.9	2.7	3.3	1.9	1.9	2.2	0.6	0.4	0.5
BF Max Depth (ft)	5.7	5.3	5.2	3.1	3.8	3.4	3.4	4.6	4.3	4.4	4.0	5.4	2.9	3.1	5.1	1.0	0.8	0.9
Width/Depth Ratio	7.3	7.1	7.6	13.6	11.3	12.7	11.1	9.0	15.6	9.8	11.3	9.0	13.9	14.2	11.4	12	18.5	14.6
Entrenchment Ratio	9.4	9.2	9.1	2.1	2.5	>2.5	2.2	2.4	>2.4	9.2	8.7	8.8	4.4	4.2	>7.4	3.1	3.0	2.5
Wetted Perimeter (ft)	31.7	36	32.64	30.7	30.9	28.05	28.4	32.8	41.64	34.3	35.5	36.45	30.1	30.9	29.40	8.4	8.2	8.19
Hydraulic radius (ft)	2.70	2.53	2.67	1.70	1.99	1.91	1.83	2.43	2.09	2.41	2.25	2.72	1.66	1.67	1.87	0.55	0.34	0.41
Substrate																		
d50 (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
d84 (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Parameter	MY-01 (2005)			MY-02 (2005)			MY-03 (2006)			MY-04 (2007)			MY-05 (2008)			MY+ (2009)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Pattern																		
Channel Beltwidth (ft)	NA	NA	NA	NA	NA	NA												
Radius of Curvature (ft)	NA	NA	NA	NA	NA	NA												
Meander Wavelength (ft)	NA	NA	NA	NA	NA	NA												
Meander Width Ratio	NA	NA	NA	NA	NA	NA												
Profile																		
Riffle Length (ft)	NA	NA	NA	5	79	24												
Riffle Slope (ft/ft)	NA	NA	NA	0	0.0660	0.0025												
Pool length (ft)	NA	NA	NA	19.41	98.53	33.76												
Pool spacing (ft)	NA	NA	NA	19.41	292.69	100.18												
Additional Reach Parameters																		
Valley Length (ft)		2648			2648													
Channel Length (ft)		2642			2642													
Sinuosity		0.99			0.99													
Water Surface Slope (ft/ft)		0.00267			0.00296													
BF Slope (ft/ft)		NA			0.002835													
Rosgen Classification		E/C			E/C													
Habitat Index*		NA			NA													
Macrobenthos*		NA			NA													

* Historical project documents necessary to provide this data were unavailable at the time of this report submission

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Appendix A

Appendix B