

**ELLERBE CREEK STREAM RESTORATION – Project #127
Fourth Annual Monitoring Report - 2008 - FINAL**



Submitted on January 30, 2009 to:



North Carolina Department of
Environment and Natural Resources
Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

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I. Executive Summary

The Ellerbe Creek stream restoration a project is located on the Hillandale Golf Course in Durham, North Carolina just east of the intersection of U.S. 15/501 and Interstate 85 (I-85). The project has restored 6,279 linear feet of the perennial stream in the Neuse River Basin (USGS HUC 03020201050010). The drainage area for the site covers approximately 5,635 acres (Stantec 2005a). Several unnamed tributaries enter Ellerbe Creek upstream of the restoration site. Project construction began in January 2004 and was completed in December of the same year. The fourth year of monitoring was completed in September 2008.

RJG&A's initial 2008 qualitative evaluation was conducted on 16 April. Quantitative vegetation and geomorphologic data were collected between 24 July and 18 September. Stream visual assessment was conducted on 18 September 2007.

The restoration project appears to have met its design goals. No significant geomorphologic changes have occurred during the fourth monitoring year. The average planted woody stem density (798 per acre) has exceeded the vegetation restoration goal of 320 stems per acre. This was calculated from data collected in 11 permanent monitoring plots using the EEP 2004 Stem Counting Protocol.

Although vegetation problems areas continue to exist throughout the restoration in the form of rill and gully erosion and bare floodplain areas, they are smaller in area in 2008. The stream problems areas continue to center around the presence of beaver (*Castor canadensis*) and beaverdams. Other problem areas involving bank scour/slump and aggradation are less in size than the previous year.

II. Project Background

A. Project Objectives

The objectives of the Ellerbe Creek Stream restoration project are to:

1. Establish a new floodplain at a lower elevation and connecting the stream to the new floodplain;
2. Reduce erosion and sedimentation;
3. Provide wildlife habitat through the creation of a more natural riparian buffer;
4. Improve aquatic habitat with the use of natural material stabilization structures and a riparian buffer; and
5. Improve water quality within Ellerbe Creek (Stantec 2005a).

B. Project Structure, Restoration Type, and Approach

A Priority 2 stream restoration was used for the most of project's length to establish a new floodplain, improve sediment transport capability, restore wildlife habitat, and improve water quality. Some stream enhancement was done in the Croasdaile,

Hillandale, and Albany reaches, where utility rights-of-way were present. The Albany reach also included preservation. The project involved channel dimension adjustments, pattern alterations, in-stream structure installation, and riparian buffer restoration.

**Exhibit Table I. Project Restoration Components
Ellerbe Creek Stream Restoration - Project #127**

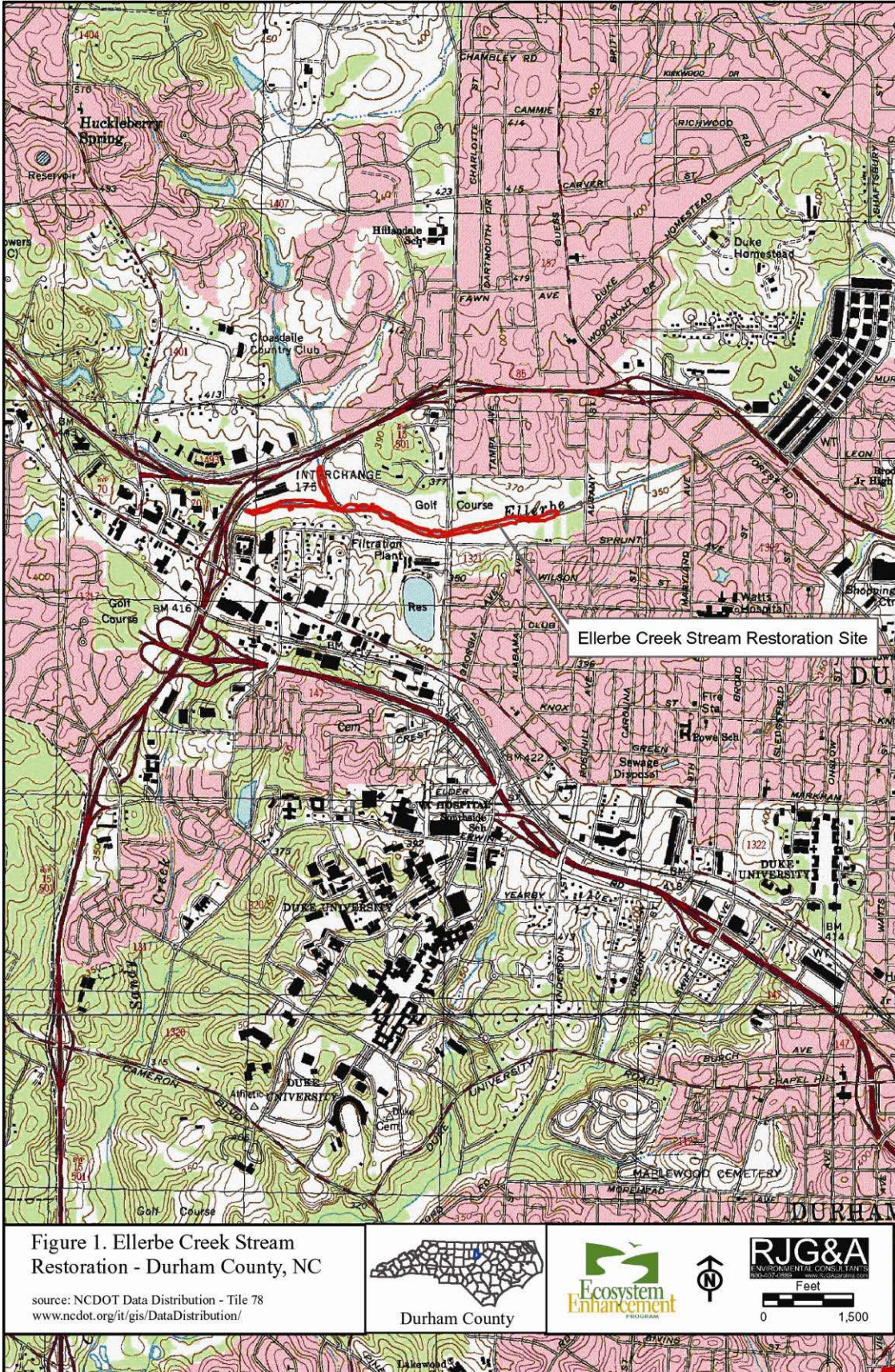
Reach ID	Existing Feet	Mitigation Type	Approach	Linear Feet or Acreage	Stationing	Comment
Hillsborough	1577	R	P2	1663 LF	1010-2673	Changed dimension, pattern, and profile
Croasdaile	788	R	P2	199 LF	CR 1000-1703	Changed dimension, pattern, and profile
Croasdaile		EI	P2	504 LF		Changed dimension and profile
Hillandale	1865	R	P2	1321 LF	2673-4612	Changed dimension, pattern, and profile
Hillandale		EI	P2	618 LF		Changed dimension and profile
Albany	1885	R	P2	1207 LF	4612-6586	Changed dimension, pattern, and profile
Albany		EI	P2	391 LF		Changed dimension and profile
Albany		P	-	376 LF		Protected existing stream
Buffer	NA	R	-	17.41 AC		Restored buffer area
Stormwater Wetland	0	Creation	-	0.15 AC		Created wetlands
Pocket Wetlands	0	Creation	-	0.23 AC		Created wetlands

C. Location and Setting

The Ellerbe Creek restoration is located in the City of Durham on the Hillandale Golf Course. The golf course and restoration area are located approximately 1,500 feet east of the I-85/U.S. 15/501 intersection, on the east and west sides of Hillandale Road. To access the site from I-85, take exit 17a and travel south down Hillandale Road. Ellerbe Creek is at the bottom of the first hill. The restoration site begins where Ellerbe Creek emerges from a double box culvert under I-85, continues east under Bellevue Avenue

and Hillandale Road, and terminates approximately 300 feet west of Albany Street. Sprunt Avenue parallels most of the site to the south. Indian Trail parallels the Albany reach to the north (Figure 1). The Croasdaile reach is along an unnamed tributary to Ellerbe Creek that emerges from a double box culvert under I-85. It is paralleled by Belleview Avenue to the east.

Maintenance of the immediately surrounding golf course, channel straightening, and the large amount of impervious surface in the surrounding urban watershed were primarily responsible for the stream's instability. The golf course had intensively managed the vegetation adjacent to the stream and only a grass buffer existed along the banks. The result was an entrenched stream with low sinuosity. The channel was incised four to six feet and erosion and slumping affected large portions of the banks (Stantec 2005b).



D. History and Background

Exhibit Table II. Activity and Reporting History Ellerbe Creek Stream Restoration – Project #127		
Activity or Report	Calendar Year of Completion or Planned Completion	Actual Completion Date
Restoration Plan	2003	March 2003
Construction	2005	March 2005
Temporary S&E mix applied	2004	December 2004
Permanent seed mix applied	2004	December 2004
Bare Root Planting	2004	January 2004
Mitigation Plan	2005	May 2005
As-built	2004	May 2005
Year 1 Monitoring	2005	October 2005
Year 2 Monitoring	2006	December 2006
Year 3 Monitoring	2007	October 2007
Year 4 Monitoring	2008	
Vegetation	2008	July 2008
Geomorphological	2008	September 2008
Report	2008	October 2008

Exhibit Table III. Project Contacts - Ellerbe Creek Stream Restoration – Project #127– Durham, NC	
Design:	Stantec Consulting, Inc. 801 Jones Franklin Road, Suite 300 Raleigh, North Carolina 27606 Mr. Brad Fairley (919) 851-6866
Construction Contractor:	SEI Environmental, Inc. 130 Penmarc Drive Raleigh, NC 27603-2470 Ms. Jackie Utley (919) 832-2535
Planting Contractor:	Harp, Inc. PO Box 655 Newell, NC 28126 Mr. Jim Matthews
Seed Contractor:	SEI Environmental, Inc. 130 Penmarc Drive Raleigh, NC 27603-2470 Ms. Jackie Utley (919) 832-2535

Seed Mix and Nursery Stock Suppliers:	Mellow Marsh Farms 1312 Woody Store Road Siler City, NC 27344 Ms. Sharon Day (919) 742-1200
Monitoring Performers (2005):	Stantec Consulting, Inc. 801 Jones Franklin Road, Suite 300 Raleigh, North Carolina 27606 Mr. Brad Fairley (919) 851-6866
Monitoring Performers (2006 - 2009):	Robert J. Goldstein & Associates 1221 Corporation Parkway, Suite 100 Raleigh, NC 27616 Ms. Jessi O'Neal (919) 872-1174

Exhibit Table IV. Project Background - Ellerbe Creek Stream Restoration – Project #127	
County	Durham
Drainage Area	Hillsborough Reach – 1,140 Acres (1.78 sq. miles)
	Hillandale Reach – 1,810 Acres (2.83 sq. miles)
	Albany Reach – 2,150 Acres (3.36 sq. miles)
	Croasdaile Reach – 535 Acres (0.84 sq. miles)
Drainage Impervious Cover Estimate (%)	80% impervious; 20% forest and residential
Stream Order	Third Order
Physiographic Region	Piedmont
Ecoregion	Triassic Basins
Rosgen Classification of As-built	C4
Dominant Soil Types	Cartecay, Chewacla, and Congaree
Reference Site ID	SCO#010551001A
USGS HUC for Project and Reference	Ellerbe: 03020201; Cabin Branch: 03020201; Tributary to Marks Creek: 03020201
NCDWQ Sub-basin for Project and Reference	Ellerbe: 03-04-01; Cabin Branch: 03-04-01; Tributary to Marks Creek: 03-04-02
NCDWQ Classification for Project and Reference	Ellerbe: Impaired; Cabin Branch: Not Rated; Tributary to Marks Creek: Excellent
Any portion of the project segment 303d listed?	Yes
Any portion of the project segment upstream of a 303d listed segment?	Yes
Reasons for 303d Listing or Stressor	Urban runoff/storm sewers
% of Project Easement Fenced 0%	None

Figure 2.1 - 2008 Plan View -
Monitoring Year 4
Ellerbe Creek Stream Restoration -
Durham, NC - NCEEP Project #127

Vegetation Plot Coordinates: Hillsborough Reach			
Plot Side	HB-V1	HB-V2	HB-V3
Pin Coordinate	E 20115741.5610 N 827358.3480	E 20116120.1110 N 827428.6750	E 2016551.0870 N 827505.1970
A	19.5'	31.1'	31.9'
B	52.1'	35.4'	32.6'
C	23.2'	33.1'	31.3'
D	53'	36.2'	39.4'

Vegetation Plot Coordinates: Croasdaile Reach		
Plot Side	CR-V1	CR-V2
Pin Coordinate	E 2016811.8250 N 827741.1850	E 2016933.510 N 827520.8490
A	32.4'	18.3'
B	33.2'	65.5'
C	29.9'	21.7'
D	31.9'	64.1'

	Easting	Northing
Cross-sections		
HB1L	2015742.0022	827332.7693
HB1R	2015772.552	827290.9634
HB2L	2015799.2852	827350.0513
HB2R	2015803.356	827295.5714
HB3L	2016595.6390	827499.8180
HB3R	2016610.0550	827433.3600
HB4L	2015654.5640	827499.8920
HB4R	20116634.3500	827432.4490
CR1L	2016939.2680	827570.7490
CR1R	2016915.6680	827552.4340
CR2L	2016957.7640	827541.2870
CR2R	2016933.5100	827520.8490
Photopoints		
HB-P1	2015577.0052	827347.3258
HB-P2	2015623.7143	827314.4264
HB-P3	2015802.5285	827349.0571
HB-P4	2015961.3634	827401.3361
HB-P5	2016127.5574	827481.3197
HB-P6&P7	2016301.8430	827496.7037
HB-P8	2016523.1130	827464.0709
HB-P9	2016749.2114	827430.4392
HB-P10	2016966.4524	827439.7628
CR-P1	2016781.3114	828053.9579
CR-P2	2016818.9390	827855.0313
CR-P3	2016919.4678	827582.3480

LEGEND

- Thalweg-9/8/08 - 09/18/08
- NCDOT Stormwater Structures
- As-built Drawings**
(Supplied by Stantec)
 - Ellerbe Easement Boundary
 - Thalweg - As-built
 - Top of Bank
 - Vegetation Monitoring Plots
 - Monitoring Cross Sections
 - Photo Points
 - As-built Features
 - Pre-existing Features

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Feet
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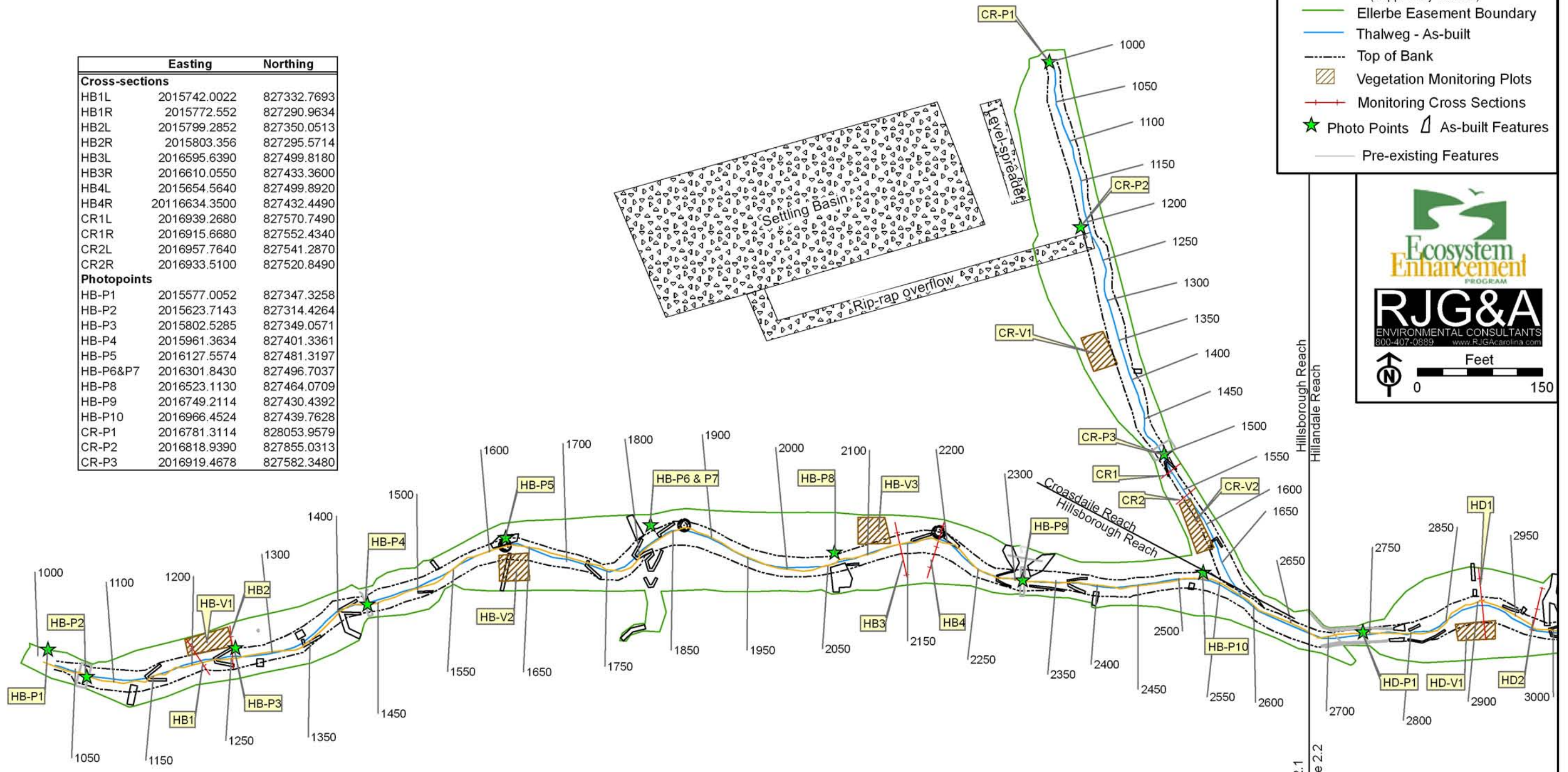
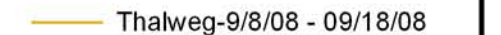
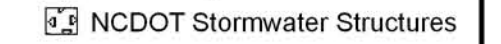
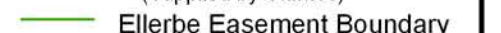



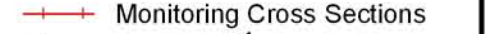
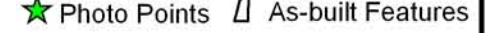





Figure 2.1
Figure 2.2

Figure 2.2 - 2008 Plan View -
Monitoring Year 4
Ellerbe Creek Stream Restoration -
Durham, NC - NCEP Project #127

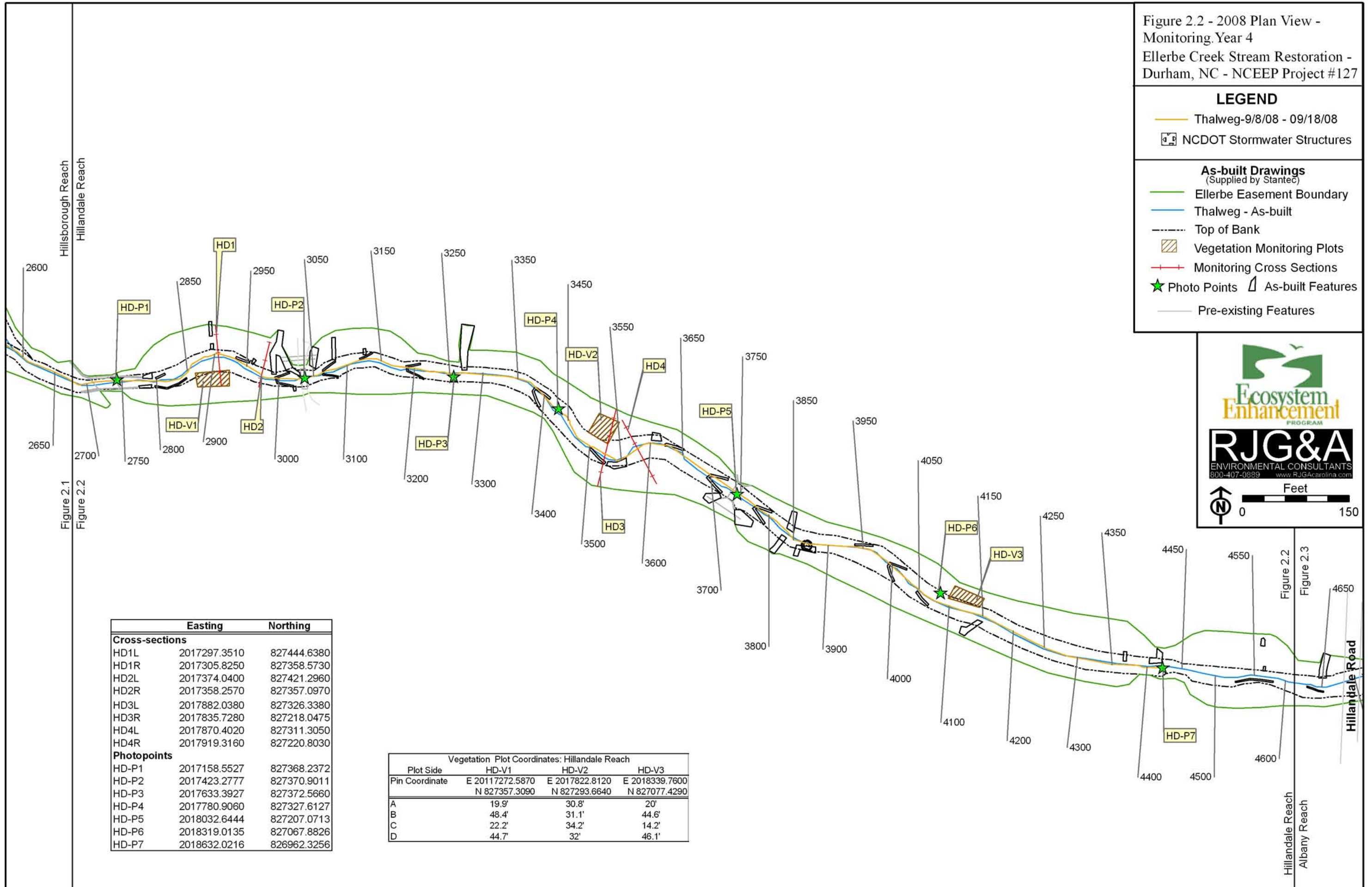
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Hillsborough Reach
Hillandale Reach

Figure 2.1
Figure 2.2

	Easting	Northing
Cross-sections		
HD1L	2017297.3510	827444.6380
HD1R	2017305.8250	827358.5730
HD2L	2017374.0400	827421.2960
HD2R	2017358.2570	827357.0970
HD3L	2017882.0380	827326.3380
HD3R	2017835.7280	827218.0475
HD4L	2017870.4020	827311.3050
HD4R	2017919.3160	827220.8030
Photopoints		
HD-P1	2017158.5527	827368.2372
HD-P2	2017423.2777	827370.9011
HD-P3	2017633.3927	827372.5660
HD-P4	2017780.9060	827327.6127
HD-P5	2018032.6444	827207.0713
HD-P6	2018319.0135	827067.8826
HD-P7	2018632.0216	826962.3256

Vegetation Plot Coordinates: Hillandale Reach			
Plot Side	HD-V1	HD-V2	HD-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.9'	30.8'	20'
B	48.4'	31.1'	44.6'
C	22.2'	34.2'	14.2'
D	44.7'	32'	46.1'

Figure 2.2
Figure 2.3


Hillandale Reach
Albany Reach

Hillandale Road

Figure 2.3 - 2008 Plan View -
Monitoring Year 4
Ellerbe Creek Stream Restoration -
Durham, NC - NCEP Project #127

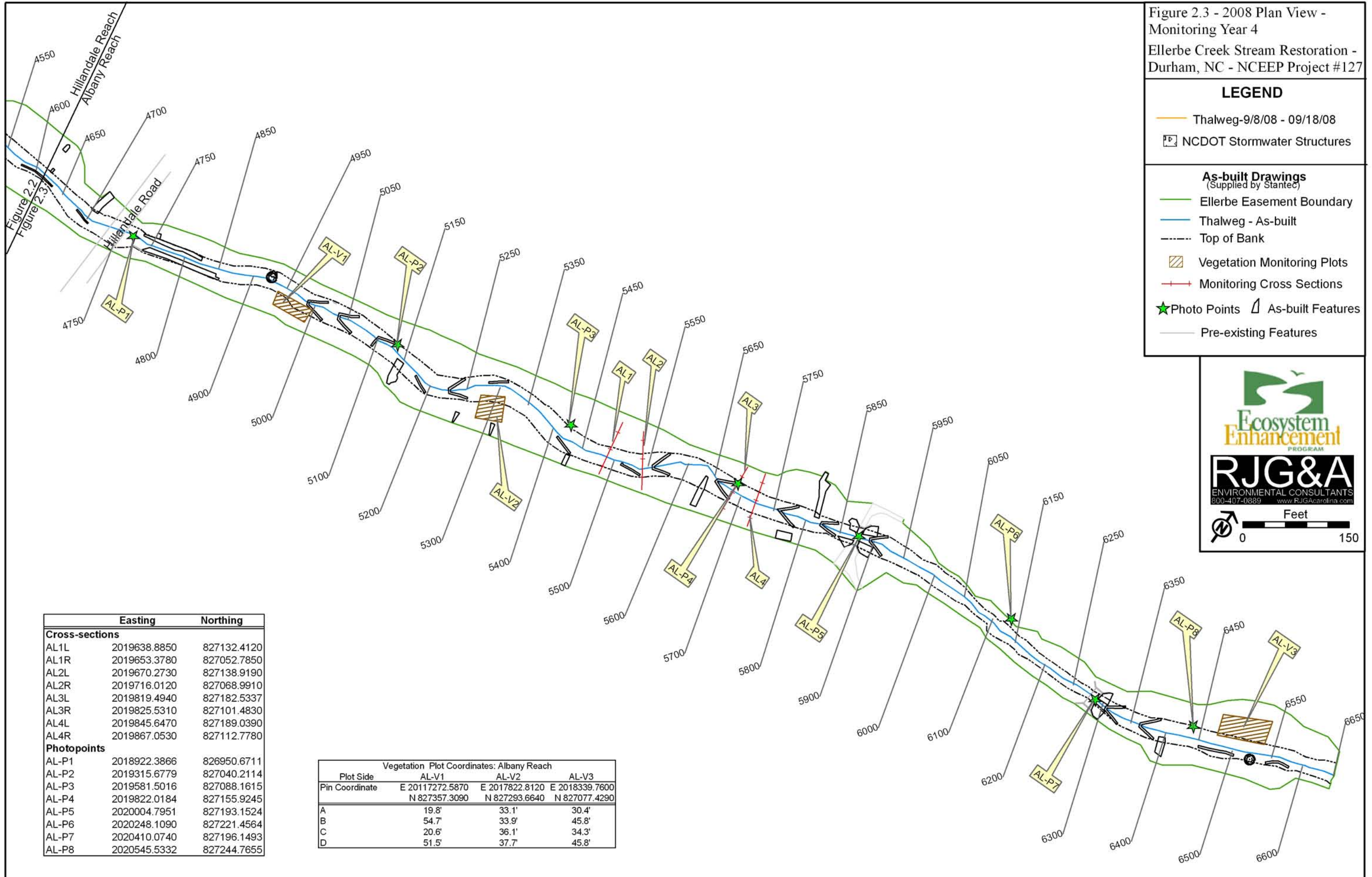
LEGEND

-  Thalweg-9/8/08 - 09/18/08
-  NCDOT Stormwater Structures
- As-built Drawings**
(Supplied by Stantec)
-  Ellerbe Easement Boundary
-  Thalweg - As-built
-  Top of Bank
-  Vegetation Monitoring Plots
-  Monitoring Cross Sections
-  Photo Points
-  As-built Features
-  Pre-existing Features



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	Easting	Northing
Cross-sections		
AL1L	2019638.8850	827132.4120
AL1R	2019653.3780	827052.7850
AL2L	2019670.2730	827138.9190
AL2R	2019716.0120	827068.9910
AL3L	2019819.4940	827182.5337
AL3R	2019825.5310	827101.4830
AL4L	2019845.6470	827189.0390
AL4R	2019867.0530	827112.7780
Photopoints		
AL-P1	2018922.3866	826950.6711
AL-P2	2019315.6779	827040.2114
AL-P3	2019581.5016	827088.1615
AL-P4	2019822.0184	827155.9245
AL-P5	2020004.7951	827193.1524
AL-P6	2020248.1090	827221.4564
AL-P7	2020410.0740	827196.1493
AL-P8	2020545.5332	827244.7655

Vegetation Plot Coordinates: Albany Reach			
Plot Side	AL-V1	AL-V2	AL-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.8'	33.1'	30.4'
B	54.7'	33.9'	45.8'
C	20.6'	36.1'	34.3'
D	51.5'	37.7'	45.8'

III. Project Conditions and Monitoring Results

RJG&A's initial 2008 qualitative evaluation was conducted in April and the project appeared to be functioning as designed. Subsequent evaluations in July and October 2008 also revealed relatively complete design compliance.

A. Vegetation Assessment

The average live, planted, woody stem density for all plots was 798 stems per acre or approximately 19 individuals per plot (Appendix A-1, Table 5). This exceeds the required 320 stems per acre in the third monitoring year by 149 percent. The eleven vegetation plots contain a total of 186 volunteer woody stems; resulting in a density of 1,483 stems per acre, when combine with the planted stems.

Hillsborough Reach

Three vegetation problem areas were observed in the Hillsborough reach during the fourth growing season. All occur on the slopes between the terrace and the golf course and are likely to have resulted from rill and gully erosion in compacted subsoil. All three areas were identified as problem areas in 2006 and 2007, but have decreased in size and move off of the floodplain areas. In addition to these three larger vegetation problem areas, small, isolated rill and gully areas exist throughout the project that have poor vegetative cover, as well (Appendix A.1 and A.2).

Although three active beaverdams were located in this reach, no evidence of beaver browsing was observed in this, or any other reach in the project.

Croasdaile Reach

In the Croasdaile reach, the NCDOT rip-rap spillway crosses the riparian buffer to intersect with the stream, resulting in no vegetation in this area. No remedial action is recommended/possible at this time.

Hillandale Reach

Two small rill and gully vegetation problem areas were observed in the Hillandale reach. One area on the left-bank slope from the terrace, immediately downstream from cross-section four, and the other on the right-bank slope beginning at station 3880. As described above, this vegetation problem area is likely to be the result of the lack of an adequate substrate and run-off from the golf course. The third problem area in the Hillandale reach involves bare floodplain soils at station 4450 (Vegetation problem Photo 2).

Albany Reach

Two vegetation problem areas were observed in the Albany Reach. Both are a combination of rill and gully erosion on the slopes and bare soil on the floodplain, due to poor/compacted soil. Vegetation monitoring plots in the vicinity of these areas have 19

and 34 live planted stems (769 and 1,376 stems per acre respectively), so no remedial action is recommended at this time.

B. Stream Assessment

1. Morphometric Criteria

RJG&A staff evaluated the Ellerbe Creek Stream Restoration site during April, July, and September 2008. The RJG&A staff collected the fourth year of vegetation data during July 2008 and the geomorphic data during September 2008.

As the quantitative data and qualitative evaluations indicate, after the fourth growing season the structure and function of the entire restoration project very closely match the as built conditions and nearly all structures appear to be functioning as designed.

Since 2006, a structural failure has been monitored at a cross vane on Ellerbe Creek's right bank at station 6330 (Appendix B1.3). The vane's downstream-most header rock has become entirely dislodged from the underlying footer and is in the channel below. From the header's former location, the downstream bank is eroding severely and slumping into the creek for approximately 30 more feet. Several areas of scour, aggradation, and structure undermining were observed at other locations (Table B1 in Appendix B).

A total of three active beaverdams were observed throughout the restoration project, all of which located in the Hillsborough reach. Those three, along with three additional abandoned dams in this reach, are impounding water and sediments in the uppermost reach. All six are identified in the longitudinal profile (Appendix B).

The lowest portion of the Albany reach continues to be impounded, presumably due to downstream beaver activity, resulting in flooded structures and aggregation in the two downstream-most pools.

Several slopes with rill and gully erosion are still present throughout the site (Table B1). These will continue to be evaluated.

Although construction overflow spillway that serves the I-85 stormwater settling basin has altered a portion of the Croasdaile Reach's right bank and the dimensions of the adjacent constructed wetland, it appears to be stable and functioning.

2. Hydrologic Criteria

On 13 June 2007, a crest gauge was installed at station 5818 to document bankfull events. The crest gauge was checked and reset during the spring 08 initial assessment and the fall 08 monitoring. The crest gauge data indicate that at least two bankfull events had occurred as of 18 September 2008 (Table V). Further evidence that a bankfull event has occurred include rack and drift lines and downed vegetation/stems well above the bankfull elevation that were observed on both occasions throughout the restoration.

NC CRONOS precipitation data indicate that at the National Weather Service COOP station 312515 in Durham County, significant rainfall events occurred on March 4 (2.00”), August 28 (4.82”), September 6 (3.98”), and September 26 (2.18”) (NC CRONOS 2009).

Exhibit Table V. Verification of Bankfull Events – Ellerbe Creek Stream Restoration – Project #127			
Date of Data Collection	Date of Occurrence	Method	Photo #
4/30/06	Late-April 2006	On-site high water indicators observed	NA
6/28/06	Mid-June 2006	On-site high water indicators	NA
9/19/06	Early-September 2006	On-site high water indicators	NA
02/01/07	November 22, 2006	Proximal USGS gauge	NA
4/11/07	Between 7 December 2006 and 11 April 2007	On-site high water indicators	NA
10/02/07	Between 13 June 2007 and 02 October 2007	Crest Gauge	NA
4/16/08	4 March 2008	On-site high water indicators AND Crest Gauge	NA
9/18/08	28 August, 6 September 2008	On-site high water indicators AND Crest Gauge	NA

Table VI BEHI and Sediment Export Estimates only apply to Monitoring year 5.

Exhibit Table VII. Categorical Stream Feature Visual Stability Assessment - Ellerbe Creek Stream Restoration – Project #127

Hillsborough Reach (1,663 ft)						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	95%	87%	90%	80%	
B. Pools	100%	80%	69%	94%	96%	
C. Thalweg	100%	95%	78%	87%	86%	
D. Meanders	100%	98%	94%	100%	100%	
E. Bed General	100%	85%	100%	100%	99%	
G. Bank				98%	95%	
F. Vanes/J Hooks, etc.	100%	95%	89%	100%	100%	
H. Wads and Boulders	100%	95%	75%	66.5%	67%	
Croasdaile Reach (703 ft)						
A. Riffles	100%	95%	100%	100%	95%	
B. Pools	100%	95%	100%	100%	93%	
C. Thalweg	100%	95%	100%	100%	100%	
D. Meanders	100%	95%	100%	100%	100%	
E. Bed General	100%	95%	100%	100%	99%	
G. Bank				100%	100%	
F. Vanes/J Hooks, etc.	100%	95%	100%	100%	100%	
H. Wads and Boulders	100%	95%	100%	100%	NA	
Hillandale Reach (1,939 ft)						
A. Riffles	100%	90%	93%	95%	84%	
B. Pools	100%	85%	89%	96%	90%	
C. Thalweg	100%	95%	80%	75%	96%	
D. Meanders	100%	95%	83%	92%	97%	
E. Bed General	100%	75%	100%	100%	99%	
G. Bank				94%	97%	
F. Vanes/J Hooks, etc.	100%	95%	92%	89%	86%	
H. Wads and Boulders	100%	95%	50%	100%	100%	
Albany Reach (1,974 ft)						
A. Riffles	100%	60%	75%	60%	75%	
B. Pools	100%	60%	62%	79%	87%	
C. Thalweg	100%	80%	75%	45%	74%	
D. Meanders	100%	95%	77%	77%	88%	
E. Bed General	100%	50%	100%	100%	98%	
G. Bank				89%	90%	
F. Vanes/J Hooks, etc.	100%	95%	79%	85%	90%	
H. Wads and Boulders	100%	95%	75%	75%	75%	

Exhibit Table VIII. Baseline Morphology and Hydraulic Summary - Ellerbe Creek Stream Restoration – Project #127 Reaches: Hillsborough, Hillandale, Albany																	
Parameters	USGS Gage Data			Regional Curve Interval			Project Reference Stream		Pre-Existing Condition			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension																	
Bankfull Width (ft)	NA	NA	NA	NA	NA	NA	10.1	14.3	19.9	20.7	NA	22	26	NA	16.3	24.8	NA
Floodprone Width (ft)	NA	NA	NA	NA	NA	NA	47	59	25	40	NA	48	57	NA	50	100	NA
BF Cross Sectional Area (sq ft)	NA	NA	NA	NA	NA	NA	7.2	21.4	37.9	48.3	NA	28.9	42.3	NA	25.8	82.4	NA
BF Mean Depth (ft)	NA	NA	NA	NA	NA	NA	0.7	1.5	1.5	2.4	NA	1.8	2.2	NA	1.3	3.3	NA
Maximum Depth (ft)	NA	NA	NA	NA	NA	NA	1.3	2.2	3.7	4.0	NA	2.7	3.2	NA	2.2	4.8	NA
Width/Depth Ratio	NA	NA	NA	NA	NA	NA	10	14	8	13	NA	NA	NA	NA	13	19	NA
Entrenchment Ratio	NA	NA	NA	NA	NA	NA	3.3	5.8	1.2	2.0	NA	2.2	2.2	NA	2.4	3.9	NA
Bank Height Ratio	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.02	1.31	1.07
Wetted Perimeter (ft)	NA	NA	NA	NA	NA	NA	11.6	17.3	28.3	24.8	NA	21.9	24.6	NA	19.9	38.4	NA
Hydraulic Radius (ft)	NA	NA	NA	NA	NA	NA	0.6	1.2	1.3	2.0	NA	1.3	1.7	NA	1.3	2.6	NA
Pattern																	
Channel Beltwidth (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8	NA	5	NA	NA	4	NA
Radius of Curvature (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5	49	NA
Meander Wavelength	NA	NA	NA	NA	NA	NA	38	80	25	33	NA	90	105	NA	12	55	37
Meander Width ratio	NA	NA	NA	NA	NA	NA	38	160	NA	19	15	45	95	NA	35	114	67
Profile																	
Riffle length (ft)	NA	NA	NA	NA	NA	NA	32	105	NA	129	65	85	295	NA	103	304	185
Riffle slope (ft/ft)	NA	NA	NA	NA	NA	NA	3.7	7.9	1.3	1.6	NA	4.0	4.1	NA	0.5	2.4	1.5
Pool length (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	103	NA	NA	NA	NA
Pool spacing (ft)	NA	NA	NA	NA	NA	NA	NA	NA	0.906	1.091	0.011	0.001	0.002	NA	NA	NA	NA
Substrate																	
d50 (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	27	NA	NA	NA	NA
d84 (mm)	NA	NA	NA	NA	NA	NA	5	49	19	29	24	24	160	NA	NA	NA	NA
Additional Reach Parameters																	
Valley Length (ft)	NA			NA			NA		5200			NA			NA		
Channel Length (ft)	NA			NA			NA		NA			NA			5576		
Sinuosity	NA			NA			1.2		1.0			1.1			1.1		
Water Surface Slope (ft/ft)	NA			NA			NA		0.994			NA			0.97		
BF slope (ft/ft)	NA			NA			NA		NA			NA			NA		
Rosgen Classification	NA			NA			C4b, C5		G4			C4			C4		
Habitat Index	NA			NA			NA		NA			NA			NA		
Macrobenthos	NA			NA			NA		NA			NA			NA		

Exhibit Table VIII. Baseline Morphology and Hydraulic Summary - Ellerbe Creek Stream Restoration – Project #127 - Reach: Croasdaile																	
Parameters	USGS Gage Data			Regional Curve Interval			Project Reference Stream		Pre-Existing Condition			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Min	Max	Med	Min	Max	Med	Min	Max	Med
Bankfull Width (ft)	NA	NA	NA	NA	NA	NA	10.1	14.3	19.9	20.7	NA	NA	NA	17.5	9.1	11.5	NA
Floodprone Width (ft)	NA	NA	NA	NA	NA	NA	47	59	25	40	NA	NA	NA	50	NA	NA	21
BF Cross Sectional Area (sq ft)	NA	NA	NA	NA	NA	NA	7.2	21.4	37.9	48.3	NA	NA	NA	16.9	14.5	19.7	NA
BF Mean Depth (ft)	NA	NA	NA	NA	NA	NA	0.7	1.5	1.5	2.4	NA	NA	NA	1.5	1.3	2.2	NA
Maximum Depth (ft)	NA	NA	NA	NA	NA	NA	1.3	2.2	3.7	4.0	NA	NA	NA	2.1	1.9	2.8	NA
Width/Depth Ratio	NA	NA	NA	NA	NA	NA	10	14	8	13	NA	NA	NA	12	NA	NA	9
Entrenchment Ratio	NA	NA	NA	NA	NA	NA	3.3	5.8	1.2	2.0	NA	NA	NA	2.9	NA	NA	1.9
Bank Height Ratio	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.34	2.75	NA
Wetted Perimeter (ft)	NA	NA	NA	NA	NA	NA	11.6	17.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydraulic Radius (ft)	NA	NA	NA	NA	NA	NA	0.6	1.2	1.3	2.0	NA	NA	NA	1.0	1.1	1.6	NA
Pattern																	
Channel Beltwidth (ft)	NA	NA	NA	NA	NA	NA	38	80	25	33	NA	NA	NA	83	NA	NA	NA
Radius of Curvature (ft)	NA	NA	NA	NA	NA	NA	38	160	NA	19	15	36	44	NA	NA	NA	NA
Meander Wavelength	NA	NA	NA	NA	NA	NA	32	105	NA	129	65	156	233	NA	NA	NA	NA
Meander Width ratio	NA	NA	NA	NA	NA	NA	4	8	1	2	NA	NA	NA	5	NA	NA	NA
Profile																	
Riffle length (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Riffle slope (ft/ft)	NA	NA	NA	NA	NA	NA	NA	NA	0.9	1.1	0.0	NA	NA	0.0	NA	NA	NA
Pool length (ft)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pool spacing (ft)	NA	NA	NA	NA	NA	NA	NA	NA	19	29	24	29	78	NA	NA	NA	NA
Substrate																	
d50 (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8	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
Additional Reach Parameters																	
Valley Length (ft)	NA			NA			NA		NA			NA			687		
Channel Length (ft)	NA			NA			NA		NA			NA			703		
Sinuosity	NA			NA			1.20-1.23		1.03			1.05			1.02		
Water Surface Slope (ft/ft)	NA			NA			NA		0.994			NA			NA		
BF slope (ft/ft)	NA			NA			NA		NA			NA			NA		
Rosgen Classification	NA			NA			C4b, C5		G4			C4			B4		
Habitat Index	NA			NA			NA		NA			NA			NA		
Macrobenthos	NA			NA			NA		NA			NA			NA		

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Hillsborough Reach

Dimension	HB-XS1 (Riffle)					HB-XS2 (Pool)					HB-XS3 (Riffle)					HB-XS4 (Pool)				
	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04
Bankfull Width (ft)	19.3	21.8	21.5	23.2	22.0	16.3	16.1	19.3	18.0	16.8	21.9	38.0	22.1	22.4	21.8	24.8	24.4	26.2	28.1	26.4
Floodprone Width (ft)	50	100	100	100	100	NA	100	100	100	100	85	100	100	100	100	NA	100	100	100	100
BF Cross Sectional Area (sq ft)	25.8	33.1	31.3	31.4	31.2	54.2	54.0	58.9	60.3	55.9	37.7	38.2	35.7	35.3	34.5	59.1	56.3	58.9	68.5	57.2
BF Mean Depth (ft)	1.3	1.5	1.5	1.4	1.4	3.3	3.4	3.1	3.4	3.3	1.7	1.0	1.6	1.6	1.6	2.4	2.3	2.2	2.4	2.2
BF Maximum Depth (ft)	2.2	2.6	2.6	2.7	2.9	4.5	4.6	5.0	5.0	4.8	3.1	2.8	3.1	3.2	3.1	4.5	4.4	4.3	4.4	3.9
Width/Depth Ratio	14.50	14.30	14.75	17.22	15.57	NA	4.80	6.32	5.38	5.06	12.70	37.70	13.69	14.19	13.76	NA	10.60	11.69	11.50	12.19
Entrenchment Ratio	2.60	4.60	4.66	4.30	4.54	NA	6.20	5.18	3.03	5.95	3.90	2.60	4.52	4.47	4.59	NA	4.10	3.81	2.48	3.79
Bank Height Ratio	1.16	NA	NA	1.01	1	1.07	NA	NA	1.04	1.05	1.08	NA	NA	1.08	1.09	1.03	NA	NA	1.05	1.03
Wetted Perimeter (ft)	19.9	22.8	22.5	24.3	23.1	21.1	21.5	24.6	23.6	21.6	23.2	38.7	23.3	23.7	23.2	28.0	27.3	29.2	31.5	29.5
Hydraulic Radius (ft)	1.30	1.50	1.39	1.29	1.35	2.60	2.50	2.40	2.56	2.59	1.60	1.00	1.53	1.49	1.49	2.10	2.10	2.01	2.18	1.94
Substrate																				
d50 (mm)	12	12	4	6	14	11	10	0	0	0	NA	0	0	7	0	4	1	2	1	1
d84 (mm)	49	30	40	19	37	23	41	16	4	2	NA	1200	3	21	1	11	13	14	21	15

Entire Longitudinal Profile (all HB and part of HD)

	MY-1			MY-2			MY-3			MY-4		
Pattern	min	max	average	min	max	average	min	max	average	min	max	med
Channel Beltwidth (ft)	NA	NA	NA	9.57	57.91	35.66	12.2	60.9	39.3	14	67.3	44.5
Radius of Curvature (ft)	NA	NA	NA	39.1	126.49	69.6	31	126.2	60.5	26.7	109.8	57.9
Meander Wavelength	NA	NA	NA	155.44	384.31	384.31	153.5	388.5	248.4	183.8	392.5	229.4
Meander Width ratio			NA			1.21			1.17			1.08
Profile	min	max	average	min	max	average	min	max	average	min	max	med
Riffle length (ft)	NA	NA	NA	3.54	70.53	22.91	19.1	158.5	56.6	10	123	40.5
Riffle slope (ft/ft)	NA	NA	NA	0.001	0.175	0.042	0	0.03	0.011	0	0.069	0.010
Pool length (ft)	NA	NA	NA	18.18	425.86	118.6	17.3	93.9	44.2	20	97	40.5
Pool spacing (ft)	NA	NA	NA	0.77	51.72	18.78	14.5	344	104.1	0	337	53

Additional Reach Parameters

	Mon 01	Mon 02*	Mon 03*	Mon 04*
Valley Length (ft)	1586	3,072	3,072	3,072
Channel Length (ft)	1663	3,398	3,389	3,373
Sinuosity	1.05	1.11	1.10	1.10
Water Surface Slope (ft/ft)	0.97	0.0035	0.0047	0.0032
BF slope (ft/ft)	NA	0.0018	0.0035	0.0026
Rosgen Classification	C4	C5	C5	C5
Habitat Index	NA	NA	NA	NA
Macrobenthos	NA	NA	NA	NA

*For entire longitudinal profile only

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Hillandale Reach

Dimension	HD-XS1 (Pool)					HD-XS2 (Riffle)					HD-XS3 (Pool)					HD-XS4 (Riffle)				
	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04
Bankfull Width (ft)	37.1	30.0	31.1	37.5	45.0	23.9	21.4	20.6	20.2	19.4	40.4	45.2	45.1	45.3	45.5	34.7	35.6	33.8	34.8	35.7
Floodprone Width (ft)	NA	100	100	100	110	75	100	100	100	90	NA	100	100	102	102	100	105	105	105	105
BF Cross Sectional Area (sq ft)	49.1	37.3	36.5	45.0	52.8	33.2	36.2	32.0	29.4	33.0	89.1	101.2	100.5	98.8	96.5	62.7	69.2	64.1	64.3	62.1
BF Mean Depth (ft)	1.3	1.2	1.2	1.2	1.2	1.4	1.7	1.6	1.5	1.7	2.2	2.2	2.2	2.2	2.1	1.8	1.9	1.9	1.9	1.7
BF Maximum Depth (ft)	3.2	3.0	3.0	3.0	3.2	3.0	2.9	2.8	2.8	3.0	4.2	4.5	4.6	4.8	4.7	3.2	4.0	3.7	4.1	4.0
Width/Depth Ratio	NA	24.20	26.52	31.29	38.27	17.20	12.67	13.25	13.82	11.42	NA	20.10	20.22	20.74	21.47	19.20	18.33	17.88	18.88	20.51
Entrenchment Ratio	NA	3.30	3.22	2.22	2.45	3.10	3.14	4.85	3.28	4.64	NA	2.20	2.22	0.23	2.23	2.90	2.96	3.10	0.22	2.94
Bank Height Ratio	1.13	NA	NA	1.14	1.00	1.02	NA	NA	1.08	1.11	1.07	NA	NA	1.02	1.00	1.09	NA	NA	1.12	1.20
Wetted Perimeter (ft)	38.40	31.20	32.73	39.09	46.46	25.10	22.88	21.99	21.38	20.51	41.70	46.60	46.71	47.04	47.44	35.60	36.72	35.38	36.56	36.91
Hydraulic Radius (ft)	1.30	1.20	1.11	1.15	1.14	1.30	1.58	1.46	1.38	1.61	2.10	2.20	2.15	2.10	2.03	1.80	1.88	1.81	1.76	1.68
Substrate																				
d50 (mm)	0.4	0.6	0.1	3.0	5.7	NA	0.1	0.1	0.1	0.7	1.7	7.0	9.6	0.8	1.5	1.8	0.1	0.1	6.9	1.9
d84 (mm)	5.0	8.0	6.4	13.0	14.0	10.0	0.1	0.8	0.4	3.6	10.0	18.0	15.5	14.4	16.8	6.0	0.1	7.5	15.6	11.3
Additional Reach Parameters	Mon 01																			
Valley Length (ft)	1804																			
Channel Length (ft)	1939																			
Sinuosity	1.07																			
Water Surface Slope (ft/ft)	NA																			
BF slope (ft/ft)	NA																			
Rosgen Classification	C4																			
Habitat Index	NA																			
Macrobenthos	NA																			

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Albany Reach

Dimension	AL-XS1 (Riffle)					AL-XS2 (Pool)					AL-XS3 (Riffle)					AL-XS4 (Pool)				
	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04
Bankfull Width (ft)	29.0	31.7	31.9	28.8	34.2	27.0	28.0	31.9	34.8	27.8	27.4	21.3	24.0	21.4	21.7	28.6	28.9	35.9	26.3	26.2
Floodprone Width (ft)	NA	100	100	100	98	100	100	100	100	100	NA	100	100	100	87	70	72	100	100	71
BF Cross Sectional Area (sq ft)	60.5	69.1	65.8	63.6	69.0	68.4	70.1	68.3	72.8	70.5	82.4	71.4	65.9	61.5	61.9	55.4	55.7	48.2	45.3	40.2
BF Mean Depth (ft)	2.1	2.2	2.1	2.2	2.0	2.5	2.5	2.1	2.1	2.5	3.0	3.3	2.8	2.9	2.9	1.9	1.9	1.3	1.7	1.5
BF Maximum Depth (ft)	3.5	3.9	4.1	4.3	4.4	4.8	4.6	4.7	4.7	4.7	5.1	4.4	4.4	4.3	4.3	3.2	3.3	3.3	3.1	3.3
Width/Depth Ratio	NA	14.50	15.40	13.08	16.96	10.70	11.20	14.90	16.66	10.93	NA	6.40	8.73	7.45	7.59	14.80	15.00	26.70	15.23	17.12
Entrenchment Ratio	NA	3.20	3.14	2.79	2.87	3.70	3.60	3.13	2.41	3.60	NA	4.70	4.17	0.58	4.01	2.40	2.50	2.79	0.21	2.69
Bank Height Ratio	1.07	NA	NA	1.03	1.02	1.08	NA	NA	1.06	1.07	1.14	NA	NA	1.14	1.15	1.31	NA	NA	1.23	1.28
Wetted Perimeter (ft)	30.2	33.5	33.6	30.8	36.7	30.7	30.7	35.9	38.4	31.8	32.3	25.3	28.2	24.9	24.8	29.6	30.0	37.4	27.4	27.6
Hydraulic Radius (ft)	2.00	2.10	1.96	2.06	1.88	2.20	2.30	1.90	1.89	2.22	2.50	2.80	2.34	2.47	2.50	1.90	1.90	1.29	1.65	1.45
Substrate																				
d50 (mm)	0.1	0.1	2.3	0.2	0.6	0.2	0.9	0.3	0.2	0.3	0.4	9.2	7.0	0.6	0.2	0.2	3.5	0.8	2.8	0.1
d84 (mm)	6.0	3.8	12.2	5.7	11.3	9.0	10.0	9.1	1.0	18.5	22.0	22.0	16.8	9.7	13.0	5.0	12.0	6.5	8.8	3.0

Additional Reach Parameters Mon 01

Valley Length (ft)	1888
Channel Length (ft)	1974
Sinuosity	1.04
Water Surface Slope (ft/ft)	NA
BF slope (ft/ft)	NA
Rosgen Classification	C4
Habitat Index	NA
Macrobenthos	NA

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary - Ellerbe Creek Stream Restoration – Project #127 - Croadsdale Reach

Dimension	CR-XS1 (Pool)					CR-XS2 (Riffle)				
	As-built	Mon 01	Mon 02	Mon 03	Mon 04	As-built	Mon 01	Mon 02	Mon 03	Mon 04
Bankfull Width (ft)	9.1	9.4	8.6	9.1	8.7	11.5	13.4	10.3	11.4	10.3
Floodprone Width (ft)	NA	9.8	9.8	21.9	21.4	21.2	23.3	23.3	21.8	20.7
BF Cross Sectional Area (sq ft)	19.7	20.4	18.4	20.5	19.6	14.5	17.9	11.7	14.0	12.4
BF Mean Depth (ft)	2.2	2.2	2.1	2.3	2.3	1.3	1.3	1.1	1.2	1.2
BF Maximum Depth (ft)	2.8	2.5	2.6	2.8	2.8	1.9	2.1	1.7	2.0	1.9
Width/Depth Ratio	NA	4.40	4.02	4.00	3.84	9.00	10.00	9.06	9.30	8.62
Entrenchment Ratio	NA	1.00	1.14	2.42	2.47	1.90	1.70	2.27	1.91	2.00
Bank Height Ratio	2.34	NA	NA	2.35	2.41	2.75	NA	NA	2.78	2.94
Wetted Perimeter (ft)	12.7	11.1	12.1	12.6	12.1	12.8	14.8	11.4	12.5	11.2
Hydraulic Radius (ft)	1.60	1.80	1.52	1.62	1.62	1.10	1.20	1.03	1.12	1.11
Substrate										
d50 (mm)	9.9	12.0	13.9	5.7	4.7	14.0	12.0	9.5	8.3	6.7
d84 (mm)	19.0	24.0	23.9	30.9	27.7	27.0	20.0	27.3	20.2	20.7

Additional Reach Parameters **Mon 01**

Valley Length (ft)	687
Channel Length (ft)	703
Sinuosity	1.02
Water Surface Slope (ft/ft)	NA
BF slope (ft/ft)	NA
Rosgen Classification	B4
Habitat Index	NA
Macrobenthos	NA

C. Wetland Assessment

As part of the project design, a stormwater wetland and 11 pocket wetlands were created throughout the Ellerbe Creek floodplain. No monitoring wells were established in relation to any of these wetlands and EEP did not claim any mitigation credit for them. By all appearances, all of the wetlands appear to be functioning as designed. The NCDOT rip-rap stormwater spillway could negatively impact hydrology in the Croasdaile Reach's constructed wetland.

IV. Methodology

Methods employed were a combination those specified in the Mitigation Plan, the First Annual Monitoring Report, and standard regulatory guidance and procedures documents. Photographs were taken digitally. A Trimble Geo XT handheld sub-meter GPS unit was used to collect cross section, vegetation corner, photopoint, and problem area locations.

A. Stream Methodology

Standard fluvial geomorphic techniques were used to collect geomorphic data (Rosgen 1997; USACOE 2003). A South Total Station and Nikon automatic level were used for collecting all geomorphic data. RIVERMorph 3.1 was used to analyze data. A *wetted perimeter* bed material analysis was performed at each cross section during July 2008. Photographs facing downstream were taken at each cross section.

B. Vegetation Methodology

Eleven vegetation survey plots were established during the first year of monitoring. Within each plot, the height and live stem diameter were recorded for each stem location. All planted stems were flagged with survey tape. Volunteer woody vegetation was also identified and categorized by height or diameter class. All vegetation was identified using Radford and Weakley (Radford 1968; Weakley 2007). Photos were taken of each vegetation plot from the 0,0 corner.

Tables 5 and 6 in Appendix A contain the data from the vegetation monitoring. Monitoring plot photos can also be found in Appendix A.

References

Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. (2006). *CVS-EEP Protocol for Recording Vegetation Version 4.0*. Retrieved October 30, 2006, from: <http://www.nceep.net/business/monitoring/veg/datasheets.htm>.

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Appendix A. Vegetation Raw Data
Ellerbe Creek Stream Restoration – Project #127

- A1. Vegetation Survey Data Tables
 - Table 5. Stem Count by Plot and Species
 - Table 6. Vegetation Problem Areas
- A2. Vegetation Problem Area Photos
- A3. Vegetation Monitoring Plot Photos

Appendix A1. Vegetation Data Tables

Table 5. Stem Counts and Summary Data by Species and Plot - Ellerbe Creek Stream Restoration - Durham County, N.C.

Species	Total Planted (2003)	Year 4 Total Live (2008)	Total Dead (all years)	% Survival	Hillsborough Reach			Croasdaile Reach		Hillandale Reach			Albany Reach		
					Plot HB - 1	Plot HB - 2	Plot HB - 3	Plot CR - 1	Plot CR - 2	Plot HD - 1	Plot HD - 2	Plot HD - 3	Plot AL - 1	Plot AL - 2	Plot AL - 3
<i>Alnus serrulata</i>															
<i>Aronia arbutifolia</i>	33	16	0	48	0	0	1	0	0	0	9	3	1	2	0
<i>Betula nigra</i>	42	23	1	55	3	0	4	0	0	0	3	0	0	1	12
<i>Cephalanthus occidentalis</i> *	NA	12	0	NA	0	0	0	0	0	6	0	0	4	2	0
<i>Clethra alnifolia</i>	8	13	0	163	0	2	0	1	9	0	1	0	0	0	0
<i>Cornus amomum</i>	93	59	1	63	5	9	11	12	5	1	0	4	2	8	2
<i>Cornus florida</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Fraxinus pennsylvanica</i>	35	24	0	69	7	0	0	0	0	0	0	6	0	0	11
<i>Ilex verticillata</i>	3	1	1	33	1	0	0	0	0	0	0	0	0	0	0
<i>Juniperus virginiana</i>	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Morella cerifera</i>	2	2	0	100	0	0	1	1	0	0	0	0	0	0	0
<i>Quercus coccinea</i>	7	8	0	114	1	0	0	5	0	0	0	0	0	0	2
<i>Quercus phellos</i>	24	14	0	58	2	0	1	0	0	0	3	2	0	0	6
<i>Salix sericea</i>	23	15	0	65	0	7	0	0	0	0	0	2	0	6	0
<i>Sambucus canadensis</i>	51	14	0	27	0	1	0	0	3	0	1	0	8	0	1
<i>Spirea tomentosa</i> **	NA	5	1	NA	0	0	0	0	5	0	0	0	0	0	0
<i>Symphoricarpos orbiculatus</i>	4	9	0	225	0	0	0	0	8	1	0	0	0	0	0
<i>Vaccinium corymbosum</i>	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Viburnum nudum</i>	7	2	0	29	0	0	0	0	0	0	0	0	2	0	0
<i>Unknown spp</i>	NA	0	0	NA	0	0	0	0	0	0	0	0	0	0	0
Total per plot					19	19	18	19	30	8	17	17	17	19	34
Total Planted Stems	364	217		59.6											
Average planted stems per acre	1,339	798			Total Volunteer stems			186		Average Stems per acre (planted + volunteer)			1,483		

* *Cephalanthus occidentalis* may have been identified as *Viburnum nudum* in Monitoring Year-1, so there is no record of the plant in the total planted vegetation data.

** *Spirea tomentosa* may have been identified as *Clethra alnifolia* in Monitoring Year-1, so there is no record of the plant in the total planted vegetation data.

Appendix A1. Vegetation Data Tables

Table 6. Vegetation Problem Areas Ellerbe Creek Stream Restoration – Project #127			
Feature/Issue	Station # / Range	Probable Cause	Photo #
Bare soil/eroded slopes	1140-1280	Compacted soil/high runoff from golf course	VP1
Bare soil/eroded slopes	1840-1945	Compacted soil/high runoff from golf course	VP1
Bare soil/eroded slopes	1865-1990	Compacted soil/high runoff from golf course	VP1
Bare soil/eroded slopes	3540-3630	Compacted soil/high runoff from golf course	VP1
Bare soil/eroded slopes	3880-3960	Compacted soil/high runoff from golf course	VP1
Bare soil on floodplain	4450-4470	Compacted soil	VP2
Bare soil/eroded slopes, including floodplain	5555-5840	Compacted soil/high runoff from golf course	VP1, VP2
Bare soil/eroded slopes	6315-6570	Compacted soil/high runoff from golf course	VP1

Appendix A2. Vegetation Problem Area Photographs - 2008 - Ellerbe Creek Stream Restoration - Project #127



VP1. Bare soil/eroded slopes (9/18/08)



VP2. Bare soil on floodplain (9/18/08)

Appendix A3. Vegetation Monitoring Plot Photographs - 2008 - Ellerbe Creek Stream Restoration



HB-V1 (June 25, 2007)



HB-V1 (July 24, 2008)



HB-V2 (June 25, 2007)



HB-V2 (July 24, 2008)

Appendix A3. Vegetation Monitoring Plot Photographs - 2008 - Ellerbe Creek Stream Restoration



HB-V3 (June 25, 2007)



HB-V3 (July 24, 2008)



CR-V1 (June 25, 2007)



CR-V1 (July 24, 2008)

Appendix A3. Vegetation Monitoring Plot Photographs - 2008 - Ellerbe Creek Stream Restoration



CR-V2 (June 25, 2007)



CR-V2 (July 24, 2008)



HD-V1 (June 25, 2007)



HD-V1 (July 24, 2008)

Appendix A3. Vegetation Monitoring Plot Photographs - 2008 - Ellerbe Creek Stream Restoration



HD-V2 (June 26, 2007)



HD-V2 (July 24, 2008)



HD-V3 (June 26, 2007)



HD-V3 (July 24, 2008)

Appendix A3. Vegetation Monitoring Plot Photographs - 2008 - Ellerbe Creek Stream Restoration



AL-V1 (June 26, 2007)



AL-V1 (July 25, 2008)



AL-V2 (June 26, 2007)



AL-V2 (July 25, 2008)

Appendix A3. Vegetation Monitoring Plot Photographs - 2008 - Ellerbe Creek Stream Restoration



AL-V3 (June 26, 2007)



AL-V3 (July 25, 2008)

Appendix B. Stream Data
Ellerbe Creek Stream Restoration – Project #127

1. Figure B1. Stream Current Condition Plan View
2. Table B1. Stream Problem Areas
3. Stream Problem Area Photos
4. Stream Photostation Photos
5. Table B2. Qualitative Visual Stability Assessment
6. Cross section Plots
7. Longitudinal Plots and As-Built Profile
8. Pebble Count Frequency Distribution Plots

Vegetation Plot Coordinates: Hillsborough Reach			
Plot Side	HB-V1	HB-V2	HB-V3
Pin Coordinate	E 20115741.5610 N 827358.3480	E 20116120.1110 N 827428.6750	E 2016551.0870 N 827505.1970
A	19.5'	31.1'	31.9'
B	52.1'	35.4'	32.6'
C	23.2'	33.1'	31.3'
D	53'	36.2'	39.4'

Vegetation Plot Coordinates: Croasdaile Reach		
Plot Side	CR-V1	CR-V2
Pin Coordinate	E 2016811.8250 N 827741.1850	E 2016933.510 N 827520.8490
A	32.4'	18.3'
B	33.2'	65.5'
C	29.9'	21.7'
D	31.9'	64.1'



Figure B.1.1 - Current Conditions Plan
View - 2008 - Monitoring Year 4
Ellerbe Creek Stream Restoration -
Durham, NC - NCEEP Project #127

Stream Problem Areas

- ◆ Bank undercut/scour
- Aggradation (bar)
- Boulder undercut/failure
- Aggradation (pool)
- ⊕ Root wad undercut
- Rill and gully
- ▲ Beaverdam

Vegetation Problem Areas

- Bare Soil

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- ▨ Vegetation Monitoring Plots
- Monitoring Cross Sections
- ★ Photo Points
- ▭ As-built Features
- Pre-existing Features

Legend for Thalweg and Structures:

- Thalweg 9/8/08 - 09/18/08
- ▭ NCDOT Stormwater Structures

	Easting	Northing
Cross-sections		
HB1L	2015742.0022	827332.7693
HB1R	2015772.552	827290.9634
HB2L	2015799.2852	827350.0513
HB2R	2015803.356	827295.5714
HB3L	2016595.6390	827499.8180
HB3R	2016610.0550	827433.3600
HB4L	2015654.5640	827499.8920
HB4R	20116634.3500	827432.4490
CR1L	2016939.2680	827570.7490
CR1R	2016915.6680	827552.4340
CR2L	2016957.7640	827541.2870
CR2R	2016933.5100	827520.8490
Photopoints		
HB-P1	2015577.0052	827347.3258
HB-P2	2015623.7143	827314.4264
HB-P3	2015802.5285	827349.0571
HB-P4	2015961.3634	827401.3361
HB-P5	2016127.5574	827481.3197
HB-P6&P7	2016301.8430	827496.7037
HB-P8	2016523.1130	827464.0709
HB-P9	2016749.2114	827430.4392
HB-P10	2016966.4524	827439.7628
CR-P1	2016781.3114	828053.9579
CR-P2	2016818.9390	827855.0313
CR-P3	2016919.4678	827582.3480

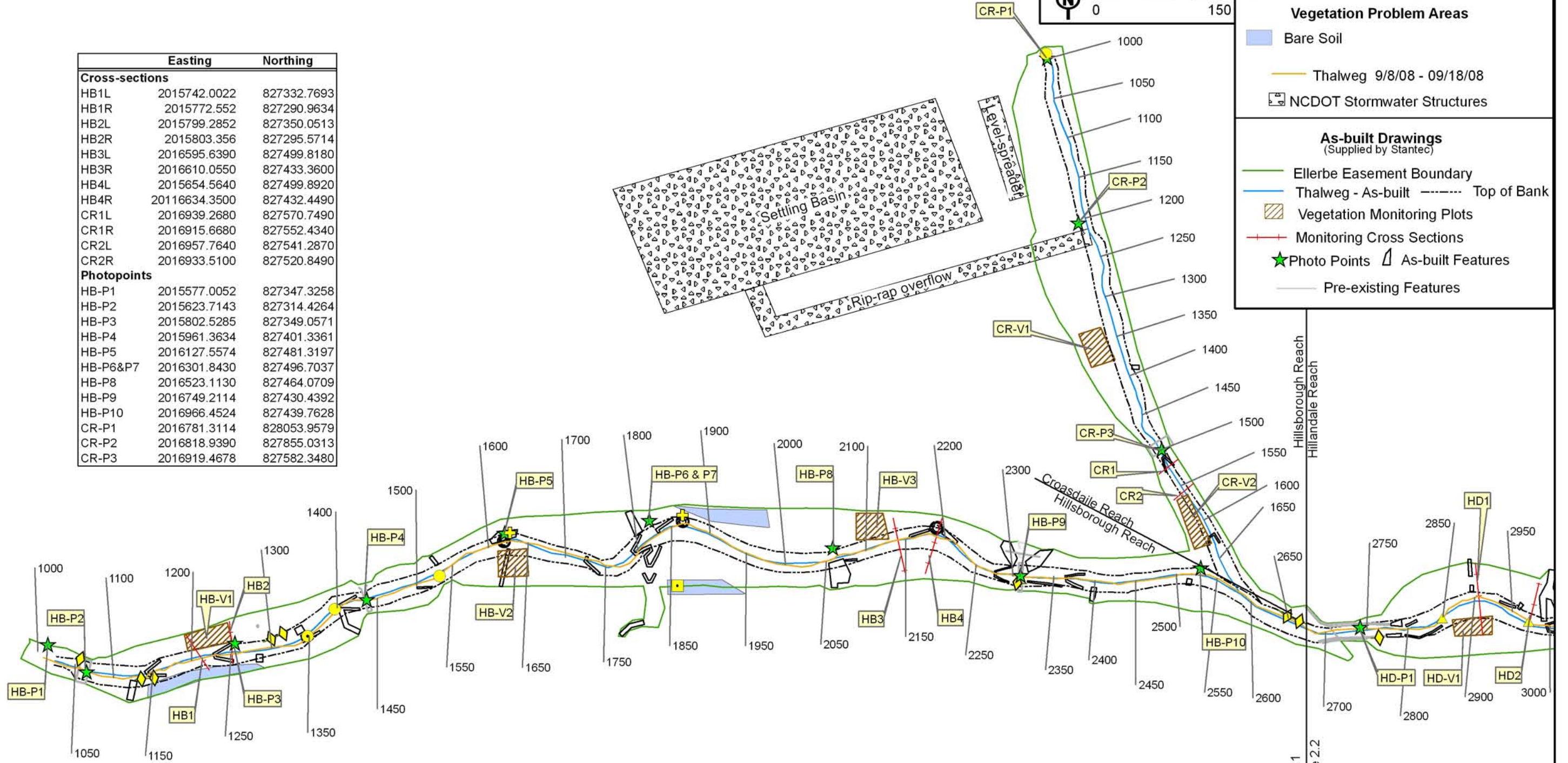


Figure 2.1
Figure 2.2

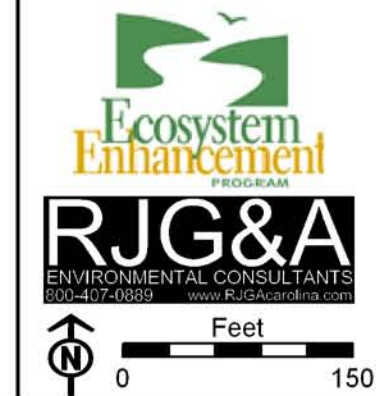


Figure B.1.2 - Current Conditions Plan View - 2008 - Monitoring Year 4
 Ellerbe Creek Stream Restoration - Durham, NC - NCEEP Project #127

Stream Problem Areas

- ◆ Bank undercut/scour
- Aggradation (bar)
- Aggradation (pool)
- ⊙ Boulder undercut/failure
- Rill and gully
- ⊕ Root wad undercut
- ▲ Beaverdam

Vegetation Problem Areas

- Bare Soil
- Thalweg 9/8/08 - 09/18/08

As-built Drawings
(Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- Top of Bank
- ▨ Vegetation Monitoring Plots
- Monitoring Cross Sections
- ★ Photo Points
- ▭ As-built Features
- Pre-existing Features

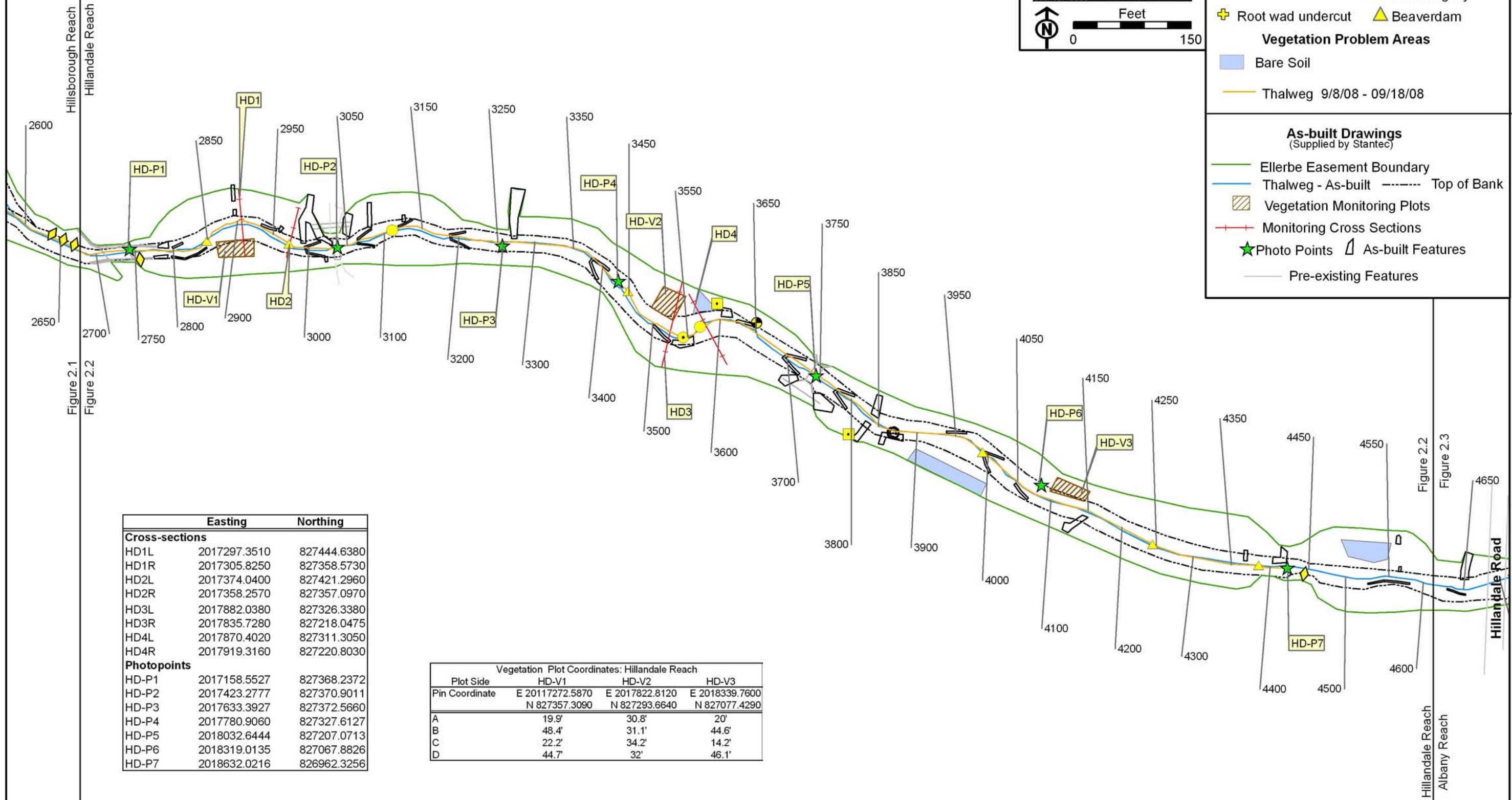


Figure 2.1
Figure 2.2

Figure 2.2
Figure 2.3

	Easting	Northing
Cross-sections		
HD1L	2017297.3510	827444.6380
HD1R	2017305.8250	827358.5730
HD2L	2017374.0400	827421.2960
HD2R	2017358.2570	827357.0970
HD3L	2017882.0380	827326.3380
HD3R	2017835.7280	827218.0475
HD4L	2017870.4020	827311.3050
HD4R	2017919.3160	827220.8030
Photopoints		
HD-P1	2017158.5527	827368.2372
HD-P2	2017423.2777	827370.9011
HD-P3	2017633.3927	827372.5660
HD-P4	2017780.9060	827327.6127
HD-P5	2018032.6444	827207.0713
HD-P6	2018319.0135	827067.8826
HD-P7	2018632.0216	826962.3256

Vegetation Plot Coordinates: Hillandale Reach			
Plot Side	HD-V1	HD-V2	HD-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.9'	30.8'	20'
B	48.4'	31.1'	44.6'
C	22.2'	34.2'	14.2'
D	44.7'	32'	46.1'



Figure B.1.3 - Current Conditions Plan View - 2008 - Monitoring Year 4
 Ellerbe Creek Stream Restoration - Durham, NC - NCEEP Project #127

Stream Problem Areas

- ◆ Bank undercut/scour
- Aggradation (bar)
- Aggradation (pool)
- ⊙ Boulder undercut/failure
- Rill and gully
- ⊕ Root wad undercut
- ▲ Beaverdam

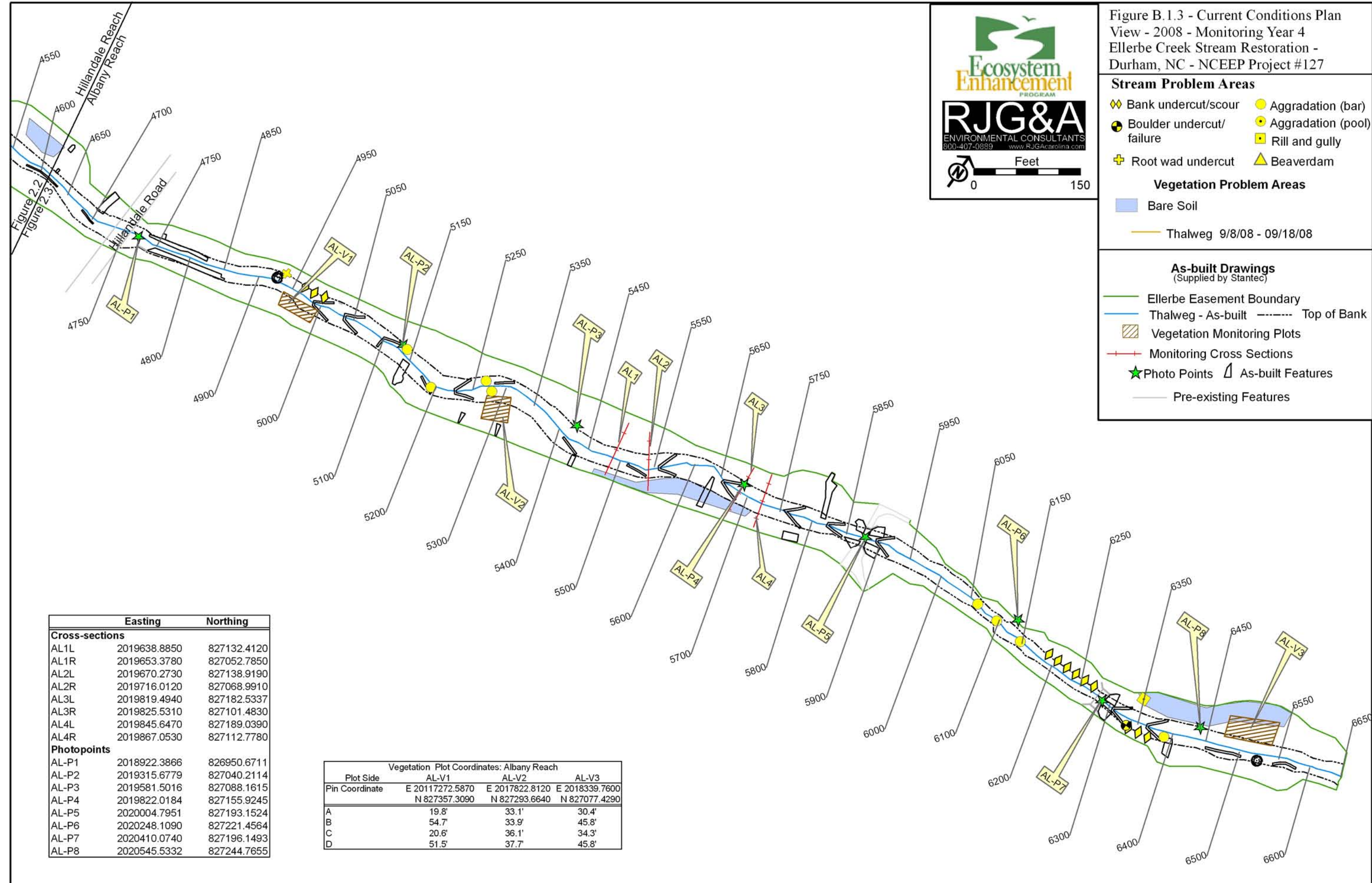
Vegetation Problem Areas

- Bare Soil

— Thalweg 9/8/08 - 09/18/08

As-built Drawings
 (Supplied by Stantec)

- Ellerbe Easement Boundary
- Thalweg - As-built
- - - - - Top of Bank
- ▨ Vegetation Monitoring Plots
- Monitoring Cross Sections
- ★ Photo Points
- ▤ As-built Features
- Pre-existing Features



	Easting	Northing
Cross-sections		
AL1L	2019638.8850	827132.4120
AL1R	2019653.3780	827052.7850
AL2L	2019670.2730	827138.9190
AL2R	2019716.0120	827068.9910
AL3L	2019819.4940	827182.5337
AL3R	2019825.5310	827101.4830
AL4L	2019845.6470	827189.0390
AL4R	2019867.0530	827112.7780
Photopoints		
AL-P1	2018922.3866	826950.6711
AL-P2	2019315.6779	827040.2114
AL-P3	2019581.5016	827088.1615
AL-P4	2019822.0184	827155.9245
AL-P5	2020004.7951	827193.1524
AL-P6	2020248.1090	827221.4564
AL-P7	2020410.0740	827196.1493
AL-P8	2020545.5332	827244.7655

Vegetation Plot Coordinates: Albany Reach			
Plot Side	AL-V1	AL-V2	AL-V3
Pin Coordinate	E 20117272.5870 N 827357.3090	E 2017822.8120 N 827293.6640	E 2018339.7600 N 827077.4290
A	19.8'	33.1'	30.4'
B	54.7'	33.9'	45.8'
C	20.6'	36.1'	34.3'
D	51.5'	37.7'	45.8'

**Appendix Table B1 Spring 2008 Stream Problem Areas
Ellerbe Creek - #127**

Feature/Issue	Station #s	Photo	Suspected Cause
Bank undercut/scour	1130-1145	SP1	Matting unattached
Bank undercut/scour	1290-1320	SP1	Scour beneath matting
Aggradation (pool)	1345-1360	SP2	Sediment from upstream/scour areas
Bank undercut/scour	1385-1403	SP6	Insufficient armoring
Aggradation (bar)	1407	SP7	Sediment from upstream/scour areas
Aggradation (bar)	1535	SP7	Sediment from upstream/scour areas
Rootwad under/backcut	1625	SP6	Rootwad placed too high in bank
Bank scour	1790	SP9	Scour in stormwater drainageway
Rill and gully	1860	SP5	Insufficient growth medium
Rootwad under/backcut	1870	SP6	Rootwad placed too high in bank
Bank erosion/scour	2300-2320	SP3	Under bridge, poor armoring of constricted flow passage
Aggradation (bar)	1000*	SP11	Sedimentation at culvert from upstream sources
Bank undercut/scour	2647-2670	SP6	Insufficient armoring
Bank undercut/scour	2750	SP6	Insufficient armoring below bridge culvert
Aggradation (bar)	2850	SP10	Former beaver impoundment
Aggradation/debris	2980	SP4	Beaverdam
Aggradation (bar)	3116-3125	SP7	Sediment from upstream/scour areas
Aggradation/debris	3453	SP4	Beaverdam
Aggradation (pool)	3503-3543	SP2	Sedimentation due to beaver impoundment
Aggradation (bar)	3570-3580	SP7	Sediment from upstream/scour areas
Rill and gully	3635	SP5	Insufficient growth medium
Boulder undercut	3650	SP7	Insufficient coarse backfill
Rill and gully	3775	SP5	Insufficient growth medium
Aggradation/debris	3996	SP10	Abandoned beaverdam
Aggradation/debris	4253	SP4	Beaverdam
Aggradation/debris	4391	SP10	Abandoned beaverdam
Bank undercut/scour	4440-4455	SP6	Insufficient armoring
Scour	4750	SP6	Stormdrain outfall
Rootwad under/backcut	4940	SP7	Rootwad placed too high in bank
Bank slump/scour	4960-5020	SP7	Insufficient rootwad/armoring
Aggradation (pool)	5120-35	SP2	Sediment from stormwater/scour areas
Aggradation (pool)	5175-5200	SP2	Sediment from stormwater/scour areas
Aggradation (bar)	5265-5275	SP7	Sediment from stormwater/scour areas
Aggradation (bar)	5285	SP7	Sediment from stormwater/scour areas
Mid-channel bar	6075	SP8	Sediment from stormwater/scour areas
Mid-channel bar	6110	SP8	Sediment from stormwater/scour areas
Mid-channel bar	6160	SP8	Sediment from stormwater/scour areas
Bank slump/scour	6180-6270	SP7	Insufficient rootwad/armoring
Boulder failure	6330	SP7	Insufficient coarse backfill
Rill and gully	6350	SP5	Insufficient growth medium
Bank undercut/scour	6340-6360	SP7	Insufficient rootwad/armoring
Aggradation (bar)	6390	SP7	Sediment from stormwater/scour areas
Rill and gully	6425	SP5	Insufficient growth medium

*Station numbers on Croasdaile Reach

Appendix B2. Stream Problem Area Photographs - 2008 - Ellerbe Creek Stream Restoration



SP1. Scour with unattached matting (4/16/08)



SP2. Aggradation (pool) (9/18/08)



SP3. Bank scour under bridge (4/16/08)



SP4. Beaverdam looking downstream (9/15/08)

Appendix B2. Stream Problem Area Photographs - 2008 - Ellerbe Creek Stream Restoration



SP5. Rill and gully (9/18/08)



SP6. Bank slump/scour (9/18/08)



SP7. Boulder failure, banks scour, bar (9/18/08)



SP8. Mid-channel bars (9/18/08)

Appendix B2. Stream Problem Area Photographs - 2008 - Ellerbe Creek Stream Restoration



SP9. Scour in stormwater drainage (7/24/08)



SP10. Aggradation/bars from former beaverdams (7/24/08)



SP11. Aggregation at culvert (9/18/08)



SP12. Beaver (4/16/08)

Appendix B2. 2008 Permanent Photopoint Photographs - Ellerbe Creek Stream Restoration



HB-P01 facing downstream (07/10/07)



HB-P01 facing downstream (07/25/08)



HB-P02 facing downstream (07/10/07)



HB-P02 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



HB-P03 facing downstream (07/10/07)



HB-P03 facing downstream (07/25/08)



HB-P04 facing downstream (07/10/07)



HB-P04 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



HB-P05 facing downstream (07/10/07)



HB-P05 facing downstream (07/25/08)



HB-P06 looking south across stream (07/10/07)



HB-P06 looking south across stream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



HB-P07 facing downstream (07/10/07)



HB-P07 facing downstream (07/25/08)



HB-P08 facing downstream (07/10/07)



HB-P08 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



HB-P09 facing downstream (07/10/07)



HB-P09 facing downstream (07/25/08)



HB-P10 facing downstream (07/10/07)



HB-P10 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



CR-P01 facing downstream (07/10/07)



CR-P01 facing downstream (07/25/08)



CR-P02 facing downstream (07/10/07)



CR-P02 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



CR-P03 facing downstream (07/10/07)



CR-P03 facing downstream (07/25/08)



HD-P01 facing downstream (07/10/07)



HD-P01 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



HD-P02 facing downstream (07/10/07)



HD-P02 facing downstream (07/25/08)



HD-P03 facing downstream (07/27/07)



HD-P03 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



HD-P04 facing downstream (07/27/07)



HD-P04 facing downstream (07/25/08)



HD-P05 facing downstream (07/27/07)



HD-P05 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



HD-P06 facing downstream (07/27/07)



HD-P06 facing downstream (07/25/08)



HD-P07 facing downstream (07/27/07)



HD-P07 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



AL-P01 facing downstream (07/27/07)



AL-P01 facing downstream (07/25/08)



AL-P02 facing downstream (07/27/07)



AL-P02 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



AL-P03 facing downstream (07/27/07)



AL-P03 facing downstream (07/25/08)



AL-P04 facing downstream (07/27/07)



AL-P04 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



AL-P05 facing downstream (07/27/07)



AL-P05 facing downstream (07/25/08)



AL-P06 facing downstream (07/27/07)



AL-P06 facing downstream (07/25/08)

Appendix B2. 2008 Permanent Photostation Photographs - Ellerbe Creek Stream Restoration



AL-P07 facing downstream (07/27/07)



AL-P07 facing downstream (07/25/08)



AL-P08 facing downstream (07/27/07)



AL-P08 facing downstream (07/25/08)

Appendix B3. Visual Stability Assessment - Ellerbe Stream Restoration Project - Hillsborough Reach - Project #127

Feature Category	Metric (per As-built and reference baselines)	(# Stable Number Performing as Intended)	Total Number per As-built	Total Number/ feet in Unstable State	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	13	14	NA	93	80
	2. Armor stable	14	14	NA	100	
	3. Facet grade appears stable	13	14	NA	93	
	4. Minimal evidence of embedding/fining	3	14	NA	21	
	5. Length appropriate	13	14	NA	93	
B. Pools	1. Present	16	16	NA	100	96
	2. Sufficiently deep	15	16	NA	94	
	3. Length appropriate	15	16	NA	94	
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	8	11	NA	73	86
	2. Downstream of meander (glide/inflection) centering	12	12	NA	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion	12	12	NA	100	100
	2. Of those eroding, # w/concomitant point bar formation			NA	NA	
	3. Apparent Rc within spec	12	12	NA	100	
	4. Sufficient floodplain access and relief	12	12	NA	100	
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	NA	NA	2/22	99	99
	2. Channel bed degradation – areas of increasing downcutting or head cutting	NA	NA	0	100	
F. Bank	1. Actively eroding, wasting or slumping bank	NA	NA	4/88	95	95
G. Vanes	1. Free of back or arm scour	7	7	NA	100	100
	2. Height appropriate	7	7	NA	100	
	3. Angle and geometry appear appropriate	7	7	NA	100	
	4. Free of piping or other structural failures	7	7	NA	100	
H. Wads/Bould	1. Free of scour	1	3	NA	33	67
	2. Footing stable	3	3	NA	100	

Appendix B3. Visual Stability Assessment - Ellerbe Stream Restoration Project - Croasdaile Reach - Project #127

Feature Category	Metric (per As-built and reference baselines)	(# Stable Number Performing as Intended)	Total Number per As-built	Total Number/ feet in Unstable State	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	4	4	NA	100	95
	2. Armor stable	4	4	NA	100	
	3. Facet grade appears stable	4	4	NA	100	
	4. Minimal evidence of embedding/fining	3	4	NA	75	
	5. Length appropriate	4	4	NA	100	
B. Pools	1. Present	5	5	NA	100	93
	2. Sufficiently deep	4	5	NA	80	
	3. Length appropriate	5	5	NA	100	
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	4	4	NA	100	100
	2. Downstream of meander (glide/inflection) centering	4	4	NA	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion	4	4	NA	100	100
	2. Of those eroding, # w/concomitant point bar formation			NA	NA	
	3. Apparent Rc within spec	4	4	NA	100	
	4. Sufficient floodplain access and relief	4	4	NA	100	
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	NA	NA	1/20	97	99
	2. Channel bed degradation – areas of increasing downcutting or head cutting	NA	NA	0/0	100	
F. Bank	1. Actively eroding, wasting or slumping bank	NA	NA	0/0	100	100
G. Vanes	1. Free of back or arm scour	2	2	NA	100	100
	2. Height appropriate	2	2	NA	100	
	3. Angle and geometry appear appropriate	2	2	NA	100	
	4. Free of piping or other structural failures	2	2	NA	100	
H. Wads/Bould	1. Free of scour	0	0	NA	NA	NA
	2. Footing stable	0	0	NA	NA	

Appendix B3. Visual Stability Assessment - Ellerbe Stream Restoration Project - Hillandale Reach - Project #127

Feature Category	Metric (per As-built and reference baselines)	(# Stable Number Performing as Intended)	Total Number per As-built	Total Number/ feet in Unstable State	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	13	14	NA	93	84
	2. Armor stable	11	14	NA	79	
	3. Facet grade appears stable	13	14	NA	93	
	4. Minimal evidence of embedding/fining	10	14	NA	71	
	5. Length appropriate	12	14	NA	86	
B. Pools	1. Present	12	14	NA	86	90
	2. Sufficiently deep	13	14	NA	93	
	3. Length appropriate	13	14	NA	93	
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	11	12	NA	92	96
	2. Downstream of meander (glide/inflection) centering	11	11	NA	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion	11	12	NA	92	97
	2. Of those eroding, # w/concomitant point bar formation	0	1	NA		
	3. Apparent Rc within spec	12	12	NA	100	
	4. Sufficient floodplain access and relief	12	12	NA	100	
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	NA	NA	6/50	97	99
	2. Channel bed degradation – areas of increasing downcutting or head cutting	NA	NA	0	100	
F. Bank	1. Actively eroding, wasting or slumping bank	NA	NA	4/48	97	97
G. Vanes	1. Free of back or arm scour	8	9	NA	89	86
	2. Height appropriate	7	9	NA	78	
	3. Angle and geometry appear appropriate	8	9	NA	89	
	4. Free of piping or other structural failures	8	9	NA	89	
H. Wads/Bould	1. Free of scour	1	1	NA	100	100
	2. Footing stable	1	1	NA	100	

Appendix B3. Visual Stability Assessment - Ellerbe Stream Restoration Project - Albany Reach - Project #127

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number/ feet in Unstable State	Percent Performing in Stable Condition	Feature Performing Mean (%)
A. Riffles	1. Present	3	4	NA	75	75
	2. Armor stable	3	4	NA	75	
	3. Facet grade appears stable	3	4	NA	75	
	4. Minimal evidence of embedding/fining	4	4	NA	100	
	5. Length appropriate	2	4	NA	50	
B. Pools	1. Present	13	13	NA	100	87
	2. Sufficiently deep	9	13	NA	69	
	3. Length appropriate	12	13	NA	92	
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	5	8	NA	63	74
	2. Downstream of meander (glide/inflection) centering	6	7	NA	86	
D. Meanders	1. Outer bend in state of limited/controlled erosion	5	8	NA	63	88
	2. Of those eroding, # w/concomitant point bar formation	3		NA	NA	
	3. Apparent Rc within spec	8	8	NA	100	
	4. Sufficient floodplain access and relief	8	8	NA	100	
E. Bed (General)	1. General channel bed aggradation areas (bar formation)	NA	NA	6/65	97	98
	2. Channel bed degradation – areas of increasing downcutting or head cutting	NA	NA	0	100	
F. Bank	1. Actively eroding, wasting or slumping bank	NA	NA	4/190	90	90
G. Vanes	1. Free of back or arm scour	10	12	NA	83	90
	2. Height appropriate	10	12	NA	83	
	3. Angle and geometry appear appropriate	12	12	NA	100	
	4. Free of piping or other structural failures	11	12	NA	92	
H. Wads/Bould	1. Free of scour	1	2	NA	50	75
	2. Footing stable	2	2	NA	100	

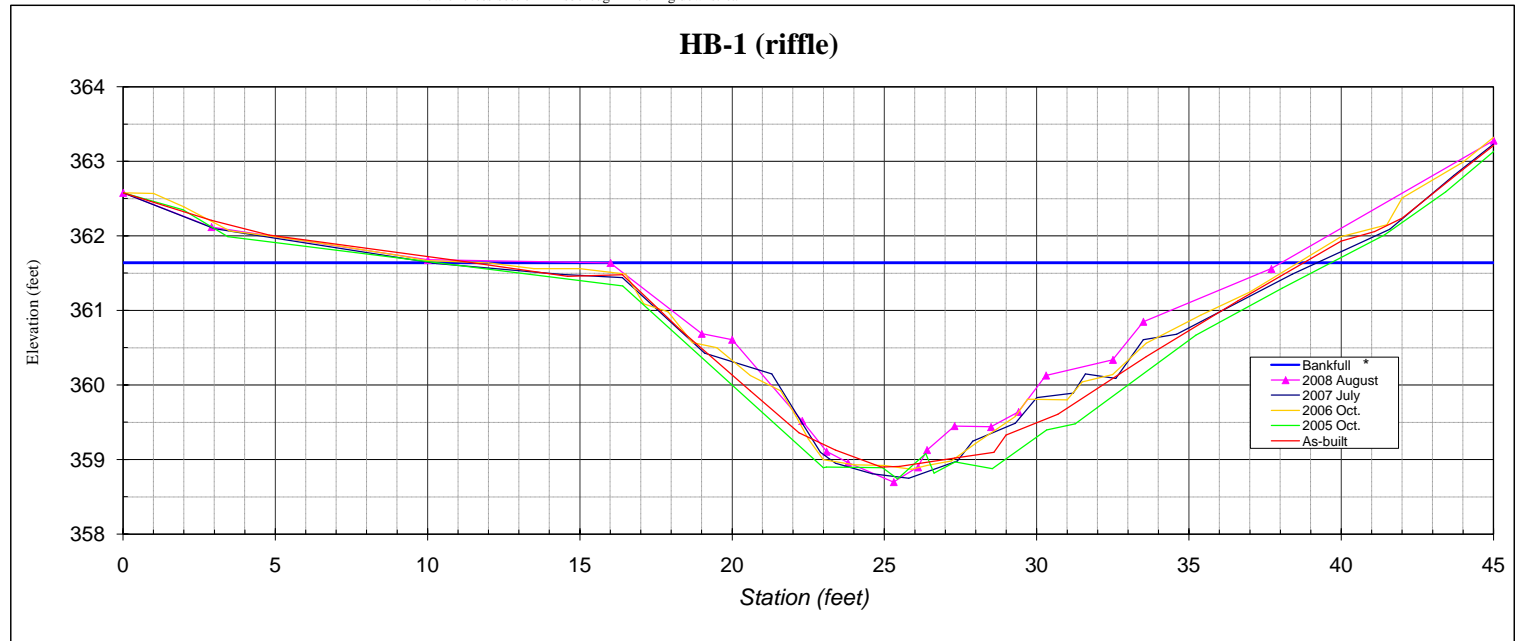
B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HB-1 (riffle)
 Reach: Hillsborough
 Date: 7/31/2008
 Field Crew: J.O. and S.D.

Station	Rod Ht.	Elevation	SUMMARY DATA
0	4.43	362.58	Floodprone Elevation (ft) 364.58
2.9	4.89	362.12	Bankfull Elevation (ft) 361.64
10	5.33	361.68	Floodprone Width (ft) 62.00
16	5.37	361.64	Bankfull Width (ft) 22.04
19	6.32	360.69	Entrenchment Ratio 2.81
20	6.4	360.61	Mean Depth (ft) 1.42
22.3	7.49	359.52	Maximum Depth (ft) 2.94
23.1	7.9	359.11	Width/Depth Ratio 15.57
23.8	8.05	358.96	Bankfull Area (sq ft) 31.19
25.3	8.31	358.7	Wetted Perimeter (ft) 23.09
26.1	8.11	358.9	Hydraulic Radius (ft) 1.35
26.4	7.88	359.13	Stream Type: C
27.3	7.56	359.45	
28.5	7.57	359.44	
29.4	7.37	359.64	
30.3	6.88	360.13	
32.5	6.67	360.34	
33.5	6.16	360.85	
37.7	5.45	361.56	
45	3.73	363.28	
47.9	2.98	364.03	



View of cross-section Hillsborough 1 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HB-2 (pool)
 Reach: Hillsborough
 Date: 7/31/2008
 Field Crew: J.O. and S.D.

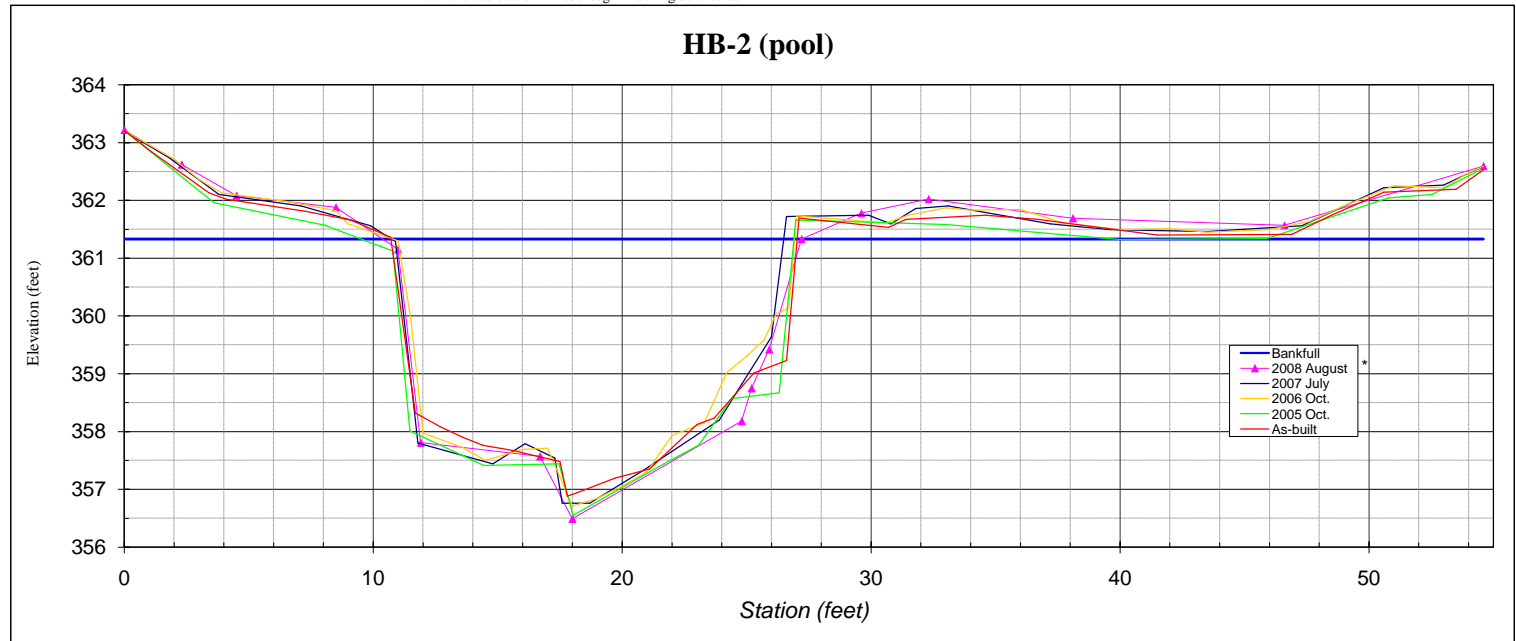
Station	Rod Ht.	Elevation
54.6	4.54	362.59
46.6	5.56	361.57
38.1	5.44	361.69
32.3	5.11	362.02
29.6	5.35	361.78
27.2	5.8	361.33
25.9	7.71	359.42
25.2	8.38	358.75
24.8	8.95	358.18
18	10.64	356.49
16.7	9.56	357.57
11.9	9.32	357.81
11	5.98	361.15
8.5	5.25	361.88
4.5	5.05	362.08
2.3	4.51	362.62
0	3.91	363.22

SUMMARY DATA	
Floodprone Elevation (ft)	366.17
Bankfull Elevation (ft)	361.33
Floodprone Width (ft)	100.00
Bankfull Width (ft)	16.82
Entrenchment Ratio	5.95
Mean Depth (ft)	3.32
Maximum Depth (ft)	4.84
Width/Depth Ratio	5.06
Bankfull Area (sq ft)	55.91
Wetted Perimeter (ft)	21.58
Hydraulic Radius (ft)	2.59

Stream Type: E



View of cross-section Hillsborough 2 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HB-3 (riffle)
 Reach: Hillsborough
 Date: 7/31/2008
 Field Crew: J.O. and S.D.

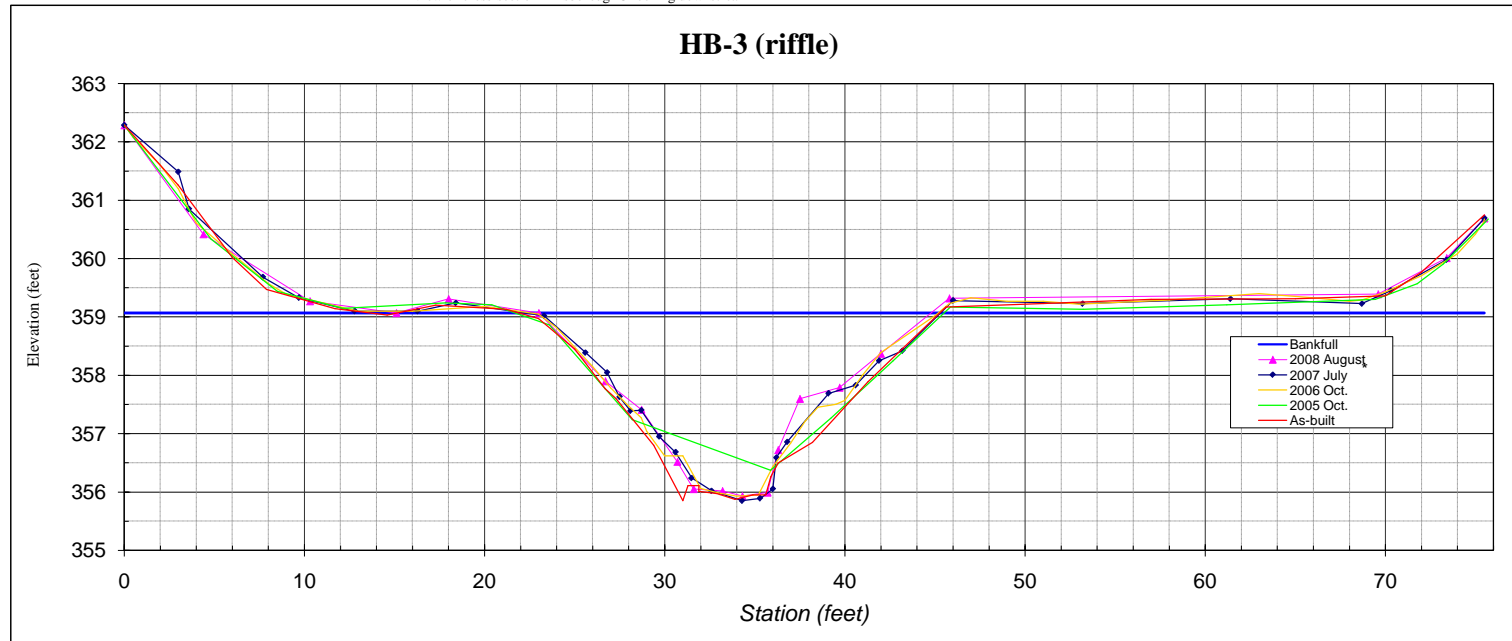
Station	Rod Ht.	Elevation
0	3.05	362.29
4.4	4.92	360.42
10.3	6.07	359.27
15.1	6.27	359.07
18	6.03	359.31
23	6.27	359.07
26.7	7.44	357.90
28.7	7.93	357.41
30.7	8.82	356.52
31.6	9.29	356.05
33.2	9.32	356.02
34.3	9.41	355.93
35.7	9.35	355.99
36.3	8.62	356.72
37.5	7.74	357.60
39.7	7.55	357.79
42	6.97	358.37
45.8	6.02	359.32
69.6	5.95	359.39
73.4	5.33	360.01
75.5	4.65	360.69

SUMMARY DATA	
Floodprone Elevation (ft)	362.21
Bankfull Elevation (ft)	359.07
Floodprone Width (ft)	85.00
Bankfull Width (ft)	21.80
Entrenchment Ratio	3.90
Mean Depth (ft)	1.58
Maximum Depth (ft)	3.14
Width/Depth Ratio	13.76
Bankfull Area (sq ft)	34.53
Wetted Perimeter (ft)	23.15
Hydraulic Radius (ft)	1.49

Stream Type: C



View of cross-section Hillsborough 3 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HB-4 (pool)
 Reach: Hillsborough
 Date: 7/31/2008
 Field Crew: J.O. and S.D.

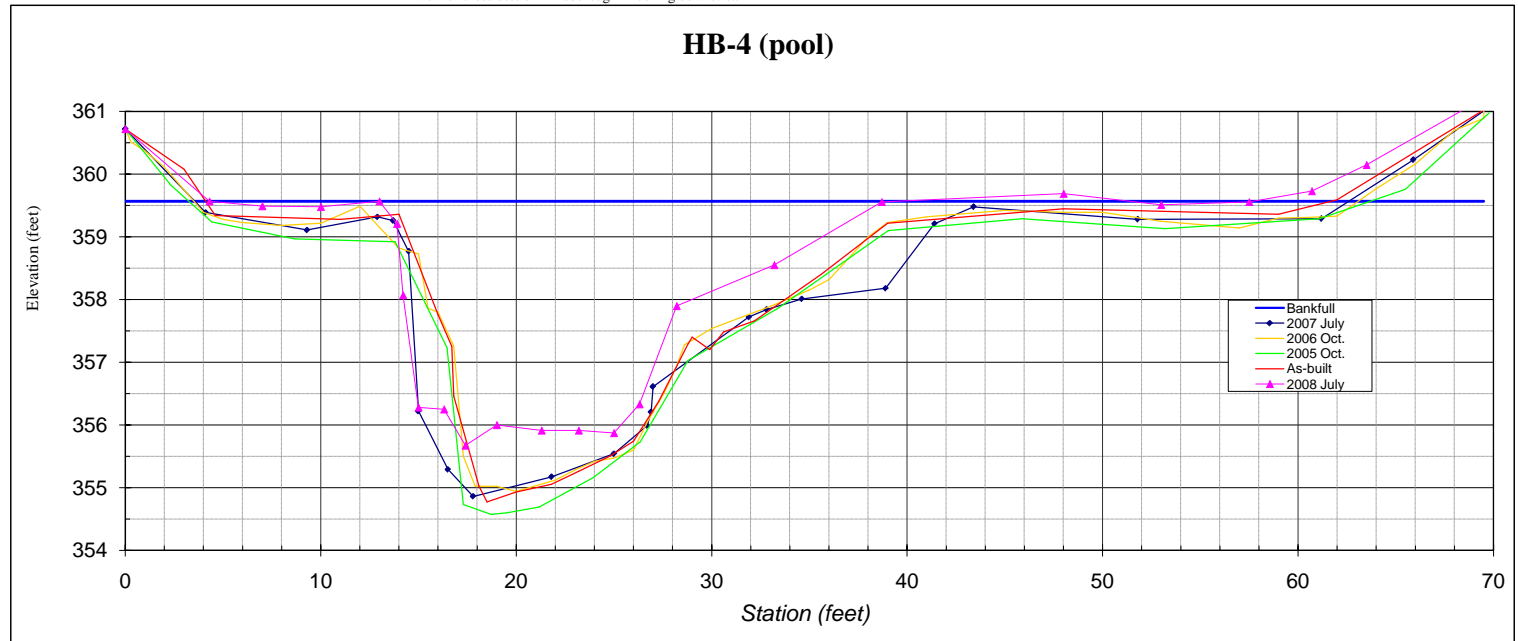
Station	Rod Ht.	Elevation
0	4.95	360.72
4.3	6.1	359.57
7	6.18	359.49
10	6.19	359.48
13	6.1	359.57
13.9	6.46	359.21
14.2	7.6	358.07
15	9.39	356.28
16.3	9.42	356.25
17.4	10	355.67
19	9.67	356
21.3	9.76	355.91
23.2	9.76	355.91
25	9.8	355.87
26.3	9.34	356.33
28.2	7.77	357.9
33.2	7.12	358.55
38.7	6.11	359.56
48	5.98	359.69
53	6.16	359.51
57.5	6.11	359.56
60.7	5.94	359.73
63.5	5.52	360.15
69.5	4.46	361.21

SUMMARY DATA	
Floodprone Elevation (ft)	363.47
Bankfull Elevation (ft)	359.57
Floodprone Width (ft)	100.00
Bankfull Width (ft)	26.42
Entrenchment Ratio	3.79
Mean Depth (ft)	2.17
Maximum Depth (ft)	3.90
Width/Depth Ratio	12.19
Bankfull Area (sq ft)	57.23
Wetted Perimeter (ft)	29.48
Hydraulic Radius (ft)	1.94

Stream Type: C



View of cross-section Hillsborough 4 looking downstream



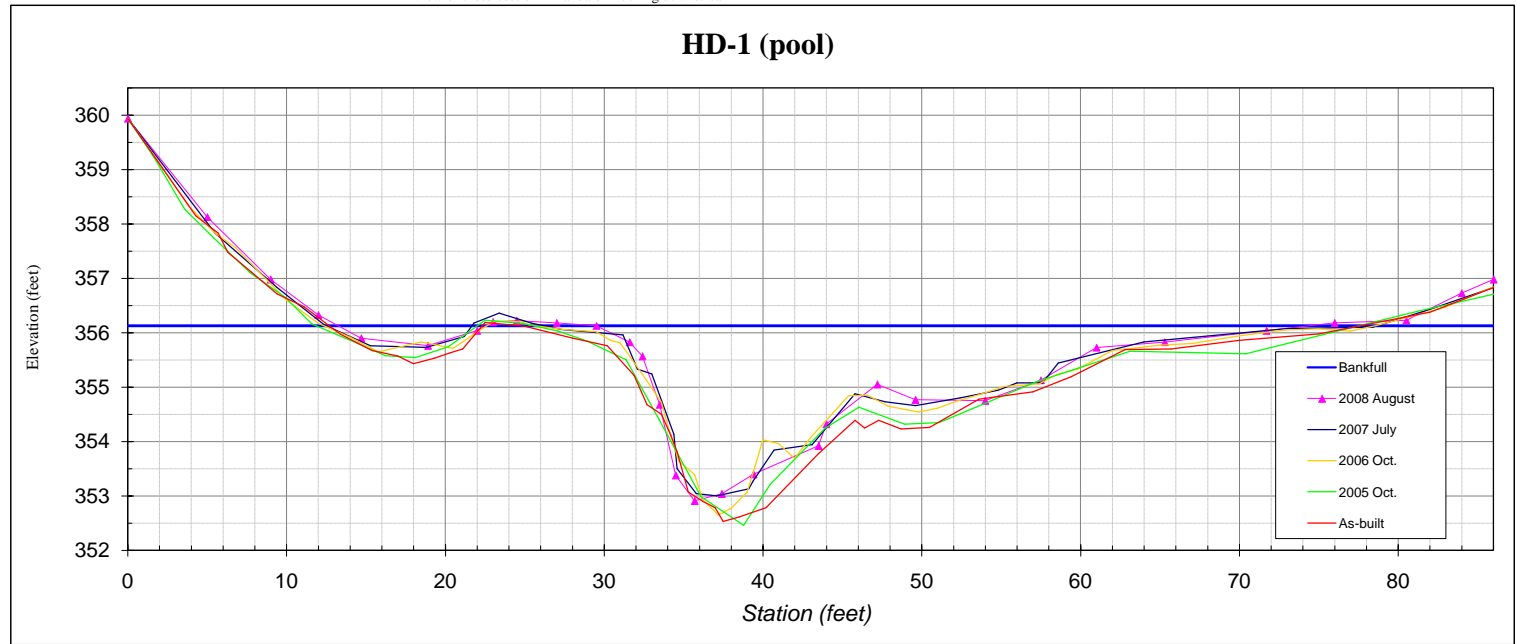
B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HD-1 (pool)
 Reach: Hillandale
 Date: 8/1/2008
 Field Crew: S.D. and A.P.

Station	Rod Ht.	Elevation	SUMMARY DATA
0	6.84	359.94	Floodprone Elevation (ft) 359.53
5	8.65	358.13	Bankfull Elevation (ft) 356.13
9	9.8	356.98	Floodprone Width (ft) 110.00
12	10.45	356.33	Bankfull Width (ft) 44.96
14.7	10.88	355.90	Entrenchment Ratio 2.45
18.9	11.02	355.76	Mean Depth (ft) 1.18
22	10.74	356.04	Maximum Depth (ft) 3.22
23	10.58	356.20	Width/Depth Ratio 38.27
24.5	10.56	356.22	Bankfull Area (sq ft) 52.83
27	10.6	356.18	Wetted Perimeter (ft) 46.46
29.5	10.65	356.13	Hydraulic Radius (ft) 1.14
31.6	10.95	355.83	Stream Type: C
32.4	11.21	355.57	
33.5	12.1	354.68	
34.5	13.4	353.38	
35.7	13.87	352.91	
37.4	13.74	353.04	
39.4	13.38	353.40	
43.5	12.86	353.92	
44	12.46	354.32	
47.2	11.73	355.05	
49.6	12.01	354.77	
54	12.03	354.75	
57.5	11.65	355.13	
61	11.05	355.73	
65.3	10.95	355.83	
71.7	10.74	356.04	
76	10.6	356.18	
80.5	10.55	356.23	
84	10.05	356.73	
86	9.8	356.98	



View of cross-section Hillandale 1 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HD-2 (riffle)
 Reach: Hillandale
 Date: 8/1/2008
 Field Crew: S.D. and A.P.

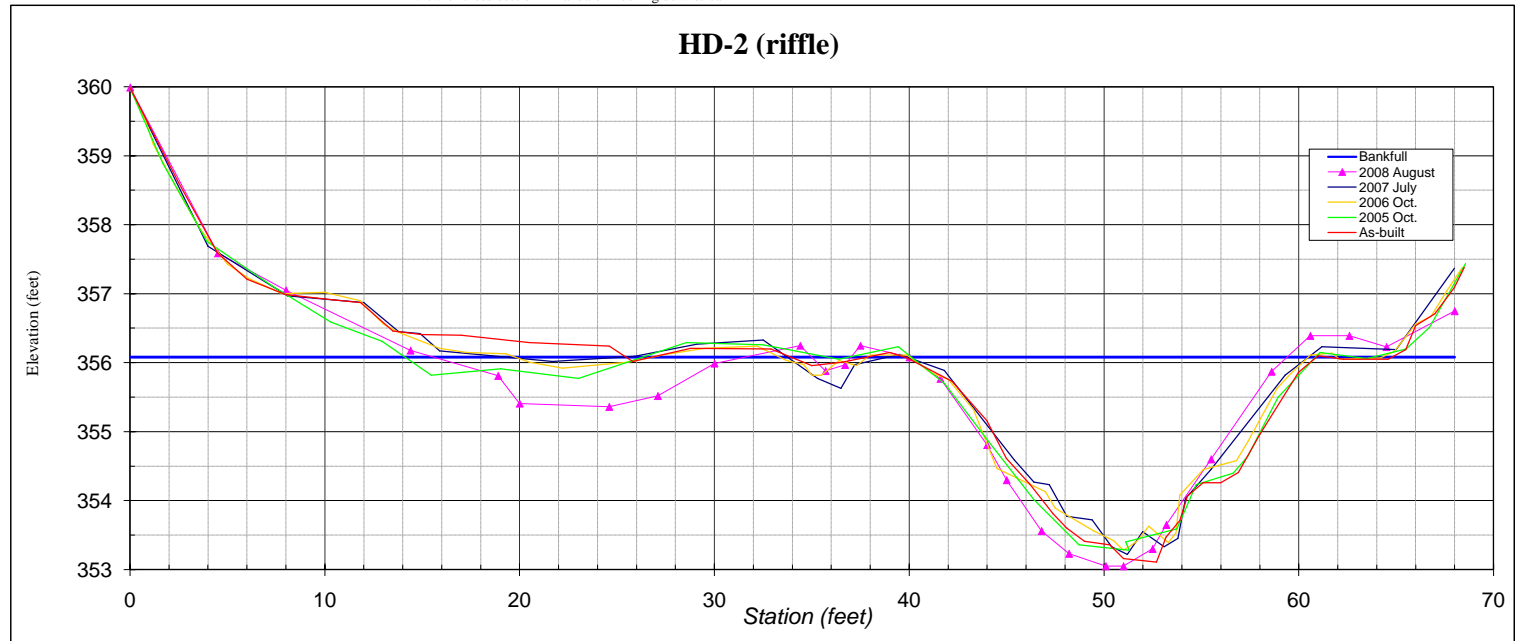
Station	Rod Ht.	Elevation
0	2.06	359.99
4.5	4.46	357.59
8	5	357.05
14.4	5.87	356.18
18.9	6.24	355.81
20	6.64	355.41
24.6	6.69	355.36
27.1	6.53	355.52
30	6.06	355.99
34.4	5.8	356.25
35.7	6.17	355.88
36.7	6.08	355.97
37.5	5.8	356.25
40	5.97	356.08
41.6	6.28	355.77
44	7.24	354.81
45	7.75	354.30
46.8	8.49	353.56
48.2	8.82	353.23
50.1	9	353.05
51	9	353.05
52.5	8.75	353.30
53.2	8.4	353.65
55.5	7.45	354.60
58.6	6.18	355.87
60.6	5.66	356.39
62.6	5.66	356.39
64.5	5.82	356.23
68	5.3	356.75

SUMMARY DATA	
Floodprone Elevation (ft)	359.11
Bankfull Elevation (ft)	356.08
Floodprone Width (ft)	90.00
Bankfull Width (ft)	19.41
Entrenchment Ratio	4.64
Mean Depth (ft)	1.70
Maximum Depth (ft)	3.03
Width/Depth Ratio	11.42
Bankfull Area (sq ft)	32.99
Wetted Perimeter (ft)	20.51
Hydraulic Radius (ft)	1.61

Stream Type: E



View of cross-section Hillandale 2 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HD-3 (pool)
 Reach: Hillandale
 Date: 8/8/2008
 Field Crew: J.O. and S.D.

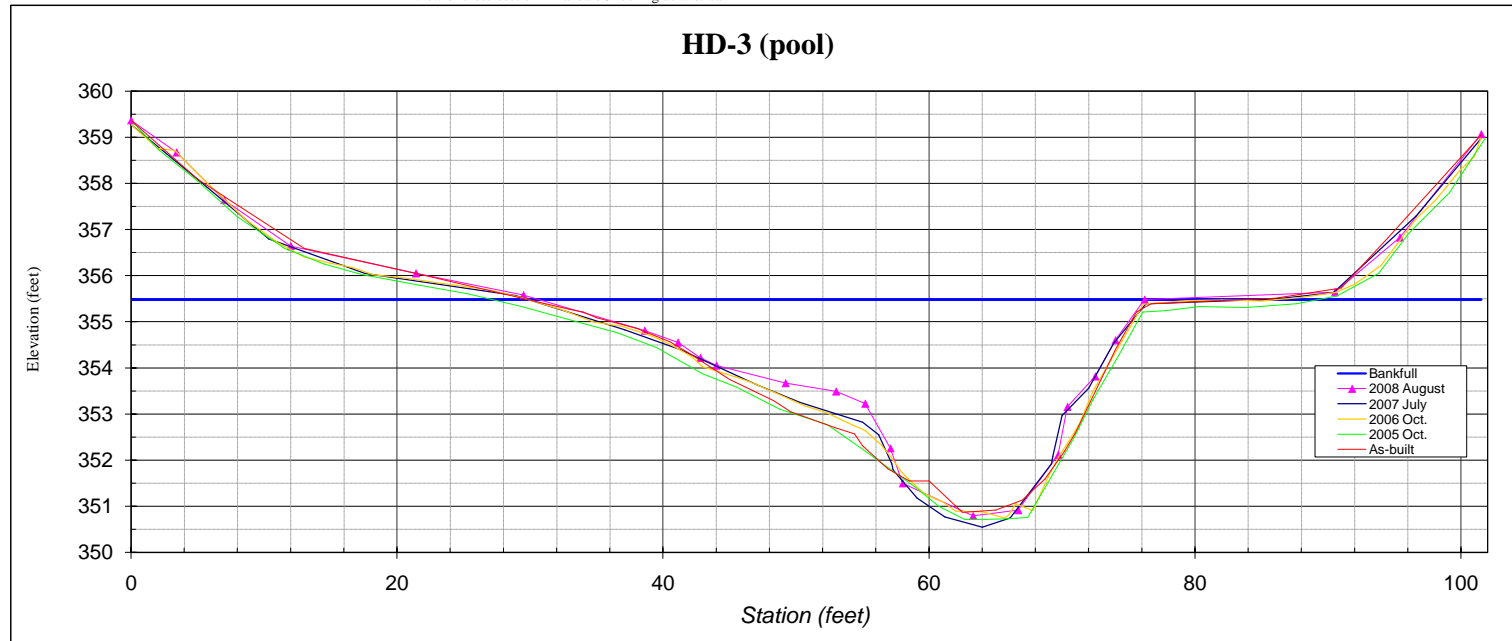
Station	Rod Ht.	Elevation
0	1.65	359.37
3.4	2.35	358.67
7	3.38	357.64
12	4.38	356.64
21.4	4.97	356.05
29.5	5.44	355.58
38.6	6.21	354.81
41.1	6.47	354.55
42.8	6.8	354.22
44	6.97	354.05
49.2	7.35	353.67
53	7.53	353.49
55.2	7.79	353.23
57.1	8.76	352.26
58	9.52	351.50
63.3	10.23	350.79
66.7	10.1	350.92
69.7	8.9	352.12
70.4	7.86	353.16
72.5	7.2	353.82
74	6.42	354.60
76.2	5.54	355.48
90.5	5.38	355.64
95.4	4.19	356.83
101.5	1.95	359.07

SUMMARY DATA	
Floodprone Elevation (ft)	360.17
Bankfull Elevation (ft)	355.48
Floodprone Width (ft)	101.50
Bankfull Width (ft)	45.52
Entrenchment Ratio	2.23
Mean Depth (ft)	2.12
Maximum Depth (ft)	4.69
Width/Depth Ratio	21.47
Bankfull Area (sq ft)	96.49
Wetted Perimeter (ft)	47.44
Hydraulic Radius (ft)	2.03

Stream Type: C



View of cross-section Hillandale 3 looking downstream



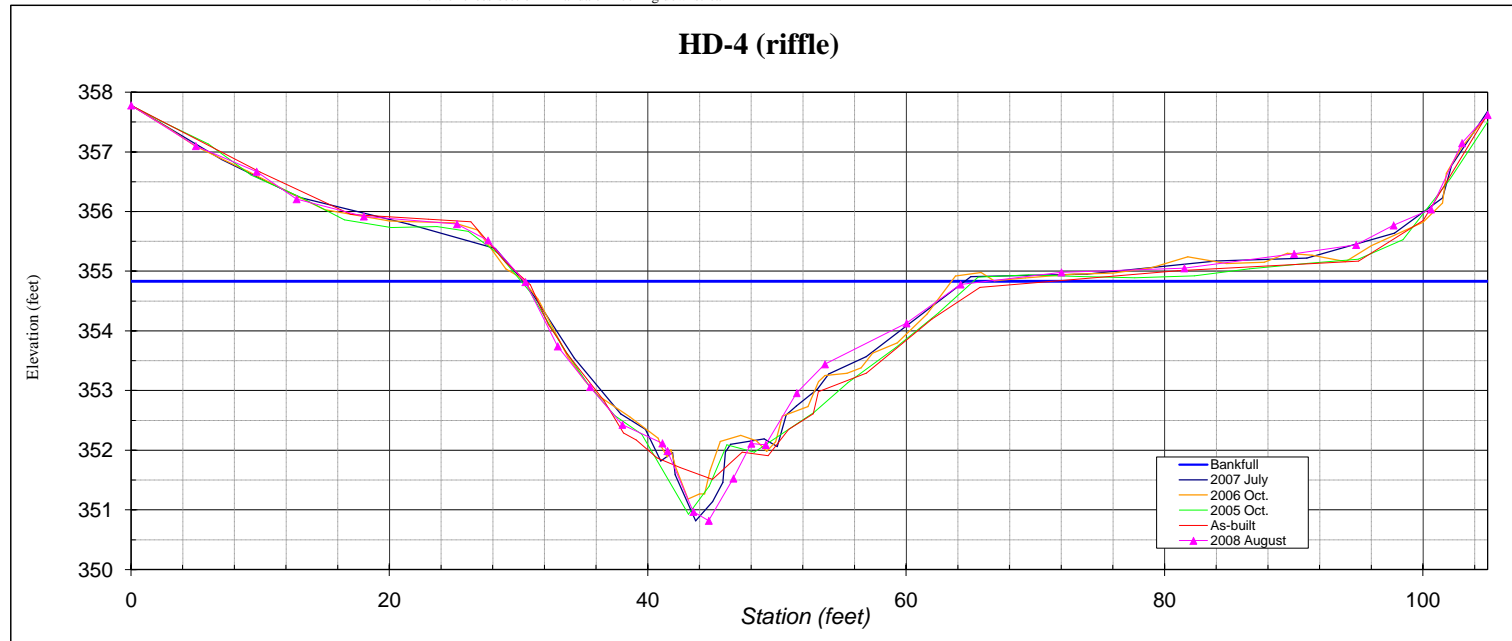
B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: HD-4 (riffle)
 Reach: Hillandale
 Date: 8/1/2008
 Field Crew: S.D. and A.P.

Station	Rod Ht.	Elevation	SUMMARY DATA
0	2.96	357.78	Floodprone Elevation (ft) 359.08
5	3.64	357.1	Bankfull Elevation (ft) 354.83
9.7	4.07	356.67	Floodprone Width (ft) 105.00
12.8	4.53	356.21	Bankfull Width (ft) 35.69
18	4.82	355.92	Entrenchment Ratio 2.94
25.2	4.95	355.79	Mean Depth (ft) 1.74
27.6	5.22	355.52	Maximum Depth (ft) 4.01
30.5	5.92	354.82	Width/Depth Ratio 20.51
33	7	353.74	Bankfull Area (sq ft) 62.10
35.5	7.68	353.06	Wetted Perimeter (ft) 36.91
38	8.31	352.43	Hydraulic Radius (ft) 1.68
41.1	8.62	352.12	Stream Type: C
41.5	8.75	351.99	
43.5	9.77	350.97	
44.7	9.92	350.82	
46.6	9.21	351.53	
48	8.63	352.11	
49.1	8.65	352.09	
51.5	7.78	352.96	
53.7	7.3	353.44	
60	6.61	354.13	
64.2	5.96	354.78	
72	5.76	354.98	
81.5	5.69	355.05	
90	5.45	355.29	
94.8	5.3	355.44	
97.7	4.97	355.77	
100.6	4.7	356.04	
103	3.59	357.15	
105	3.12	357.62	



View of cross-section Hillandale 4 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: AL-1 (riffle)
 Reach: Albany
 Date: 8/8/2008
 Field Crew: S.D. and A.P.

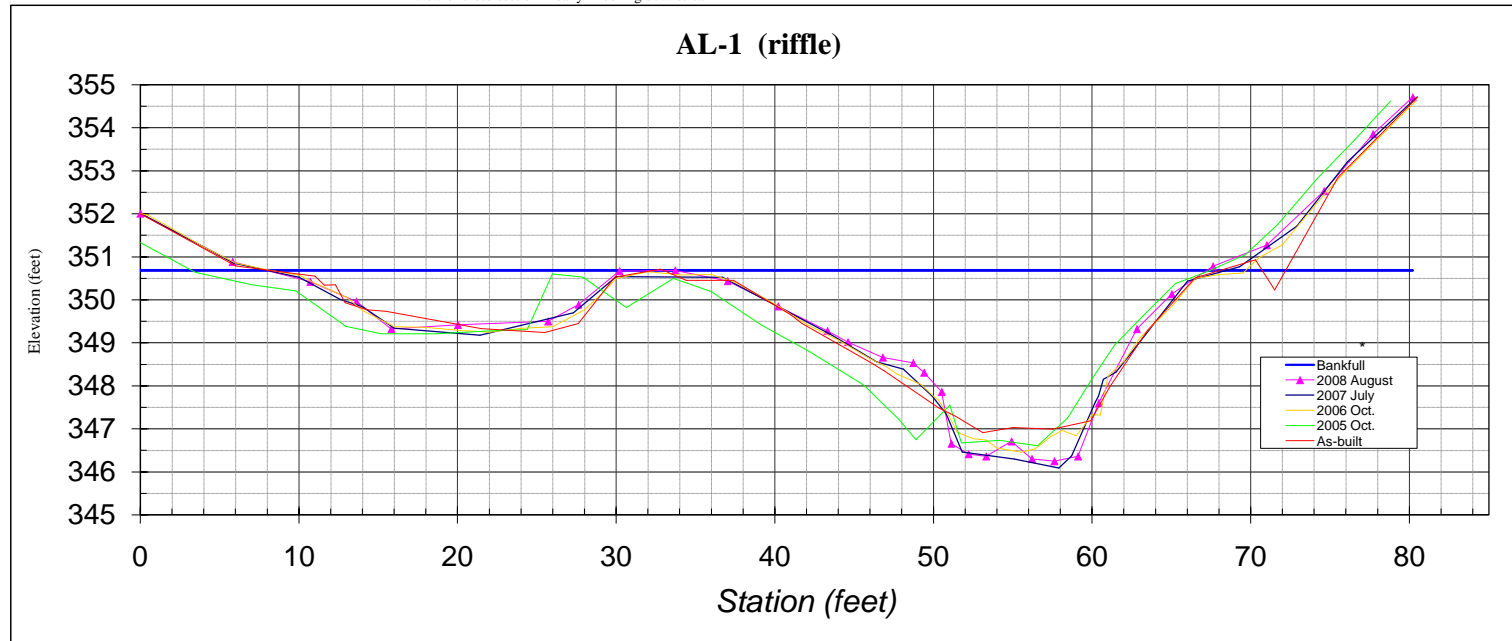
Station	Rod Ht.	Elevation
0	7.35	352.01
5.8	8.48	350.88
10.7	8.94	350.42
13.6	9.4	349.96
15.8	10.04	349.32
20	9.94	349.42
25.7	9.86	349.50
27.6	9.47	349.89
30.2	8.69	350.67
33.7	8.68	350.68
37	8.92	350.44
40.2	9.51	349.85
43.3	10.08	349.28
44.6	10.34	349.02
46.8	10.7	348.66
48.7	10.83	348.53
49.4	11.05	348.31
50.5	11.5	347.86
51.1	12.7	346.66
52.2	12.95	346.41
53.3	13	346.36
54.9	12.65	346.71
56.2	13.06	346.30
57.6	13.11	346.25
59.1	13	346.36
60.4	11.76	347.60
62.8	10.04	349.32
65	9.23	350.13
67.6	8.58	350.78
71	8.09	351.27
74.6	6.83	352.53
77.7	5.51	353.85
80.2	4.65	354.71

SUMMARY DATA	
Floodprone Elevation (ft)	355.11
Bankfull Elevation (ft)	350.68
Floodprone Width (ft)	98.00
Bankfull Width (ft)	34.20
Entrenchment Ratio	2.87
Mean Depth (ft)	2.02
Maximum Depth (ft)	4.43
Width/Depth Ratio	16.96
Bankfull Area (sq ft)	68.97
Wetted Perimeter (ft)	36.66
Hydraulic Radius (ft)	1.88

Stream Type: C



View of cross-section Albany 1 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: AL-2 (pool)
 Reach: Albany
 Date: 8/8/2008
 Field Crew: S.D. and A.P.

Station	Rod Ht.	Elevation
0	7.17	352.24
3.4	7.76	351.65
8.8	8.48	350.93
15	8.69	350.72
16	9	350.41
18.4	9.24	350.17
21.3	9.31	350.1
23.5	9.42	349.99
26.1	9	350.41
28	8.71	350.7
34.5	8.81	350.6
36.9	9.18	350.23
39	9.5	349.91
41.7	10.07	349.34
43.9	10.42	348.99
48.4	10.91	348.5
49.1	13.1	346.31
52.9	13.48	345.93
54	13.43	345.98
56.8	13.15	346.26
59.5	12.53	346.88
61	11.85	347.56
62.4	8.47	350.94
66.4	8.6	350.81
68.6	8.39	351.02
73.4	8.07	351.34
74.5	7.69	351.72
77.5	7.09	352.32
81	5.88	353.53
84.2	4.94	354.47

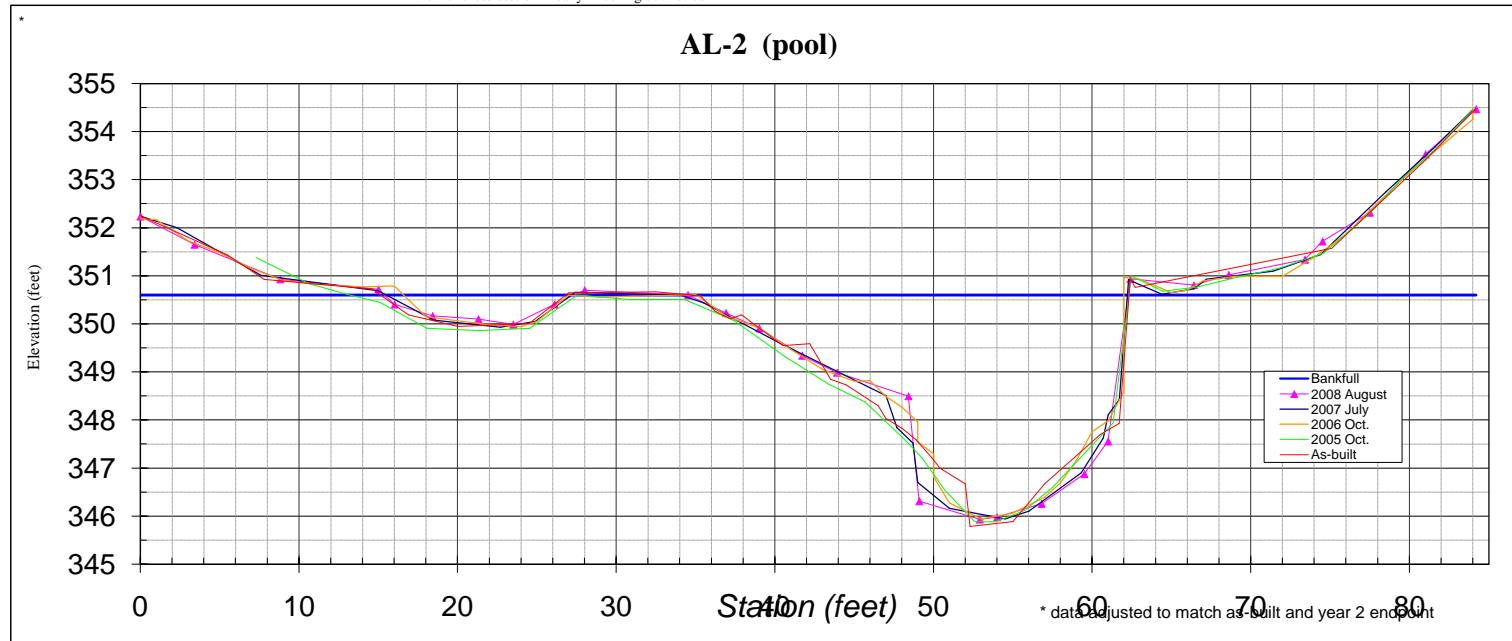
SUMMARY DATA

Floodprone Elevation (ft)	355.27
Bankfull Elevation (ft)	350.60
Floodprone Width (ft)	100.00
Bankfull Width (ft)	27.76
Entrenchment Ratio	3.60
Mean Depth (ft)	2.54
Maximum Depth (ft)	4.67
Width/Depth Ratio	10.93
Bankfull Area (sq ft)	70.47
Wetted Perimeter (ft)	31.81
Hydraulic Radius (ft)	2.22

Stream Type: E



View of cross-section Albany 2 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: AL-3 (pool)
 Reach: Albany
 Date: 8/8/2008
 Field Crew: S.D. and A.P.

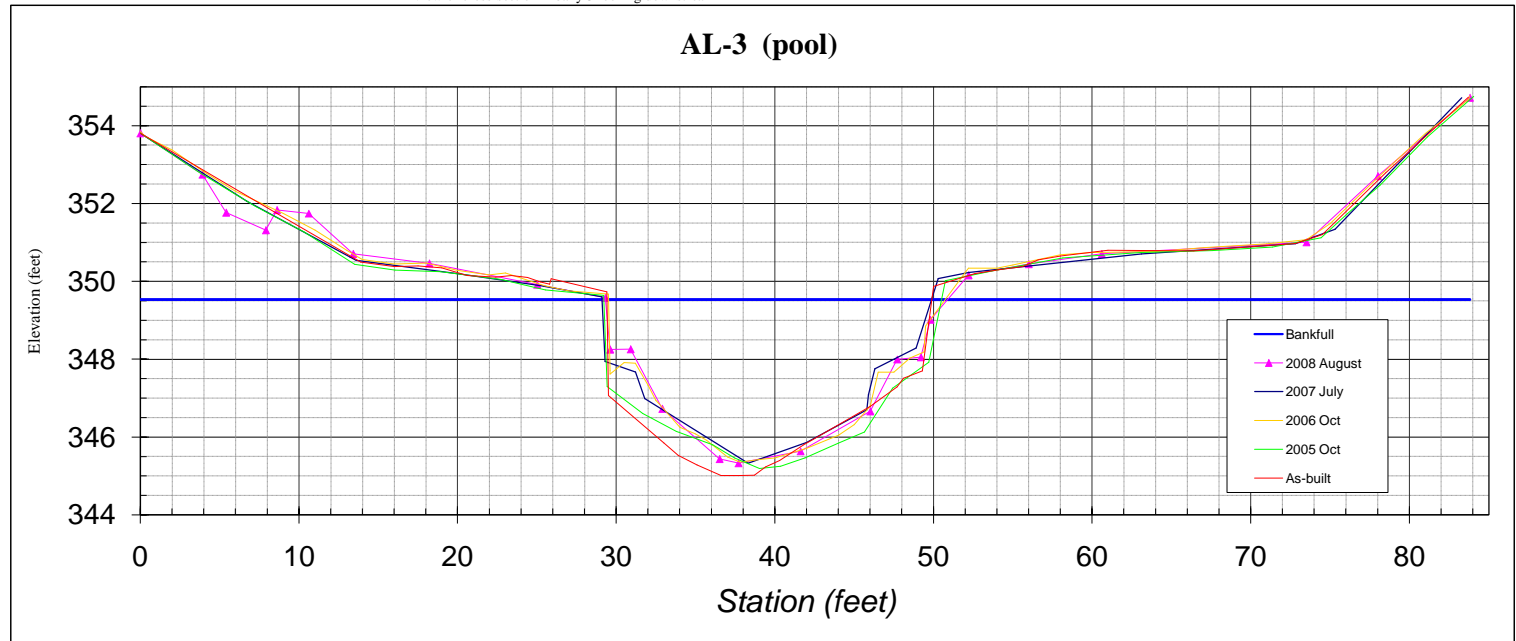
Station	Rod Ht.	Elevation
0	5.85	353.81
3.9	6.91	352.75
5.4	7.89	351.77
7.9	8.34	351.32
8.6	7.82	351.84
10.6	7.91	351.75
13.4	8.95	350.71
18.2	9.2	350.46
25	9.74	349.92
29.3	10.08	349.58
29.6	11.41	348.25
30.9	11.4	348.26
32.9	12.93	346.73
36.5	14.22	345.44
37.7	14.33	345.33
41.6	14.02	345.64
46	13	346.66
47.7	11.66	348.00
49.2	11.61	348.05
49.8	10.64	349.02
52.2	9.5	350.16
56	9.21	350.45
60.6	8.95	350.71
73.5	8.65	351.01
78	6.95	352.71
83.8	4.94	354.72

SUMMARY DATA	
Floodprone Elevation (ft)	353.83
Bankfull Elevation (ft)	349.53
Floodprone Width (ft)	87.00
Bankfull Width (ft)	21.68
Entrenchment Ratio	4.01
Mean Depth (ft)	2.85
Maximum Depth (ft)	4.25
Width/Depth Ratio	7.59
Bankfull Area (sq ft)	61.89
Wetted Perimeter (ft)	24.75
Hydraulic Radius (ft)	2.50

Stream Type:	E
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View of cross-section Albany 3 looking downstream



B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: AL-4 (riffle)
 Reach: Albany
 Date: 8/8/2008
 Field Crew: S.D. and A.P.

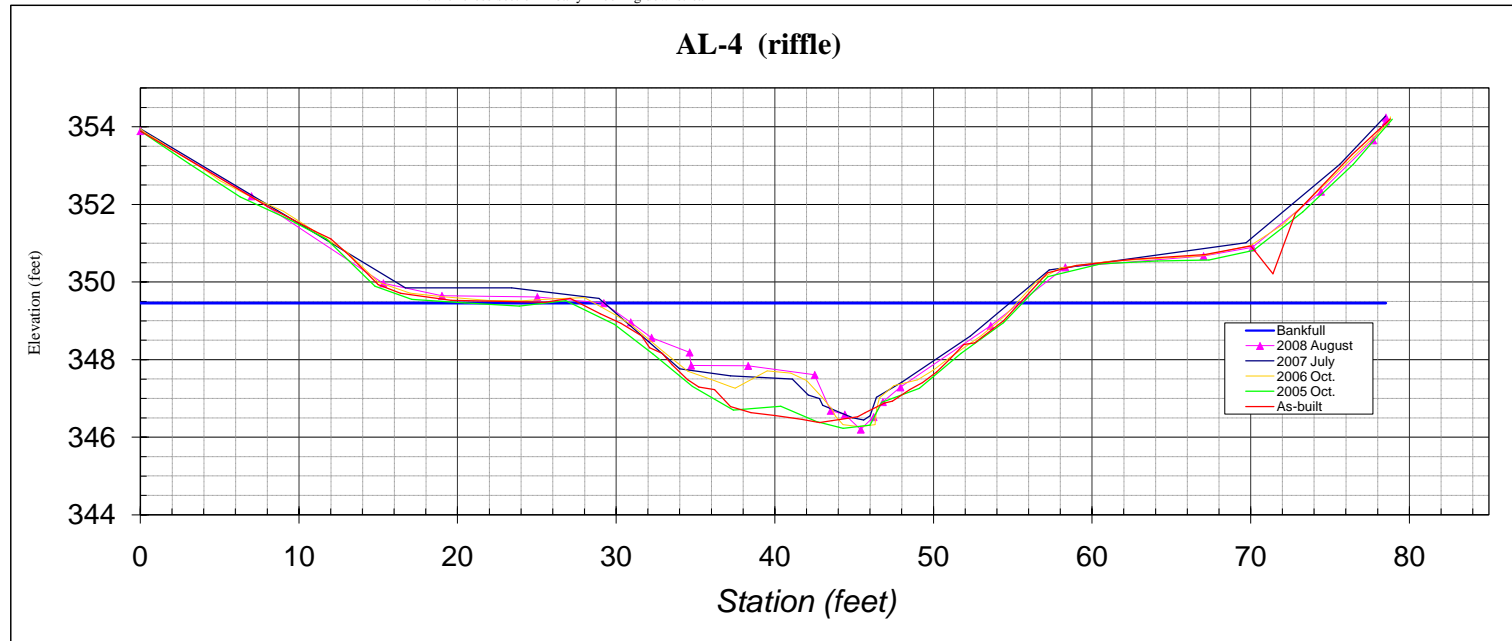
Station	Rod Ht.	Elevation
0	5.78	353.89
7	7.46	352.21
15.3	9.7	349.97
19	10.02	349.65
25	10.06	349.61
29.2	10.21	349.46
30.9	10.71	348.96
32.2	11.1	348.57
34.6	11.48	348.19
34.7	11.82	347.85
38.3	11.83	347.84
42.5	12.06	347.61
43.5	12.98	346.69
44.4	13.08	346.59
45.4	13.47	346.20
46.2	13.15	346.52
46.8	12.76	346.91
47.9	12.38	347.29
53.6	10.8	348.87
58.3	9.29	350.38
67	9	350.67
70.1	8.78	350.89
74.4	7.34	352.33
77.7	6.02	353.65
78.5	5.53	354.14
78.5	5.43	354.24

SUMMARY DATA	
Floodprone Elevation (ft)	352.72
Bankfull Elevation (ft)	349.46
Floodprone Width (ft)	70.50
Bankfull Width (ft)	26.24
Entrenchment Ratio	2.69
Mean Depth (ft)	1.53
Maximum Depth (ft)	3.26
Width/Depth Ratio	17.12
Bankfull Area (sq ft)	40.21
Wetted Perimeter (ft)	27.64
Hydraulic Radius (ft)	1.45

Stream Type: C



View of cross-section Albany 4 looking downstream



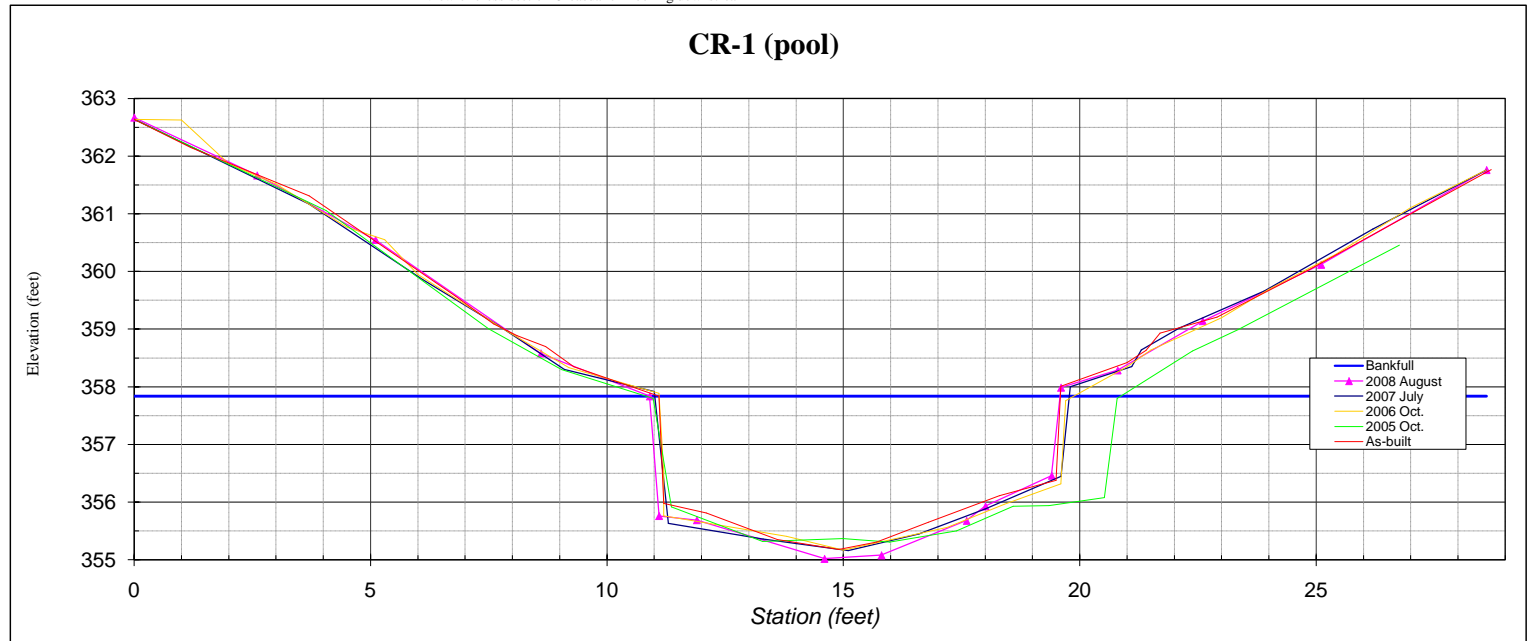
B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: CR-1 (pool)
 Reach: Croasdaile
 Date: 7/31/2008
 Field Crew: J.O. and S.D.

Station	Rod Ht.	Elevation	SUMMARY DATA	
28.6	5.43	361.76	Floodprone Elevation (ft)	360.66
25.1	6.43	360.12	Bankfull Elevation (ft)	357.84
22.6	7.55	359.14	Floodprone Width (ft)	21.40
20.8	9.52	358.29	Bankfull Width (ft)	8.68
19.6	10.26	357.99	Entrenchment Ratio	2.47
19.4	12.34	356.46	Mean Depth (ft)	2.26
18	12.41	355.93	Maximum Depth (ft)	2.82
17.6	13.08	355.68	Width/Depth Ratio	3.84
15.8	13.02	355.08	Bankfull Area (sq ft)	19.63
14.6	12.42	355.02	Wetted Perimeter (ft)	12.13
11.9	12.17	355.69	Hydraulic Radius (ft)	1.62
11.1	11.64	355.76		
10.9	10.11	357.84	Stream Type:	E
8.6	9.81	358.58		
5.1	8.96	360.55		
2.6	7.98	361.67		
0	6.34	362.67		



View of cross-section Croasdaile 1 looking downstream



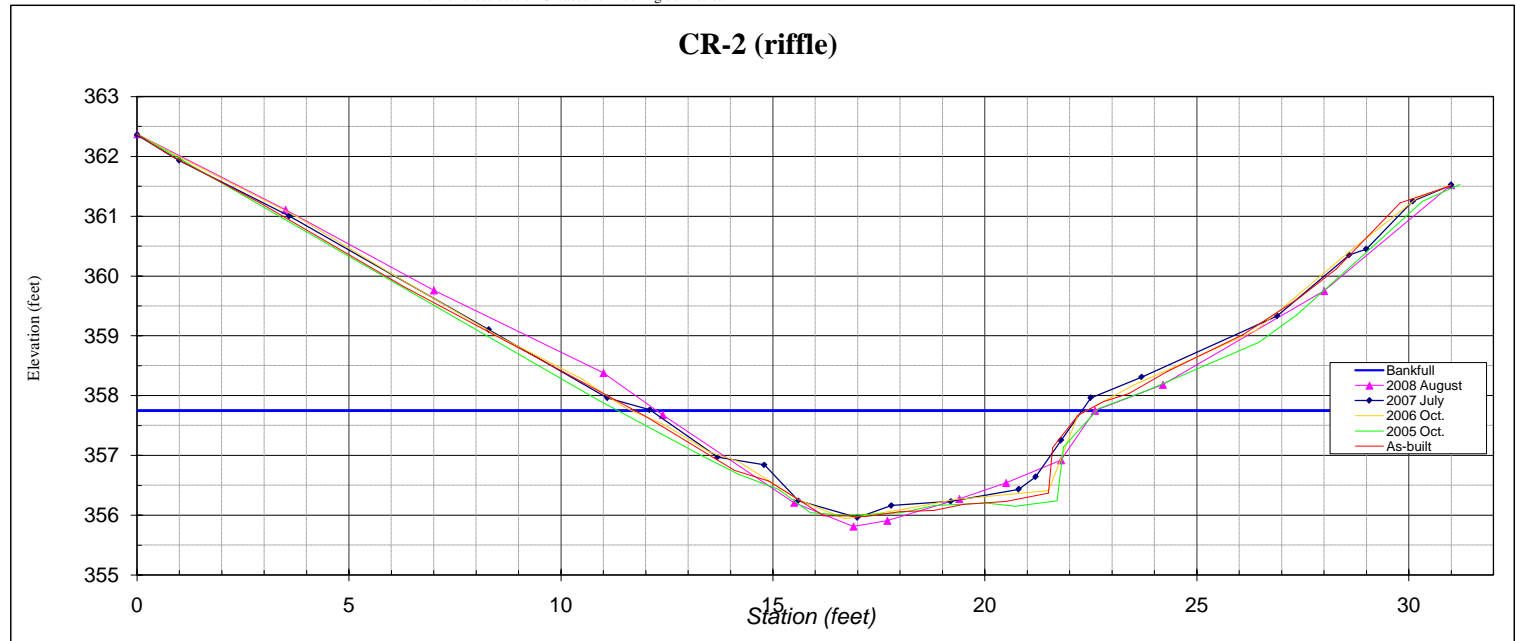
B5. Cross Section Plots, Photos, and Raw Data Tables - Ellerbe Creek Restoration Monitoring Year 2 (2006) - Durham, NC

River Basin: Neuse
 Watershed: Ellerbe Creek
 XS ID: CR-2 (riffle)
 Reach: Croasdaile
 Date: 7/31/2008
 Field Crew: J.O. and S.D.

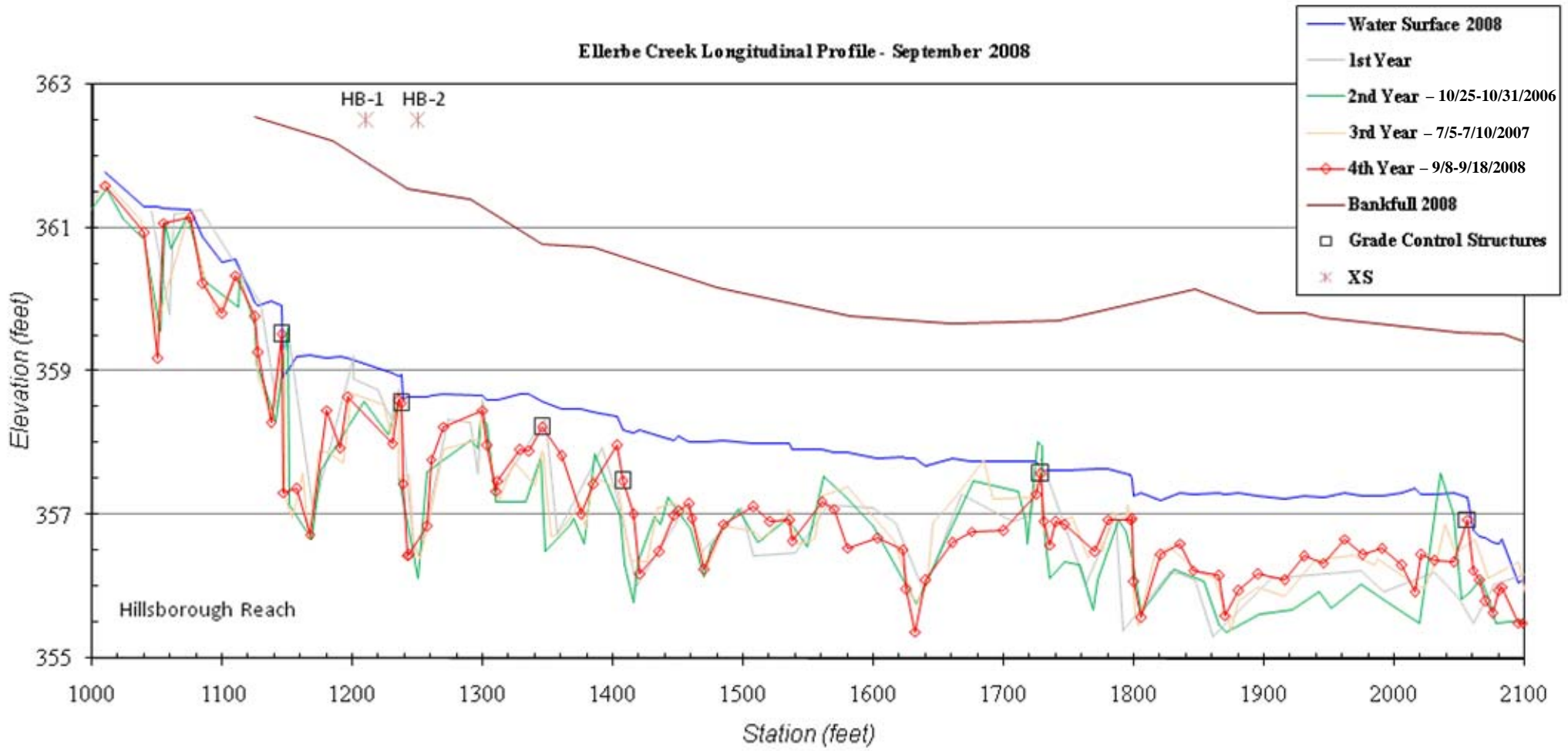
Station	Rod Ht.	Elevation	SUMMARY DATA	
31	6.59	361.52	Floodprone Elevation (ft)	359.69
28	8.36	359.75	Bankfull Elevation (ft)	357.75
24.2	9.93	358.18	Floodprone Width (ft)	20.65
22.6	10.36	357.75	Bankfull Width (ft)	10.34
21.8	11.19	356.92	Entrenchment Ratio	2.00
20.5	11.57	356.54	Mean Depth (ft)	1.20
19.4	11.84	356.27	Maximum Depth (ft)	1.94
17.7	12.2	355.91	Width/Depth Ratio	8.62
16.9	12.3	355.81	Bankfull Area (sq ft)	12.41
15.5	11.9	356.21	Wetted Perimeter (ft)	11.23
12.4	10.43	357.68	Hydraulic Radius (ft)	1.11
11	9.73	358.38		
7	8.35	359.76	Stream Type:	B
3.5	7	361.11		
0	5.74	362.37		



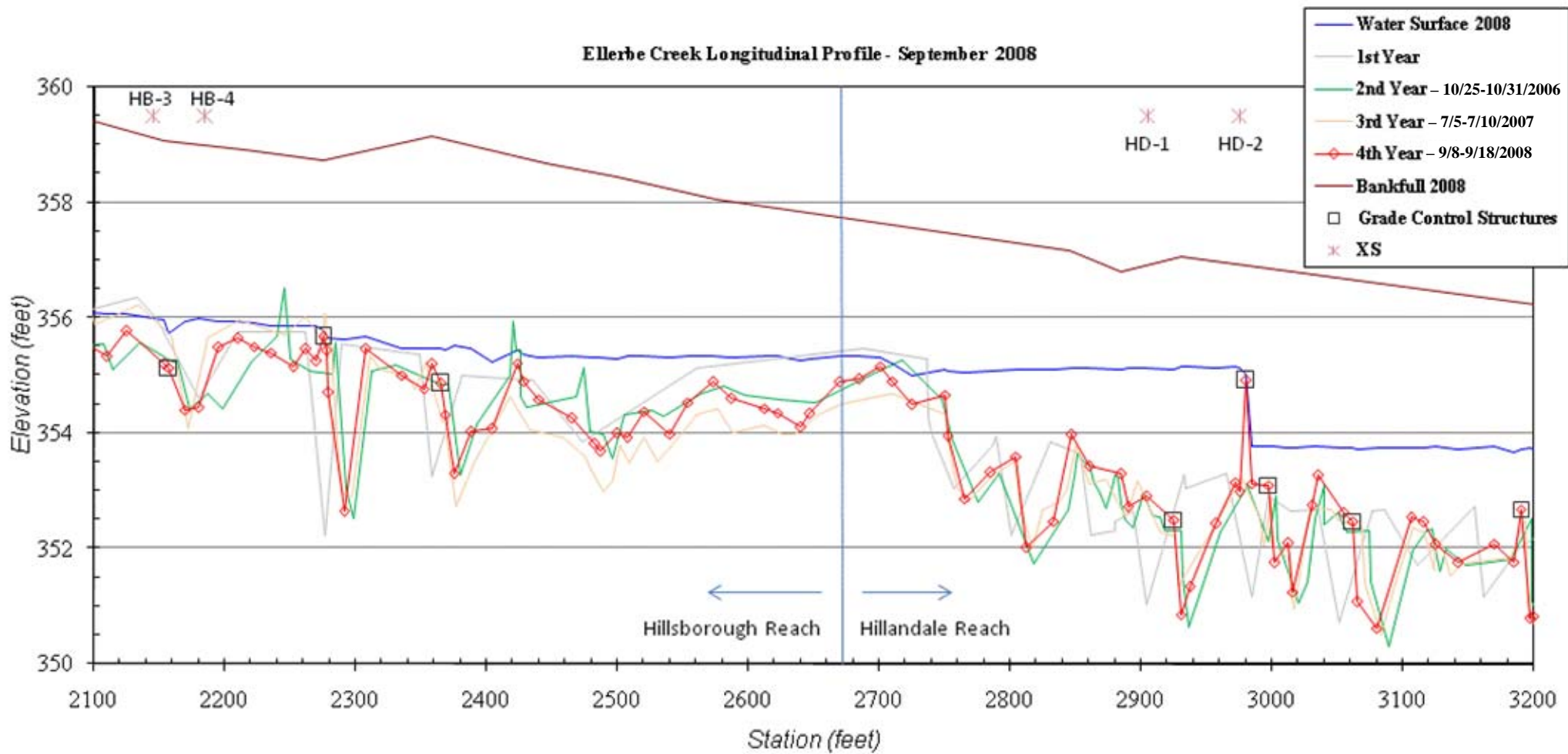
View of cross-section Croasdaile 2 looking downstream



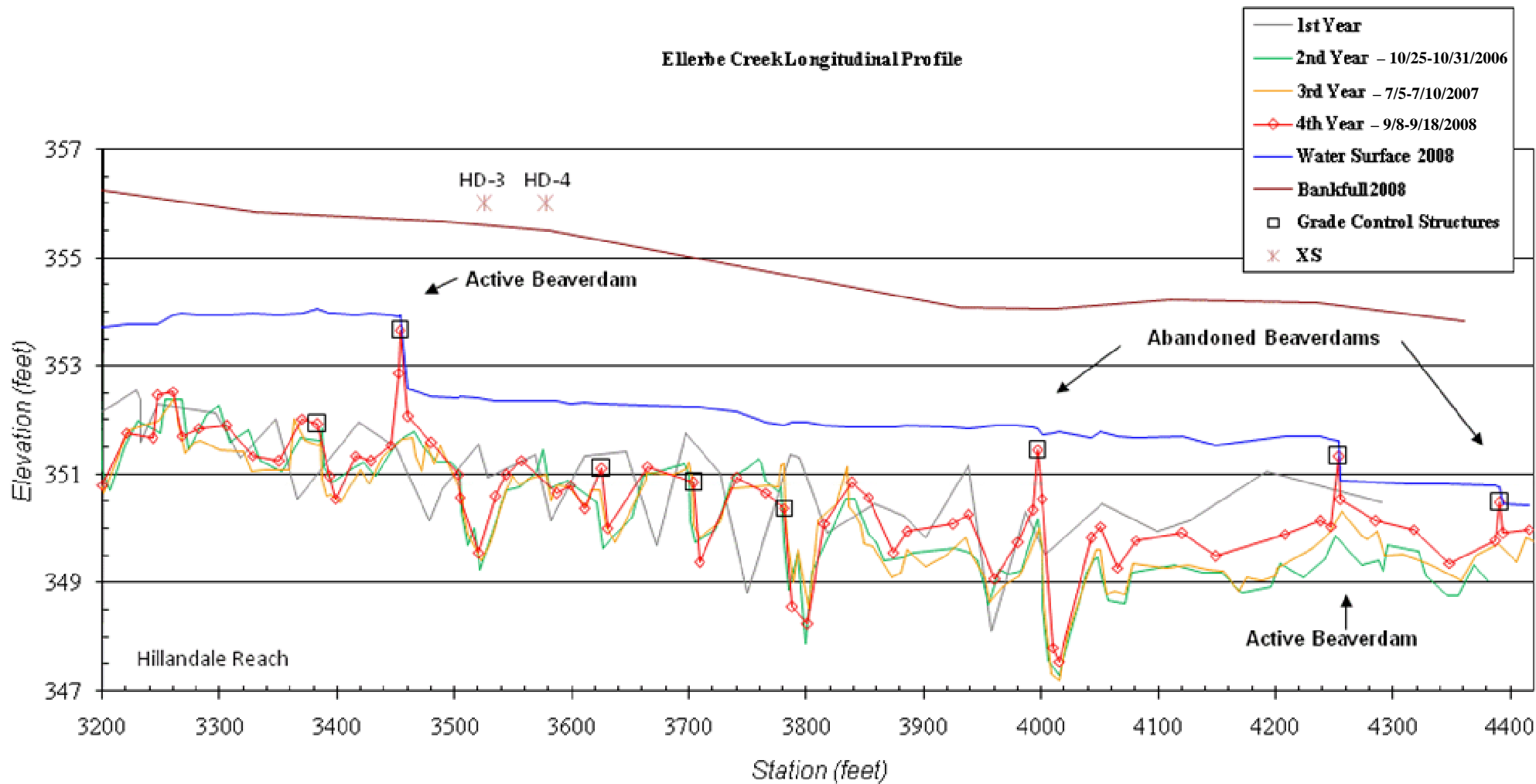
B5. Longitudinal Plots



Ellerbe Creek Longitudinal Profile - September 2008



Ellerbe Creek Longitudinal Profile



SURVEY FOR
SEI ENVIRONMENTAL, INC.
TOPOGRAPHIC ASBUILT SURVEY
ELLERBEE CREEK
HILLDALE GOLF COURSE
 DURHAM, NC

SEAL

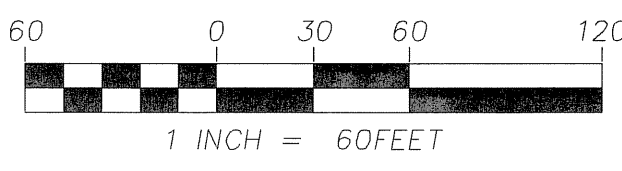


DURHAM COUNTY TOWNSHIP PIN	DATE	BY	DESCRIPTION
	02/11/05	LFL	ADD PROFILE
		JP	DESCRIPTION

DRAWN BY: LFL
 APPROVED BY: REB
 CHECKED BY: JP
 DATE: 02/11/05

TREE TABLE

T2096	18"	CEDAR
T2172	20"	MAPLE
T2178	30"	OAK
T2179	30"	OAK
T2940	12"	CEDAR
T2941	12"	TWIN CEDAR
T2942	14"	CEDAR
T3290	10"	CEDAR
T3297	24"	PINE
T3299	14"	GUM
T3300	20"	GUM
T3322	10"	TRIPLET CEDAR
T3564	12"	PEAR
T4909	34"	PINE
T4913	22"	PINE
T4914	25"	PINE
T4916	18"	CEDAR



I, Lawrence F. Lee III, hereby certify that this Topographic Survey map was prepared under my supervision, that the survey was conducted under my supervision according to the Standards of Practice for Land Surveying in North Carolina; that this survey is a Class A topographic survey, and the vertical error does not exceed .10 times the square root of the number of miles run from the reference datum; witness my hand and seal this 25TH day of MARCH, 2005.

Lawrence F. Lee III
Lawrence F. Lee III, PLS L-3884

NOTES

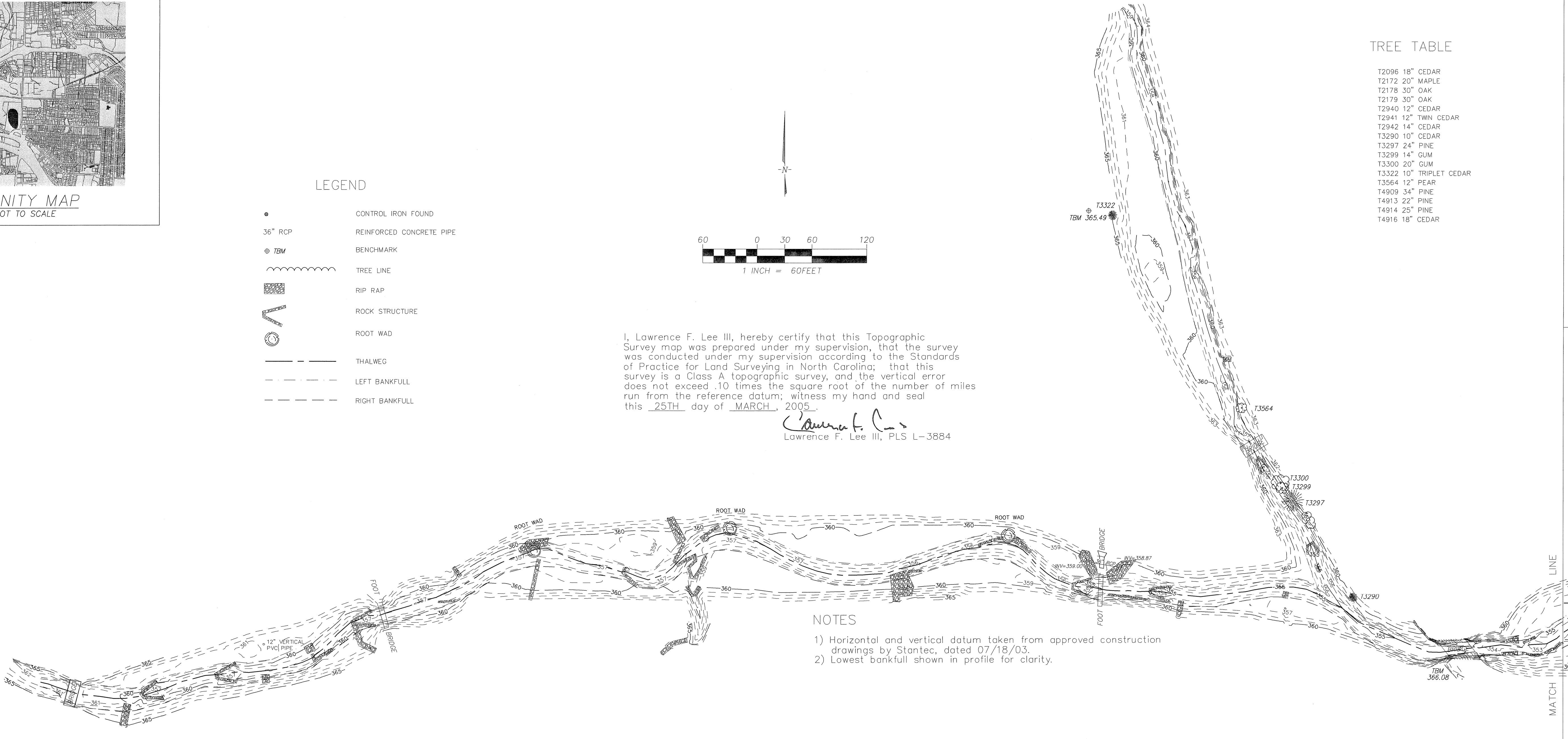
- 1) Horizontal and vertical datum taken from approved construction drawings by Stantec, dated 07/18/03.
- 2) Lowest bankfull shown in profile for clarity.

LEGEND

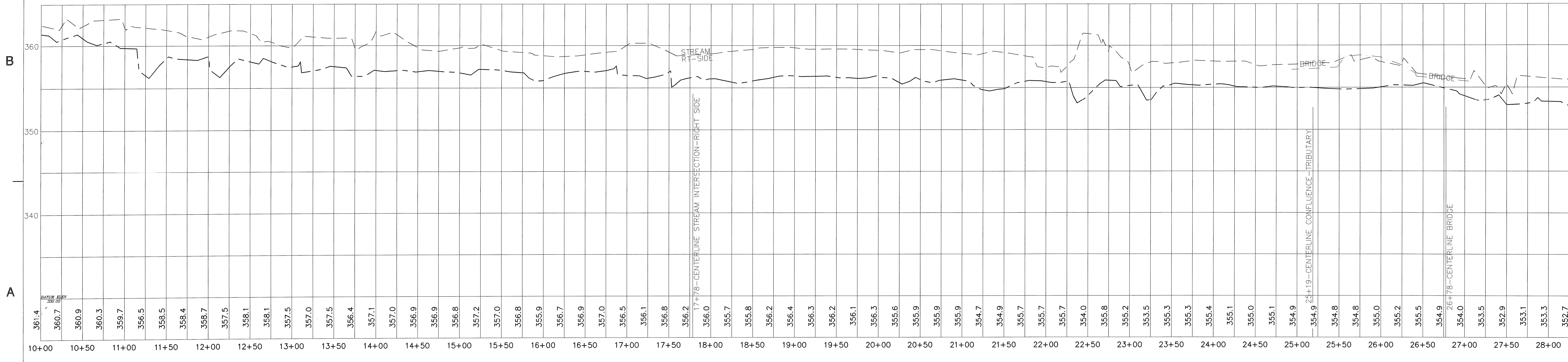
- CONTROL IRON FOUND
- 36" RCP REINFORCED CONCRETE PIPE
- ⊕ TBM BENCHMARK
- ~ TREE LINE
- ▨ RIP RAP
- ⌒ ROCK STRUCTURE
- ⊙ ROOT WAD
- THALWEG
- - - LEFT BANKFULL
- - - RIGHT BANKFULL

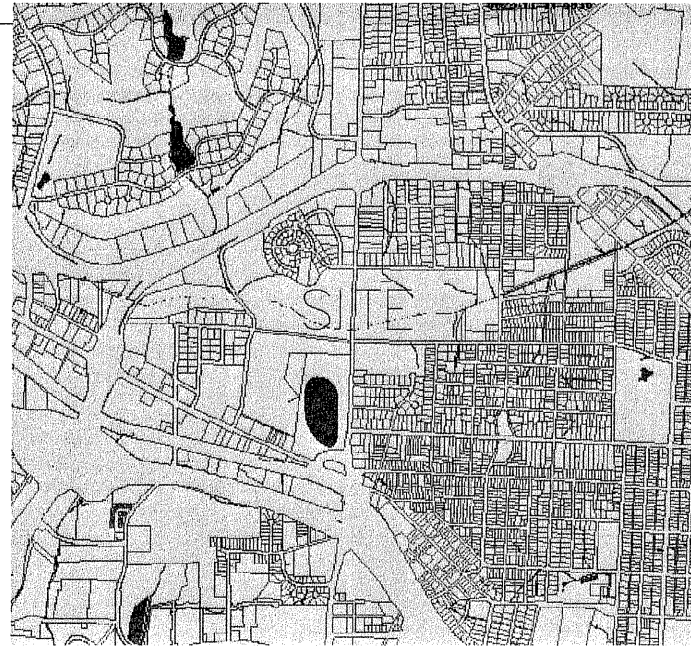


VICINITY MAP
NOT TO SCALE



PROFILE MAIN LINE HORIZONTAL SCALE
1"=60'
VERTICAL SCALE
1"=60'

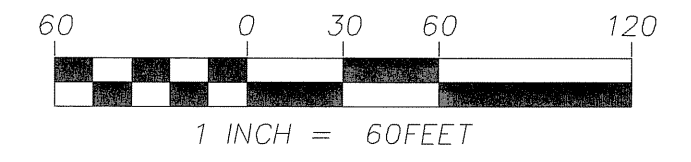
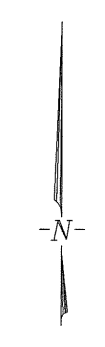




VICINITY MAP
NOT TO SCALE

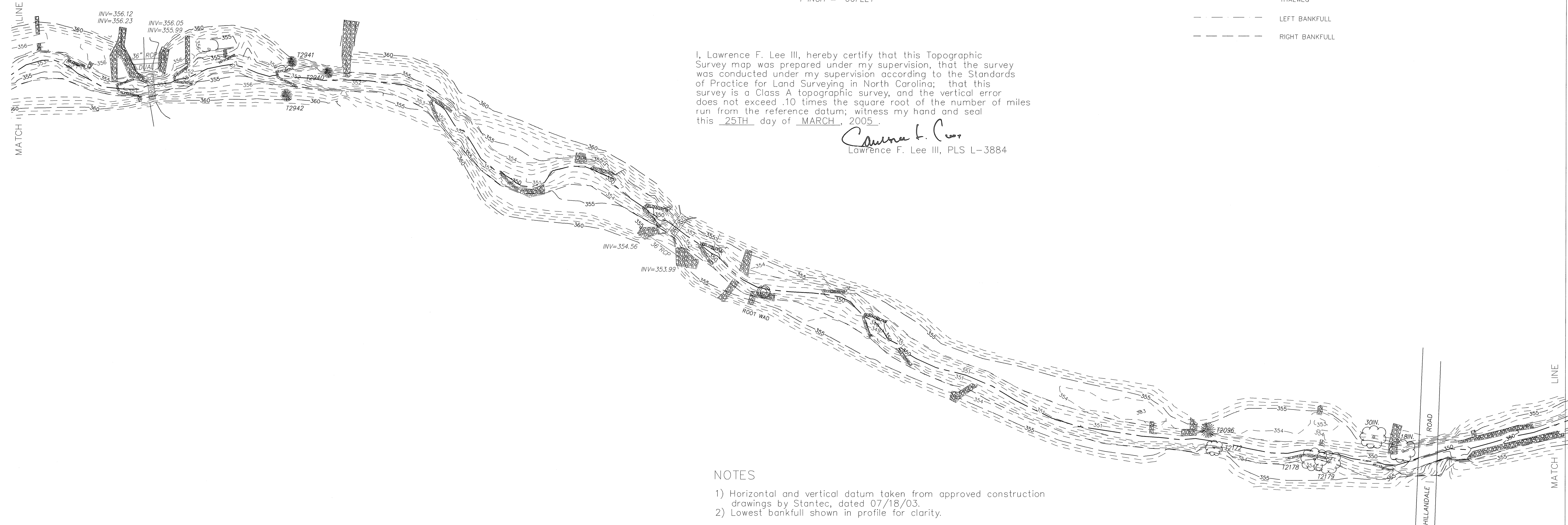
TREE TABLE

T2096	18"	CEDAR
T2172	20"	MAPLE
T2178	30"	OAK
T2179	30"	OAK
T2940	12"	CEDAR
T2941	12"	TWIN CEDAR
T2942	14"	CEDAR
T3290	10"	CEDAR
T3297	24"	PINE
T3299	14"	GUM
T3300	20"	GUM
T3322	10"	TRIPLET CEDAR
T3564	12"	PEAR
T4909	34"	PINE
T4913	22"	PINE
T4914	25"	PINE
T4916	18"	CEDAR



LEGEND

- CONTROL IRON FOUND
- 36" RCP REINFORCED CONCRETE PIPE
- ⊕ B.M. BENCHMARK
- ~ TREE LINE
- ▨ RIP RAP
- ⊠ ROCK STRUCTURE
- ⊙ ROOT WAD
- - - THALWEG
- - - LEFT BANKFULL
- - - RIGHT BANKFULL



I, Lawrence F. Lee III, hereby certify that this Topographic Survey map was prepared under my supervision, that the survey was conducted under my supervision according to the Standards of Practice for Land Surveying in North Carolina; that this survey is a Class A topographic survey, and the vertical error does not exceed .10 times the square root of the number of miles run from the reference datum; witness my hand and seal this 25TH day of MARCH, 2005.

Lawrence F. Lee III
Lawrence F. Lee III, PLS L-3884

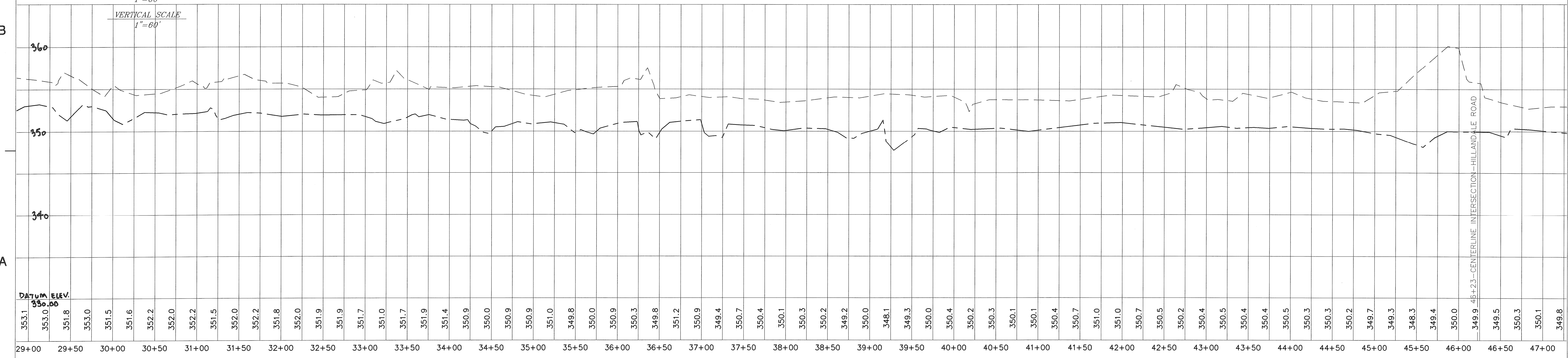
NOTES

- Horizontal and vertical datum taken from approved construction drawings by Stantec, dated 07/18/03.
- Lowest bankfull shown in profile for clarity.

PROFILE MAIN LINE

HORIZONTAL SCALE
1"=60'

VERTICAL SCALE
1"=60'



DATUM ELEV.
350.00

Dewberry

Dewberry & Davis, Inc.
2301 REAWOODS DRIVE
SUITE 200
RALEIGH, NC 27607
PHONE: 919.881.9939
FAX: 919.881.9923

SURVEY FOR
SEI ENVIRONMENTAL, INC.
TOPOGRAPHIC ASBUILT SURVEY
 ELLERBEE CREEK
 HILLDALE GOLF COURSE
 DURHAM, NC

SEAL



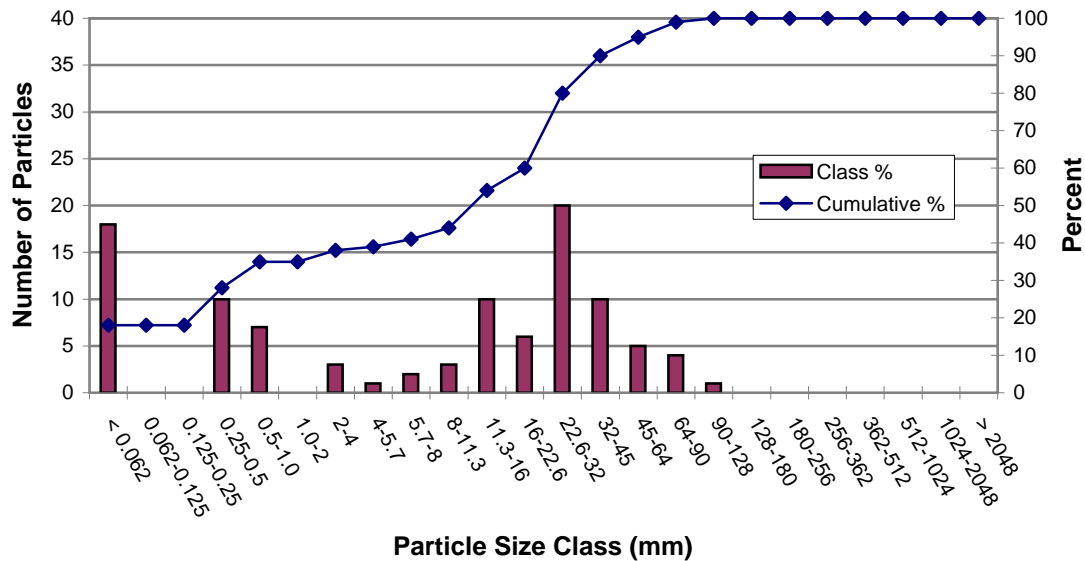
DURHAM COUNTY	
TOWNSHIP	
PN	
1	1/2/05 LFL ADD PROFILE
2	DATE EPT DESCRIPTION
	REVISIONS
DRAWN BY	LFL
APPROVED BY	REB
CHECKED BY	JIP
DATE	02/11/05

Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (07/31/2008)

Cross Section HB-XS1

S/C	Particle	Size Range (mm)	Total #	Class %	Cumulative %
	Silt/Clay	< 0.062	18	18	18
Sand	Very Fine Sand	0.062-0.125	0	0	18
	Fine Sand	0.125-0.25	0	0	18
	Medium Sand	0.25-0.5	10	10	28
	Coarse Sand	0.5-1.0	7	7	35
	Very Coarse Sand	1.0-2	0	0	35
Gravel	Very Fine Gravel	2-4	3	3	38
	Fine Gravel	4-5.7	1	1	39
	Fine Gravel	5.7-8	2	2	41
	Medium Gravel	8-11.3	3	3	44
	Medium Gravel	11.3-16	10	10	54
	Coarse Gravel	16-22.6	6	6	60
	Coarse Gravel	22.6-32	20	20	80
	Very Coarse Gravel	32-45	10	10	90
	Very Coarse Gravel	45-64	5	5	95
Cobble	Small Cobble	64-90	4	4	99
	Small Cobble	90-128	1	1	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 14.12 mm
d₈₄ = 37.2 mm



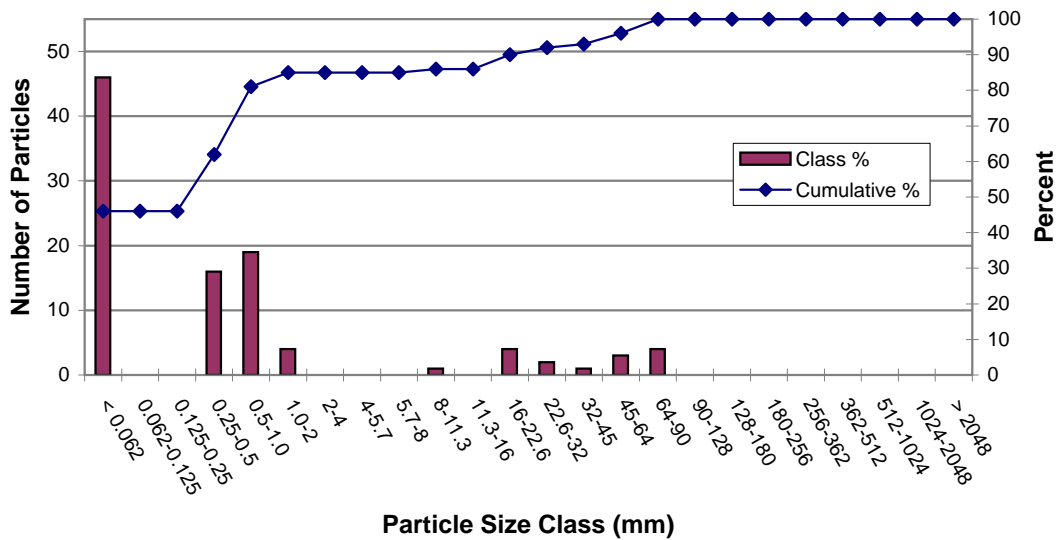
Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (07/31/2008)

Cross Section HB-XS2

S/C	Particle	Size Range (mm)	Total #	Class %	Cumulative %
	Silt/Clay	< 0.062	46	46	46
Sand	Very Fine Sand	0.062-0.125	0	0	46
	Fine Sand	0.125-0.25	0	0	46
	Medium Sand	0.25-0.5	16	16	62
	Coarse Sand	0.5-1.0	19	19	81
	Very Coarse Sand	1.0-2	4	4	85
Gravel	Very Fine Gravel	2-4	0	0	85
	Fine Gravel	4-5.7	0	0	85
	Fine Gravel	5.7-8	0	0	85
	Medium Gravel	8-11.3	1	1	86
	Medium Gravel	11.3-16	0	0	86
	Coarse Gravel	16-22.6	4	4	90
	Coarse Gravel	22.6-32	2	2	92
	Very Coarse Gravel	32-45	1	1	93
	Very Coarse Gravel	45-64	3	3	96
Cobble	Small Cobble	64-90	4	4	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 0.31 mm

d₈₄ = 1.75 mm

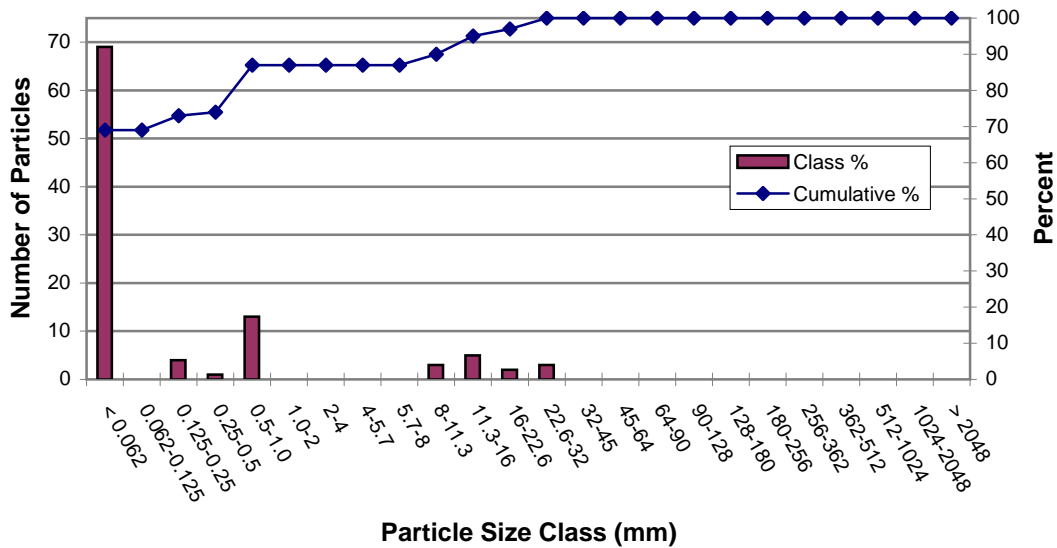


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (07/31/2008)

Cross Section HB-XS3

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	69	69	69
Sand	Very Fine Sand	0.062-0.125	0	0	69
	Fine Sand	0.125-0.25	4	4	73
	Medium Sand	0.25-0.5	1	1	74
	Coarse Sand	0.5-1.0	13	13	87
	Very Coarse Sand	1.0-2	0	0	87
Gravel	Very Fine Gravel	2-4	0	0	87
	Fine Gravel	4-5.7	0	0	87
	Fine Gravel	5.7-8	0	0	87
	Medium Gravel	8-11.3	3	3	90
	Medium Gravel	11.3-16	5	5	95
	Coarse Gravel	16-22.6	2	2	97
	Coarse Gravel	22.6-32	3	3	100
	Very Coarse Gravel	32-45	0	0	100
	Very Coarse Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 0.05 mm
d₈₄ = 0.88 mm

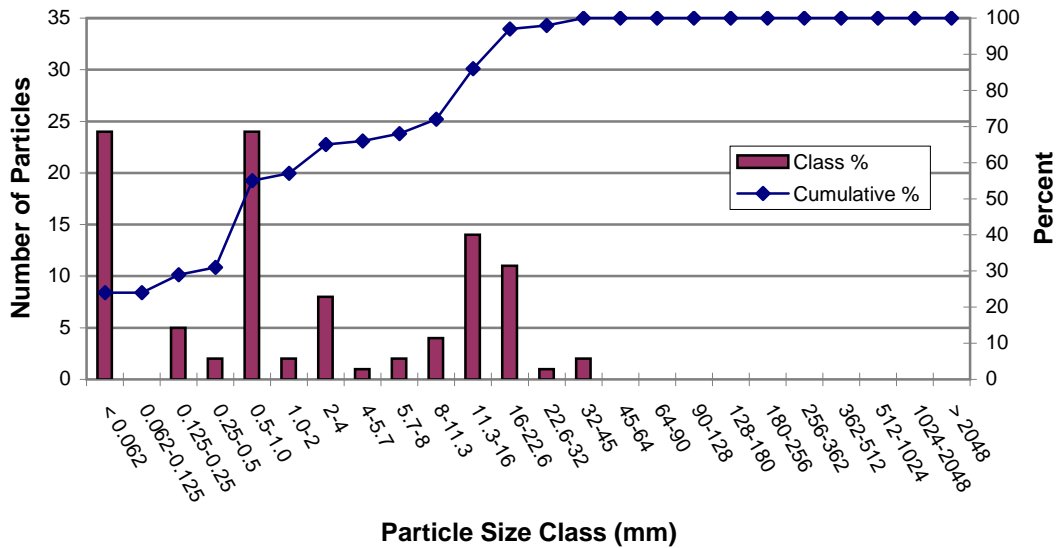


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (07/31/2008)

Cross Section HB-XS4

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	24	24	24
Sand	Very Fine Sand	0.062-0.125	0	0	24
	Fine Sand	0.125-0.25	5	5	29
	Medium Sand	0.25-0.5	2	2	31
	Coarse Sand	0.5-1.0	24	24	55
	Very Coarse Sand	1.0-2	2	2	57
Gravel	Very Fine Gravel	2-4	8	8	65
	Fine Gravel	4-5.7	1	1	66
	Fine Gravel	5.7-8	2	2	68
	Medium Gravel	8-11.3	4	4	72
	Medium Gravel	11.3-16	14	14	86
	Coarse Gravel	16-22.6	11	11	97
	Coarse Gravel	22.6-32	1	1	98
	Very Coarse Gravel	32-45	2	2	100
	Very Coarse Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 0.9 mm
d₈₄ = 15.33 mm

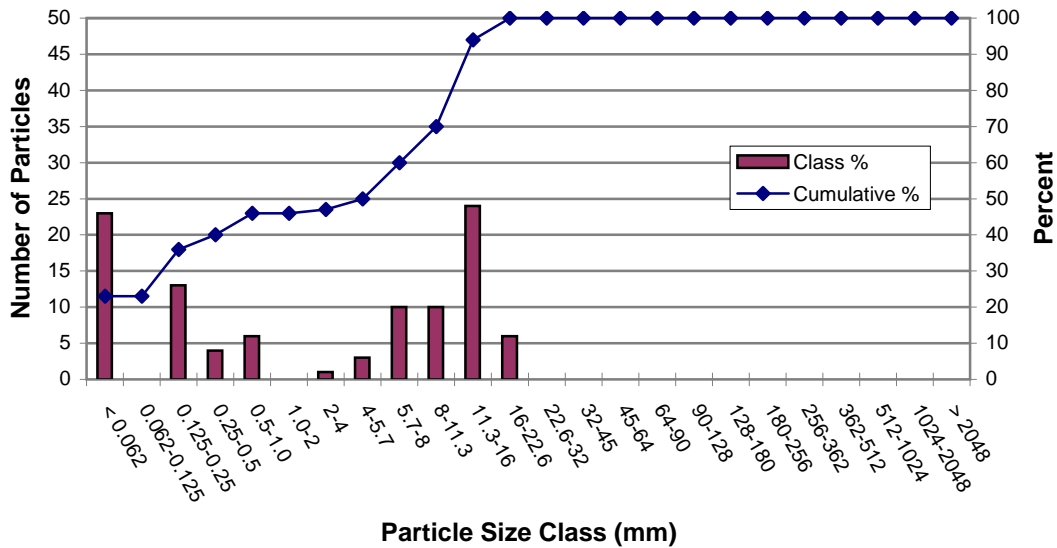


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/01/2008)

Cross Section HD-XS1

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	23	23	23
Sand	Very Fine Sand	0.062-0.125	0	0	23
	Fine Sand	0.125-0.25	13	13	36
	Medium Sand	0.25-0.5	4	4	40
	Coarse Sand	0.5-1.0	6	6	46
	Very Coarse Sand	1.0-2	0	0	46
Gravel	Very Fine Gravel	2-4	1	1	47
	Fine Gravel	4-5.7	3	3	50
	Fine Gravel	5.7-8	10	10	60
	Medium Gravel	8-11.3	10	10	70
	Medium Gravel	11.3-16	24	24	94
	Coarse Gravel	16-22.6	6	6	100
	Coarse Gravel	22.6-32	0	0	100
	Very Coarse Gravel	32-45	0	0	100
	Very Coarse Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 5.7 mm
d₈₄ = 14.04 mm

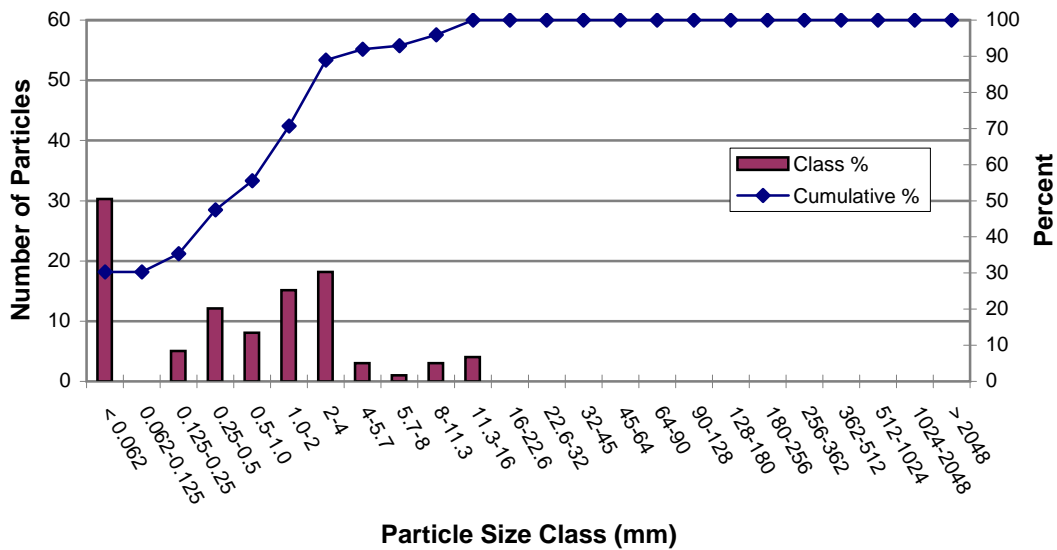


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/01/2008)

Cross Section HD-XS2

S/C	Particle	Size Range (mm)	Total #	Class %	Cumulative %
	Silt/Clay	< 0.062	30	30	30
Sand	Very Fine Sand	0.062-0.125	0	0	30
	Fine Sand	0.125-0.25	5	5	35
	Medium Sand	0.25-0.5	12	12	47
	Coarse Sand	0.5-1.0	8	8	56
	Very Course Sand	1.0-2	15	15	71
Gravel	Very Fine Gravel	2-4	18	18	89
	Fine Gravel	4-5.7	3	3	92
	Fine Gravel	5.7-8	1	1	93
	Medium Gravel	8-11.3	3	3	96
	Medium Gravel	11.3-16	4	4	100
	Coarse Gravel	16-22.6	0	0	100
	Coarse Gravel	22.6-32	0	0	100
	Very Course Gravel	32-45	0	0	100
	Very Course Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			99		

$d_{50} = 0.69 \text{ mm}$
 $d_{84} = 3.56 \text{ mm}$

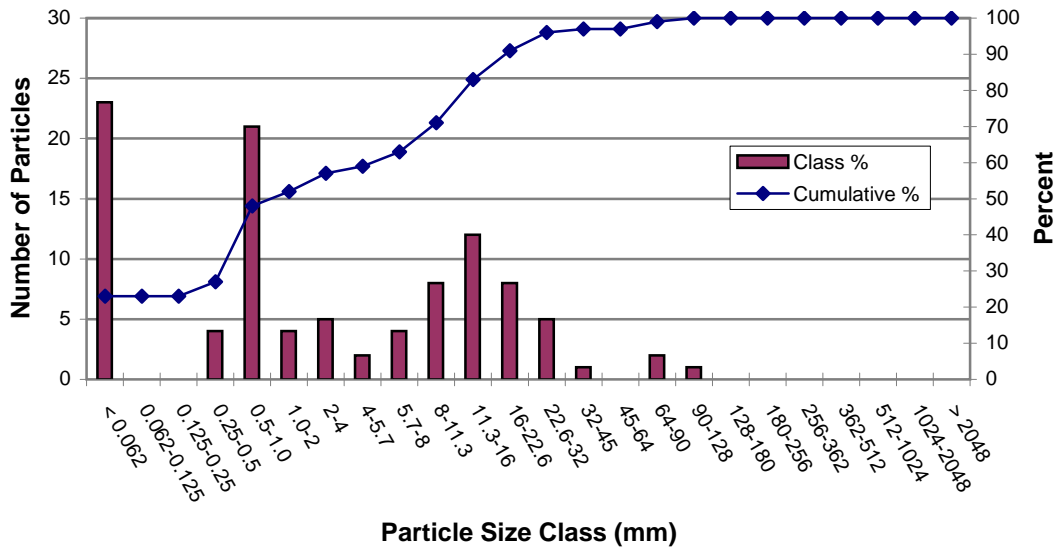


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section HD-XS3

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	23	23	23
Sand	Very Fine Sand	0.062-0.125	0	0	23
	Fine Sand	0.125-0.25	0	0	23
	Medium Sand	0.25-0.5	4	4	27
	Coarse Sand	0.5-1.0	21	21	48
	Very Coarse Sand	1.0-2	4	4	52
Gravel	Very Fine Gravel	2-4	5	5	57
	Fine Gravel	4-5.7	2	2	59
	Fine Gravel	5.7-8	4	4	63
	Medium Gravel	8-11.3	8	8	71
	Medium Gravel	11.3-16	12	12	83
	Coarse Gravel	16-22.6	8	8	91
	Coarse Gravel	22.6-32	5	5	96
	Very Coarse Gravel	32-45	1	1	97
	Very Coarse Gravel	45-64	0	0	97
Cobble	Small Cobble	64-90	2	2	99
	Small Cobble	90-128	1	1	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 1.5 mm
d₈₄ = 16.83 mm

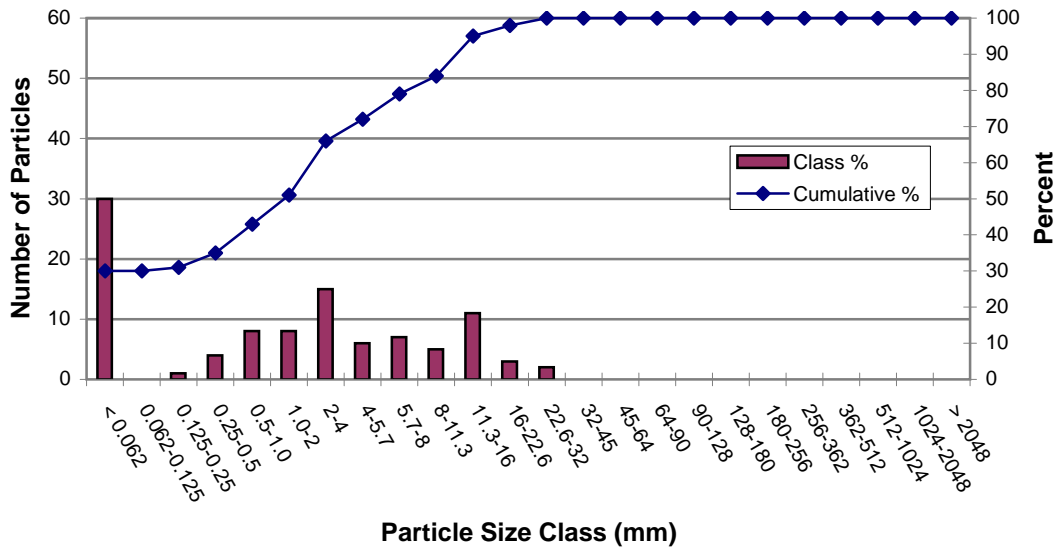


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section HD-XS4

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	30	30	30
Sand	Very Fine Sand	0.062-0.125	0	0	30
	Fine Sand	0.125-0.25	1	1	31
	Medium Sand	0.25-0.5	4	4	35
	Coarse Sand	0.5-1.0	8	8	43
	Very Coarse Sand	1.0-2	8	8	51
Gravel	Very Fine Gravel	2-4	15	15	66
	Fine Gravel	4-5.7	6	6	72
	Fine Gravel	5.7-8	7	7	79
	Medium Gravel	8-11.3	5	5	84
	Medium Gravel	11.3-16	11	11	95
	Coarse Gravel	16-22.6	3	3	98
	Coarse Gravel	22.6-32	2	2	100
	Very Coarse Gravel	32-45	0	0	100
	Very Coarse Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 1.88 mm
d₈₄ = 11.3 mm



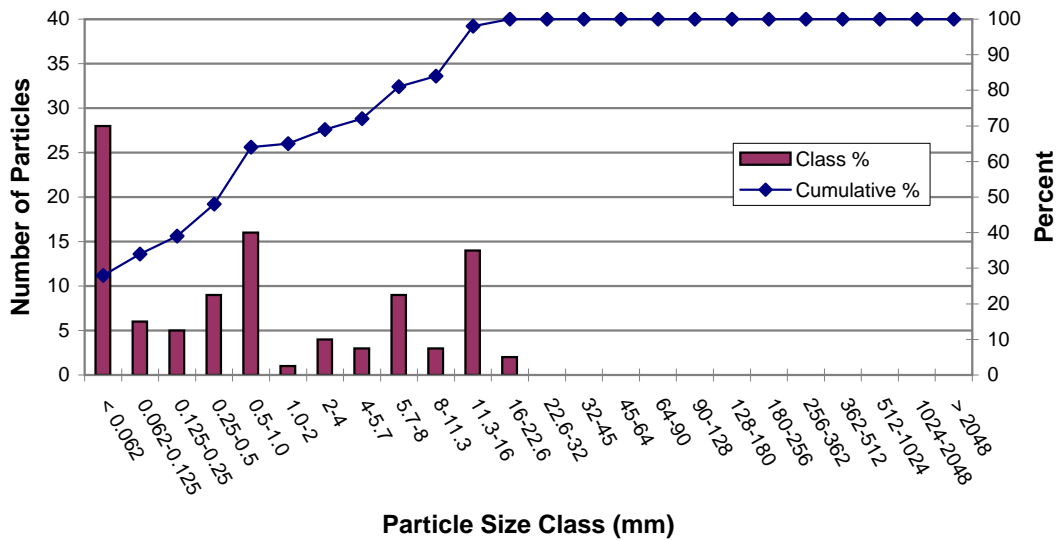
Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section AL-XS1

S/C	Particle	Size Range (mm)	Total #	Class %	Cumulative %
	Silt/Clay	< 0.062	28	28	28
Sand	Very Fine Sand	0.062-0.125	6	6	34
	Fine Sand	0.125-0.25	5	5	39
	Medium Sand	0.25-0.5	9	9	48
	Coarse Sand	0.5-1.0	16	16	64
	Very Coarse Sand	1.0-2	1	1	65
Gravel	Very Fine Gravel	2-4	4	4	69
	Fine Gravel	4-5.7	3	3	72
	Fine Gravel	5.7-8	9	9	81
	Medium Gravel	8-11.3	3	3	84
	Medium Gravel	11.3-16	14	14	98
	Coarse Gravel	16-22.6	2	2	100
	Coarse Gravel	22.6-32	0	0	100
	Very Coarse Gravel	32-45	0	0	100
	Very Coarse Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 0.56 mm

d₈₄ = 11.3 mm

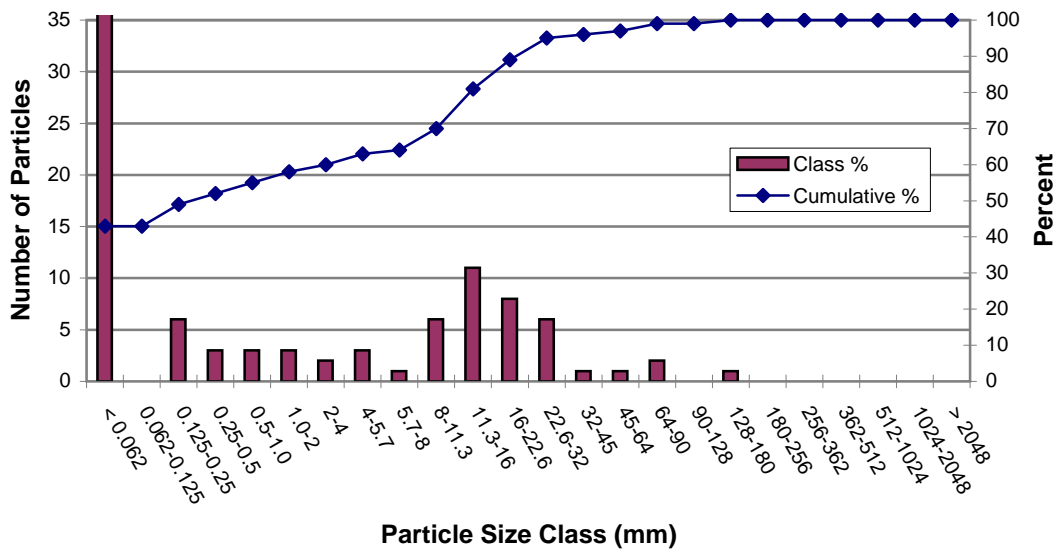


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section AL-XS2

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	43	43	43
Sand	Very Fine Sand	0.062-0.125	0	0	43
	Fine Sand	0.125-0.25	6	6	49
	Medium Sand	0.25-0.5	3	3	52
	Coarse Sand	0.5-1.0	3	3	55
	Very Coarse Sand	1.0-2	3	3	58
Gravel	Very Fine Gravel	2-4	2	2	60
	Fine Gravel	4-5.7	3	3	63
	Fine Gravel	5.7-8	1	1	64
	Medium Gravel	8-11.3	6	6	70
	Medium Gravel	11.3-16	11	11	81
	Coarse Gravel	16-22.6	8	8	89
	Coarse Gravel	22.6-32	6	6	95
	Very Coarse Gravel	32-45	1	1	96
	Very Coarse Gravel	45-64	1	1	97
Cobble	Small Cobble	64-90	2	2	99
	Small Cobble	90-128	0	0	99
	Medium Cobble	128-180	1	1	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 0.33 mm
d₈₄ = 18.48 mm

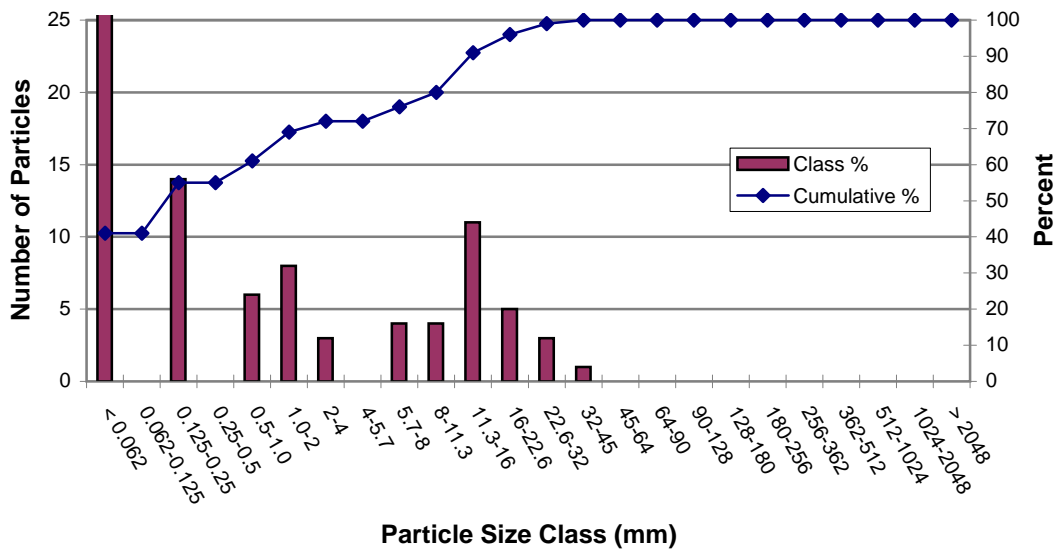


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section AL-XS3

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	41	41	41
Sand	Very Fine Sand	0.062-0.125	0	0	41
	Fine Sand	0.125-0.25	14	14	55
	Medium Sand	0.25-0.5	0	0	55
	Coarse Sand	0.5-1.0	6	6	61
	Very Coarse Sand	1.0-2	8	8	69
Gravel	Very Fine Gravel	2-4	3	3	72
	Fine Gravel	4-5.7	0	0	72
	Fine Gravel	5.7-8	4	4	76
	Medium Gravel	8-11.3	4	4	80
	Medium Gravel	11.3-16	11	11	91
	Coarse Gravel	16-22.6	5	5	96
	Coarse Gravel	22.6-32	3	3	99
	Very Coarse Gravel	32-45	1	1	100
	Very Coarse Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

$d_{50} = 0.21 \text{ mm}$
 $d_{84} = 13.01 \text{ mm}$

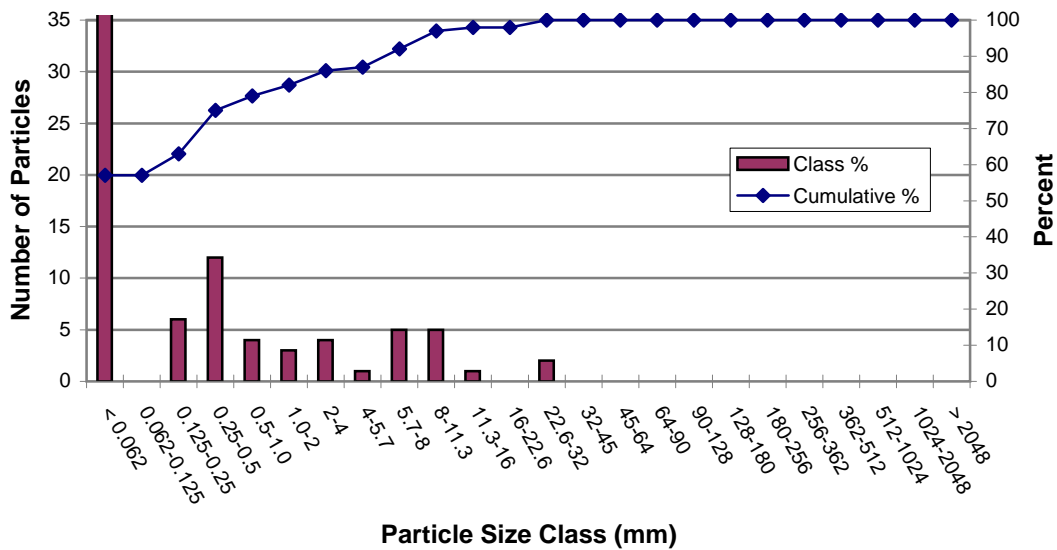


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section AL-XS4

	Particle	Size Range (mm)	Total #	Class %	Cumulative %
S/C	Silt/Clay	< 0.062	57	57	57
Sand	Very Fine Sand	0.062-0.125	0	0	57
	Fine Sand	0.125-0.25	6	6	63
	Medium Sand	0.25-0.5	12	12	75
	Coarse Sand	0.5-1.0	4	4	79
	Very Coarse Sand	1.0-2	3	3	82
Gravel	Very Fine Gravel	2-4	4	4	86
	Fine Gravel	4-5.7	1	1	87
	Fine Gravel	5.7-8	5	5	92
	Medium Gravel	8-11.3	5	5	97
	Medium Gravel	11.3-16	1	1	98
	Coarse Gravel	16-22.6	0	0	98
	Coarse Gravel	22.6-32	2	2	100
	Very Coarse Gravel	32-45	0	0	100
	Very Coarse Gravel	45-64	0	0	100
Cobble	Small Cobble	64-90	0	0	100
	Small Cobble	90-128	0	0	100
	Medium Cobble	128-180	0	0	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

$d_{50} = 0.05 \text{ mm}$
 $d_{84} = 3 \text{ mm}$

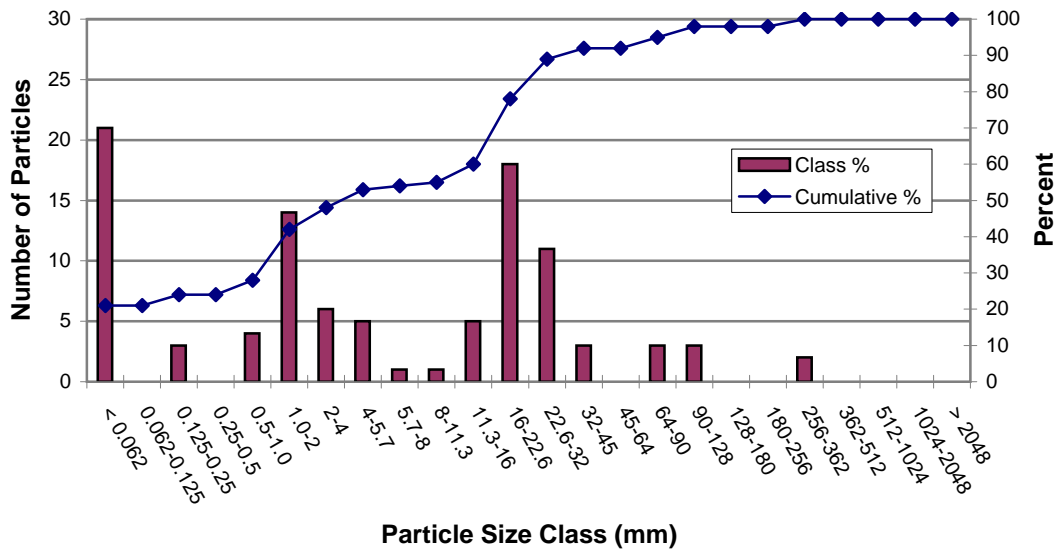


Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section CR-XS1

S/C	Particle	Size Range (mm)	Total #	Class %	Cumulative %
	Silt/Clay	< 0.062	21	21	21
Sand	Very Fine Sand	0.062-0.125	0	0	21
	Fine Sand	0.125-0.25	3	3	24
	Medium Sand	0.25-0.5	0	0	24
	Coarse Sand	0.5-1.0	4	4	28
	Very Coarse Sand	1.0-2	14	14	42
Gravel	Very Fine Gravel	2-4	6	6	48
	Fine Gravel	4-5.7	5	5	53
	Fine Gravel	5.7-8	1	1	54
	Medium Gravel	8-11.3	1	1	55
	Medium Gravel	11.3-16	5	5	60
	Coarse Gravel	16-22.6	18	18	78
	Coarse Gravel	22.6-32	11	11	89
	Very Coarse Gravel	32-45	3	3	92
	Very Coarse Gravel	45-64	0	0	92
Cobble	Small Cobble	64-90	3	3	95
	Small Cobble	90-128	3	3	98
	Medium Cobble	128-180	0	0	98
	Large Cobble	180-256	0	0	98
Boulder	Small Boulders	256-362	2	2	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 4.68 mm
d₈₄ = 27.73 mm



Appendix B6. Pebble Count - Ellerbe Creek Restoration Monitoring Year 4 (08/08/2008)

Cross Section CR-XS2

S/C	Particle	Size Range (mm)	Total #	Class %	Cumulative %
	Silt/Clay	< 0.062	27	27	27
Sand	Very Fine Sand	0.062-0.125	0	0	27
	Fine Sand	0.125-0.25	9	9	36
	Medium Sand	0.25-0.5	8	8	44
	Coarse Sand	0.5-1.0	3	3	47
	Very Coarse Sand	1.0-2	0	0	47
Gravel	Very Fine Gravel	2-4	0	0	47
	Fine Gravel	4-5.7	0	0	47
	Fine Gravel	5.7-8	7	7	54
	Medium Gravel	8-11.3	3	3	57
	Medium Gravel	11.3-16	17	17	74
	Coarse Gravel	16-22.6	14	14	88
	Coarse Gravel	22.6-32	6	6	94
	Very Coarse Gravel	32-45	1	1	95
	Very Coarse Gravel	45-64	0	0	95
Cobble	Small Cobble	64-90	0	0	95
	Small Cobble	90-128	4	4	99
	Medium Cobble	128-180	1	1	100
	Large Cobble	180-256	0	0	100
Boulder	Small Boulders	256-362	0	0	100
	Small Boulders	362-512	0	0	100
	Medium Boulders	512-1024	0	0	100
	Large Boulders	1024-2048	0	0	100
	Bedrock	> 2048	0	0	100
Total			100		

d₅₀ = 6.69 mm
d₈₄ = 20.71 mm

