ANNUAL MONITORING REPORT
BOLD RUN

STREAM AND BUFFER RESTORATION
WAKE COUNTY, NORTH CAROLINA
(EEP Project Number 439)

Monitoring Year 2 of 5 (2008)

Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

December 2008

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Submitted to:
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Prepared by:
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Willow Spring, North Carolina 27592

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Axiom Environmental, Inc.

Ecosystem Enhancement PROGRAM

December 2008

EXECUTIVE SUMMARY

The Bold Run Stream and Buffer Restoration Site (Site) is located five miles northwest of the Town of Wake Forest on Bold Hill Road, approximately 1.5 miles east of the intersection with Mangum Dairy Road in Wake County. The Site is located within United States Geological Survey Hydrologic Unit 03020201065010 (North Carolina Division of Water Quality Subbasin 03-04-08) of the Neuse River Basin. The Site was identified to assist the North Carolina Ecosystem Enhancement Program in meeting stream and buffer restoration goals. This report summarizes data for year 2 (2008) monitoring.

Primary activities at the Site included stream restoration and riparian buffer restoration by stabilizing stream banks, installing in-stream structures, adjusting stream planform, and replanting riparian areas with native vegetation. Project restoration efforts provided 1629 Stream Mitigation Units and 27.1 Buffer Mitigation Units.

Fifteen vegetation plots (10-meters square) were established and permanently monumented following Site construction with five plots established in the streamside riparian buffer planting zone and ten plots within the remaining buffer area. Plots were surveyed in August and September 2008 for the year 2 (2008) monitoring season. Based on the number of stems counted, average densities were measured at 456 planted stems per acre surviving in year 2 (2008). The dominant species identified at the Site were planted stems of green ash (*Fraxinus pennsylvanica*), cherrybark oak (*Quercus pagoda*), and willow oak (*Quercus phellos*). In addition, each individual plot met success criteria and no vegetation problem areas were noted during the year 2 (2008) monitoring season.

Five permanent cross-sections were established after construction was completed. Measurements of each cross-section include points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections are classified using the Applied Fluvial Morphology (Rosgen) stream classification system. Longitudinal profile measurements of the entire Site restoration reaches include thalweg, water surface, and bankfull; with each measurement taken at the head of facets (i.e. riffle, run, pool, and glide) in addition to the maximum pool depth. Visual assessments of in-stream structures were conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

Success criteria for stream restoration reaches should show little to no change from the as-built channel over the five-year monitoring period. Year 2 (2008) monitoring measurements indicate that there have been minimal changes in both the longitudinal profile and cross-sections as compared to as-built data.

Stream problem areas documented within the Site during the year 2 (2008) monitoring year consisted of a large beaver dam at the downstream extent of the Site near the confluence with New Light Creek and an area of stream widening and bank erosion near cross-section 5. Beaver activity has resulted in backwater effects from the beaver dam. Proactive maintenance measures including the removal of existing beaver dams and beaver is recommended, as necessary.

In summary, the Site achieved success criteria for vegetation and stream attributes in the Second Monitoring Year (2008).

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1.0 PROJECT BACKGROUND

1.1 Location and Setting

The Bold Run Stream and Buffer Restoration Site (Site) is located five miles northwest of the Town of Wake Forest on Bold Hill Road, approximately 1.5 miles east of the intersection with Mangum Dairy Road in Wake County (Figure 1). The Site is located within United States Geological Survey (USGS) Hydrologic Unit 03020201065010 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-04-08) of the Neuse River Basin. The Site was identified to assist the North Carolina Ecosystem Enhancement Program (NCEEP) in meeting stream and buffer restoration goals.

Directions to the Site from Raleigh, North Carolina, are as follows:

- From Interstate 440 take the Six Forks Road exit, travel north for approximately 8 miles
- Turn left to stay on Six Forks Road, travel approximately 3 miles
- Turn right on Highway 98, travel approximately 2.7 miles
- Turn left on Stony Hill Road, travel approximately 2.4 miles
- Turn left on Purnell Road, travel approximately 0.1 mile
- Turn right on Mangum Dairy Road, travel approximately 1.8 miles
- Turn right on Bold Hill Road, travel approximately 1.5 miles
- The Site is on the right

1.2 Project Objectives

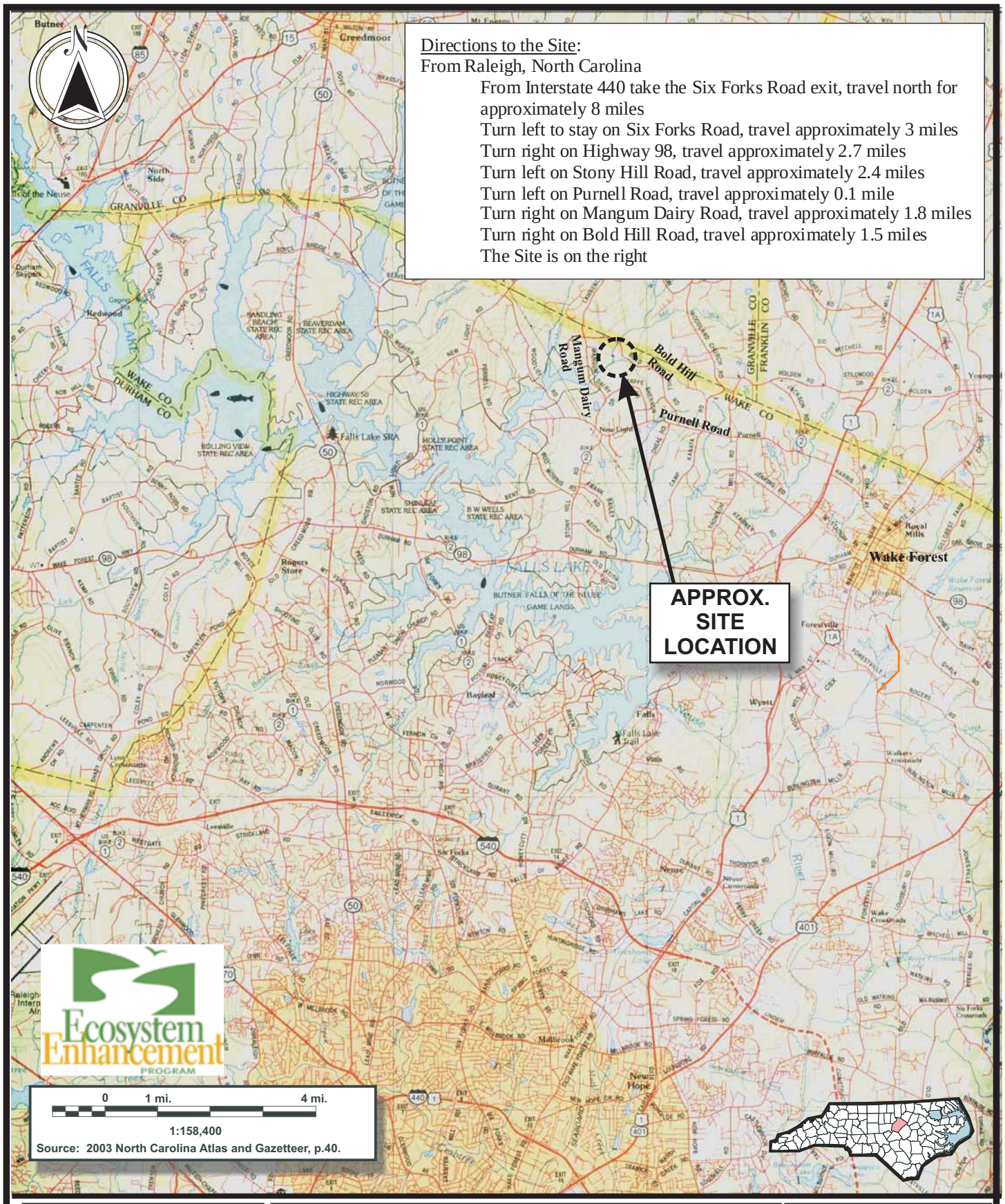
The primary components of the restoration project included the following.

- Construction of a stable, riffle-pool stream channel capable of moving sediments supplied by the watershed so that the channel neither aggrades nor degrades.
- Stabilize stream banks, install in-stream structures, adjust stream planform, and replant 27.1 acres of riparian areas with native vegetation.
- Improve water quality and reduce lateral erosion and bed degradation of stream channels by establishment of riparian vegetation.
- Enhance aquatic and terrestrial wildlife habitat through improvements to stream water quality including improved oxygen levels, reduced sediments and nutrients, and varied stream bed features.
- Assess project success by measuring stream dimension, pattern, and profile; taking Site photographs; and sampling vegetation.
    - Stream measurements should show little to no change from the as-built channel over the five-year monitoring period.
    - Riparian vegetation should meet minimum survival standards for riparian buffers of 320 stems per acre surviving after five years.

1.3 Project Structure, Restoration Type, and Approach

The Site is encompassed within a 31-acre easement owned by NCEEP. Prior to restoration activities, the Site was utilized for livestock pasture. Land use modifications including the removal of riparian vegetation and hoof shear to stream banks resulted in degraded water quality and unstable channel characteristics (stream entrenchment, erosion, and bank collapse).

Primary activities at the Site included stream restoration and riparian buffer restoration by stabilizing stream banks, installing in-stream structures, adjusting stream planform, and replanting riparian areas with native vegetation. Project restoration efforts provided 1629 Stream Mitigation Units and 27.1 Buffer Mitigation Units as outlined in Table 1.



Axiom Environmental
2126 Rowland Pond Dr
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

SITE LOCATION
BOLD RUN RESTORATION SITE
Project Number 439
Wake County, North Carolina

Dwn. by:	CLF
Ckd by:	WGL
Date:	Oct 2008
Project:	08-001

FIGURE 1

Table 1. Site Restoration Structures and Objectives

Bold Run Restoration Site (EEP Project Number 439)

Restoration Segment/ Reach ID	Existing Linear Footage/Acres	Restoration Type/Approach*	Designed Linear Footage/Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
Reach 1	175	Restoration/P4	175	1	175	10+00 – 11+75	--
Reach 2	1296	Restoration/P2	1454	1	1454	11+75 – 26+29	--
Riparian Buffer	27.1	Restoration	27.1	1	27.1	--	--

Mitigation Unit Summations

Stream	Riparian Wetland	Nonriparian Wetland	Total Wetland	Riparian Buffer	Comment
1629	0	0	0	27.1	--

*P2=Priority 2, P4=Priority 4

1.4 Project History and Background

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4.

Table 2. Project Activity and Reporting History

Bold Run Restoration Site (EEP Project Number 439)

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	November 2005	February 2006
Final Design – Construction Plans	NA	July 2006
Construction	NA	February 2007
Termporary Seed Mix Applied to Entire Project Area	NA	February 2007
Permanent Seed Mix Applied to Entire Project Area	NA	February 2007
Tree Planting	NA	February 2007
Mitigation Plan/As-builts (Year 0 Monitoring-Baseline)	March 2007	March 2007
Year 1 Monitoring (2007)	October 2007	January 2008
Year 2 Monitoring (2008)	September 2008	October 2008

Table 3. Project Contacts Table

Bold Run Restoration Site (EEP Project Number 439)

Designer, Monitoring Year 0 Performer, Monitoring Year 1 (2007) Performer	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Road Raleigh, North Carolina 27609 April Davis and Adam Spiller (919) 783-9214
Construction and Seeding Contractor	Vaughn Contracting, Inc. PO Box 796 Wadesboro, North Carolina 28170 Don Vaughn (704) 694-6450
Planting Contractor and Nursery Stock Supplier	Bruton Nurseries and Landscapes PO Box 1197 Freemont, North Carolina 27830 Kelly Bruton (919) 524-5304
Seed Mix Source	Evergreen Seed Company (919)567-1333
Year 2 (2008) Monitoring Performer	Axiom Environmental, Inc. 2126 Rowland Pond Dr. Willow Spring, NC 27592 Grant Lewis (919) 215-1693

Table 4. Project Background Table

Bold Run Restoration Site (EEP Project Number 439)

Project County	Wake County, North Carolina
Drainage Area	1.6 square miles
Drainage impervious cover estimate (%)	< 1 percent
Stream Order	Second
Physiographic Region	Piedmont
Ecoregion	Northern Outer Piedmont
Rosgen Classification of As-built	C4-type
Dominant Soil Types	Chewacla, Chewacla variant, Chewacla-Riverview
Reference Site ID	Richland Creek
USGS HUC	Site-03020201065010 Reference-03020201070060
NCDWQ Subbasin	Site-03-04-08 Reference-03-04-02
NCDWQ Classification for Project	WS-IV, NSW, CA (Stream Index # 27-13-(0.1))
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	100 percent

1.5 Monitoring Plan View

Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed in Figure C1 in Appendix C. Site features including vegetation, stream dimension (cross-sections), stream profile and pattern, wetland hydrology, and photographic documentation were monitored in year 2 (2008).

2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Assessment

Following Site construction fifteen plots (10-meters square) were established and monumented with metal fence posts at all plot corners and PVC at each plot origin. Five plots are located in the streamside riparian buffer planting zone and ten plots are located within the remaining buffer area. Plots were surveyed in August and September 2008 for the year 2 (2008) monitoring season. Sampling was conducted as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix A. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007). The locations of vegetation monitoring plots are depicted on Figure C1 in Appendix C.

Success criteria dictate that an average density of 320 stems per acre must be surviving after five monitoring years in accordance with North Carolina Division of Water Quality Administrative Code 15A NCAC 02B.0242 (Neuse River Basin, Mitigation Program for Protection and Maintenance of Existing Riparian Buffers) (NCDWQ 2007). Based on the number of stems counted, average densities were measured at 456 planted stems per acre surviving in year 2 (2008). The dominant species identified at the Site were planted stems of green ash (*Fraxinus pennsylvanica*), cherrybark oak (*Quercus pagoda*), and willow oak (*Quercus phellos*). In addition, each individual plot met success criteria and no vegetation problem areas were noted during the year 2 (2008) monitoring season.

2.2 Stream Assessment

Five permanent cross-sections were established after construction was completed. Measurements of each cross-section include points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections are classified using the Applied Fluvial Morphology (Rosgen) stream classification system. Longitudinal profile measurements of the entire Site restoration reaches include thalweg, water surface, and bankfull; with each measurement taken at the head of facets (i.e. riffle, run, pool, and glide) in addition to the maximum pool depth. Visual assessment of in-stream structures was conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

Success criteria for stream restoration reaches should show little to no change from the as-built channel over the five-year monitoring period. Year 2 (2008) monitoring measurements indicate that there have been minimal changes in both the longitudinal profile and cross-sections as compared to as-built data.

2.2.1 Bankfull Events

Documented bankfull events are included in the table below. One bankfull event was documented during the year 2 (2008) monitoring period.

Table 5. Verification of Bankfull Events

Bold Run Restoration Site (EEP Project Number 439)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
November 19, 2007	Between 8/31/2007 and 11/19/2007	Crest Gauge	--
October 8, 2008	August 28, 2008	Total of 3.48 inches* of rain reported to fall over 2 days (August 27 – 28, 2008) as well as crest gauge readings at the Site	--

* Reported at KNCWAKEF1 Weather Station on Welcome Drive in Wake Forest.

2.2.3 Stream Problem Areas

Stream problem areas documented within the Site during the year 2 (2008) monitoring year consisted of a large beaver dam at the downstream extent of the Site near the confluence with New Light Creek and an area of stream widening and bank erosion near cross-section 5. Beaver activity has resulted in backwater effects from the beaver dam. Proactive maintenance measures including the removal of existing beaver dams and beaver is recommended, as necessary. Stream problem areas are summarized in Table B1 and documented in photographs in Appendix B and are depicted in Figure C1 in Appendix C.

2.2.4 Categorical Stream Feature Visual Stability Assessment

The stream was visually inspected during the year 2 (2008) monitoring period using eight feature categories and various metrics within each category. Assessment features included riffles, pools, thalweg, meanders, channel bed, banks, structures, and root wads/boulders. Semi-quantitative assessements for the stream are included in Appendix B (Table B2). The mean percentage of performance for features is summarized in the tables below.

Table 6. Categorical Stream Feature Visual Stability Assessment

Bold Run Restoration Site (EEP Project Number 439)

Feature	Year 0 (2006)	Year 1 (2007)	Year 2 (2008)	Year 3 (2009)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%	100%	100%			
B. Pools	100%	100%	95.6%			
C. Thalweg	100%	100%	100%			
D. Meanders	100%	100%	100%			
E. Bed General	100%	98%	99.5%			
F. Banks	100%	99%	98%			
G. Vanes / J. Hooks, Etc.	100%	94%	100%			
H. Wads and Boulders	100%	100%	100%			

2.2.5 Quantitative Stream Measurements

During the year 2 (2008) monitoring period 5 cross-sections and longitudinal profiles on the entire stream reach were measured; plots for year 2 (2008) monitoring overlain on baseline and previous monitoring years data are included in Appendix B. As a whole, monitoring measurements indicate that there have been minimal changes in both the longitudinal profile and cross-sections as compared to as-built data. The as-built channel geometry compares favorably with the emulated, stable E/C type stream reach as set forth in the detailed mitigation plan and construction plans. Current monitoring has demonstrated

dimension, pattern, and profile were stable over the course of the monitoring period. Tables for quantitative assessements are included below; these tables include data from previous years.

Table 7. Baseline Morphology and Hydraulic Summary
Bold Run Restoration Site (EEP Project Number 439)

Parameter	USGS Gauge Data			Regional Curve			Pre-existing Conditions			Project Reference			Design		As-built		
Dimension	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Max	Min	Mean	Max
Bankfull Width (ft)							14.8	17	18.3	22.9	26.9	30.8	17.8		18.1	18.5	18.9
Floodprone Width (ft)							18.5	22.3	30	300	300	300	>100		>70		>80
Bankfull Cross-Sectional Area (ft2)							24.2	24.8	25.2	59.2	66.9	74.6	27.6		29.6	31.8	34.1
Bankfull Mean Depth (ft)							1.3	1.5	1.7	2.4	2.5	2.6	1.4		1.6	1.7	1.8
Bankfull Max Depth (ft)							1.9	2.0	2.3	3.7	3.8	3.9	2.2		2.6	2.8	3.1
Width/Depth Ratio							8.8	11.7	13.8	8.8	10.8	12.7	12.7		10.4	10.8	11.1
Entrenchment Ratio							1.1	1.3	1.7	9.7	11.4	13.1	>3.0		>2.2		>4.3
Bank Height Ratio							1.7	2.3	2.6	1.1	1.2	1.3	1.0		1.0	1.0	1.0
Wetted Perimeter (ft)																	
Hydraulic Radius (ft)																	
Pattern																	
Channel Beltwidth (ft)							20		75	300		300	160	195	32	76.3	136
Radius of Curvature (ft)							20		70	30		70	20	55	21	38	55
Meander Wavelength (ft)							68		150	110		200	60	180	96	117	142
Meander Width Ratio							1.1		4.3	9.3		10.7	9	11	5.2	6.3	7.7
Profile																	
Riffle Length (ft)															5	23	86
Riffle Slope (ft/ft)							0.0040		0.0210	0.0045		0.0090	0.0088	0.0158	0.0039	0.0170	0.0278
Pool Length (ft)							29		43	5		25	3	20	7	14	25
Pool Spacing (ft)							10		70	25		90	15	55	38	88	237
Substrate																	
d50 (mm)							11.7			7.1					11.2		
d84 (mm)							38								46.7		
Additional Reach Parameters																	
Valley Length (ft)													1,481		1,481		
Channel length (ft)							1,609			383			1,629		1,629		
Sinuosity							1.04			1.1			1.1		1.1		
Water Surface Slope (ft/ft)							0.007			0.004			0.007		0.007		
Bankfull slope (ft/ft)										0.004			0.007		0.006		
Rosgen Classification							B4c, F4, G4c			C4			C4		C4		

Table 8. Morphology and Hydraulic Monitoring Summary
Bold Run Restoration Site (EEP Project Number 439)

Parameter	Cross-Section 1 Riffle						Cross-Section 2 Pool						Cross-Section 3 Riffle					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	18.1	20.1	18.2				19.3	19.0	15.9				18.9	18.9	16.5			
Floodprone Width (ft)	>80	>80	>80				>65	>65	>65				>74	>74	>74			
Bankfull Cross-Sectional Area (ft^2)	29.6	30.6	31.1				30.8	29.3	24.3				34.1	34.5	28.7			
Bankfull Mean Depth (ft)	1.6	1.5	1.7				1.6	1.5	1.5				1.8	1.8	1.7			
Bankfull Max Depth (ft)	2.6	2.7	2.8				3	3.1	2.6				2.9	2.9	2.7			
Width/Depth Ratio	11.1	13.2	10.6				12.2	12.3	NA				10.4	10.4	9.5			
Entrenchment Ratio	>4.4	>4.0	>5				>3.4	>3.4	NA				>3.9	>3.9	>2			
Bank Height Ratio	1.0	1.0	1.0				0.9	0.9	NA				1.0	1.0	1.0			
Wetted Perimeter (ft)	19.3	20.0	19.5				20.5	19.7	16.9				20.3	20.2	17.7			
Hydraulic Radius (ft)	1.5	1.6	1.6				1.5	1.5	1.4				1.7	1.7	1.6			
Substrate																		
d50 (mm)	20	18	14				0.65	9.3	6.6				7.3	12.0	14			
d84 (mm)	70	71	67				14	15	14				23	31	30			

Parameter	Cross-Section 4 Riffle						Cross-Section 5 Pool					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	18.5	16.2	19.5				30.1	31.4	32.9			
Floodprone Width (ft)	>70	>70	>70				>70	>70	>70			
Bankfull Cross-Sectional Area (ft^2)	31.6	30.3	38.0				65.5	68.9	84.1			
Bankfull Mean Depth (ft)	1.7	1.9	1.9				2.2	2.2	2.6			
Bankfull Max Depth (ft)	2.9	2.9	3.5				3.5	3.9	4.3			
Width/Depth Ratio	10.8	8.7	10.0				13.8	13.6	NA			
Entrenchment Ratio	>3.8	>4.3	>3				>2.3	>2.2	NA			
Bank Height Ratio	1.0	1.0	1.0				1.0	1.0	NA			
Wetted Perimeter (ft)	20.2	19.7	21.0				31.5	32.8	34.4			
Hydraulic Radius (ft)	1.6	1.6	1.8				2.1	2.1	2.4			
Substrate												
d50 (mm)	6.4	18	8.3				0.12	1.0	6.7			
d84 (mm)	40	41	16				0.30	18	27			

Parameter	MY - 01 (2007)			MY - 02 (2008)			MY - 03 (2009)			MY - 04 (2010)			MY - 05 (2011)		
Pattern	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Channel Beltwidth (ft)	139	29	71	32	136	68.5									
Radius of Curvature (ft)	20	55	38	21	55	38									
Meander Wavelength (ft)	96	142	109	96	142	115									
Meander Width Ratio	1.6	7.6	3.6	5.2	7.7	6.3									
Profile															
Riffle Length (ft)	6	66	16	8	270	36									
Riffle Slope (ft/ft)	0.0035	0.0604	0.0184	0.0039	0.0410	0.0100									
Pool Length (ft)	8	43	17	13	158	19									
Pool Spacing (ft)	28	293	73	38	237	60									
Additional Reach Parameters															
Valley Length (ft)	1,792			1,792											
Channel Length (ft)	1,629			1,629											
Sinuosity	1.1			1.1											
Water Surface Slope (ft/ft)	0.0070			0.0068											
Rosgen Classification	C4			E type											

3.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0. (online). Available: http://cvs.bio.unc.edu/methods.htm

North Carolina Division of Water Quality (NCDWQ). 2007. Redbook, Surface Waters and Wetlands Standards. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, North Carolina.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology (Publisher). Pagosa Springs, Colorado.

Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: http://www.herbarium.unc.edu/WeakleysFlora.pdf [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

APPENDIX A

VEGETATION DATA

1. Vegetation Survey Data Tables
2. Vegetation Monitoring Plot Photos

Report Prepared By	Corri Faquin
Date Prepared	12/18/2008 14:04
database name	Axiom-2008-B-v2.2.6.mdb
database location	C:\Business\CVS database
computer name	AXIOM-0A9116A70
file size	47788032

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	BR
project Name	Bold Run
Description	Bold Run Stream and Buffer Mitigation Site
River Basin	Neuse
length(ft)	
stream-to-edge width (ft)	
area (sq m)	125451
Required Plots (calculated)	22
Sampled Plots	15

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 2
BR	Bold Run	Neuse	455.95

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code	Project Name	River Basin	Year 2
BR	Bold Run	Neuse	515.2997188

Plot Information

plot	Plot Level	Year	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/ Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
BR-AXE-0001	2	2	17	9	0	6	23	9	688	364	243	931	607	5
BR-AXE-0010	2	2	10	10	0	1	11	10	405	405	40	445	445	4
BR-AXE-0011	2	2	12	12	0	11	23	12	486	486	445	931	931	3
BR-AXE-0012	2	2	22	22	0	2	24	22	890	890	81	971	971	4
BR-AXE-0013	2	2	11	11	0	0	11	11	445	445	0	445	445	3
BR-AXE-0014	2	2	8	8	0	0	8	8	324	324	0	324	324	3
BR-AXE-0015	2	2	11	11	0	0	11	11	445	445	0	445	445	2
BR-AXE-0002	2	2	9	7	0	5	14	7	364	283	202	567	486	4
BR-AXE-0003	2	2	13	9	0	16	29	9	526	364	647	1174	1012	3
BR-AXE-0004	2	2	19	13	0	7	26	13	769	526	283	1052	809	7
BR-AXE-0005	2	2	12	12	0	1	13	12	486	486	40	526	526	4
BR-AXE-0006	2	2	12	12	0	0	12	12	486	486	0	486	486	4
BR-AXE-0007	2	2	12	10	0	0	12	10	486	405	0	486	405	4
BR-AXE-0008	2	2	9	9	0	1	10	9	364	364	40	405	405	3
BR-AXE-0009	2	2	14	14	0	1	15	14	567	567	40	607	607	4

Vigor

vigor	Count	Percent
	1	0.5
1	4	2.1
2	52	27.2
3	92	48.2
4	43	22.5

Damage

Damage	Count	Percent Of Stems
(no damage)	113	58.9
Deer	56	29.2
Insects	10	5.2
Unknown	5	2.6
Site Too Dry	2	1
Human Trampled	2	1
Rodents	1	0.5
Other/Unknown Animal	1	0.5
Diseased	1	0.5
Beaver	1	0.5

Vigor by Species

	Species	4	3	2	1	0	Missing	Unknown
	Betula nigra		1	2				
	Celtis laevigata			6				
	Cornus amomum			4	1			
	Fraxinus pennsylvanica	9	23	12	1			
	Juglans nigra		2	1				
	Quercus lyrata	2	10	5	1			
	Quercus michauxii	4	7	2				
	Quercus pagoda	1	17	7				
	Quercus phellos	10	15	3				
	Salix nigra	4	2	3				
	Salix sericea	1	3	4				
	Sambucus canadensis		1					
	Ulmus rubra		1					
	Liriodendron tulipifera	3	3	1	1			
	Platanus occidentalis	9	7					
	Ulmus			1				
	Ulmus americana			1				
TOT:	**17**	**43**	**92**	**52**	**4**			

Damage by Species

	Species	All Damage Categories	(no damage)	Beaver	Deer	Diseased	Human Trampled	Insects	Other/Unknown Animal	Rodents	Site Too Dry	Unknown
	Betula nigra	3	3									
	Celtis laevigata	6			6							
	Cornus amomum	5	2		2							1
	Fraxinus pennsylvanica	45	29		14			2				
	Juglans nigra	3	2								1	
	Liriodendron tulipifera	8	5		1		1		1			
	Platanus occidentalis	16	16									
	Quercus lyrata	18	5		11	1						1
	Quercus michauxii	14	10		3			1				
	Quercus pagoda	25	8		8		1	5			1	2
	Quercus phellos	28	15		9			2		1		1
	Salix nigra	9	8	1								
	Salix sericea	8	8									
	Sambucus canadensis	1	1									
	Ulmus	1			1							
	Ulmus americana	1	1									
	Ulmus rubra	1			1							
TOT:	**17**	**192**	**113**	**1**	**56**	**1**	**2**	**10**	**1**	**1**	**2**	**5**

Damage by Plot

	plot	All Damage Categories	(no damage)	Beaver	Deer	Diseased	Human Trampled	Insects	Other/Unknown Animal	Rodents	Site Too Dry	Unknown
	BR-AXE-0001	17	16		1							
	BR-AXE-0002	9	8									1
	BR-AXE-0003	13	13									
	BR-AXE-0004	19	16	1	2							
	BR-AXE-0005	12	12									
	BR-AXE-0006	12	9		2							1
	BR-AXE-0007	12	1		11							
	BR-AXE-0008	9	2		5			1	1			
	BR-AXE-0009	14	7		5						1	1
	BR-AXE-0010	10	7		2		1					
	BR-AXE-0011	12	3		4		1	4				
	BR-AXE-0012	23	12		7			4				
	BR-AXE-0013	11	1		9	1						
	BR-AXE-0014	8	2		6							
	BR-AXE-0015	11	4		2			1		1	1	2
TOT:	**15**	**192**	**113**	**1**	**56**	**1**	**2**	**10**	**1**	**1**	**2**	**5**

Planted Stems by Plot and Species

	Species	Total Planted Stems	# plots	avg# stems	plot BR-AXE-0001-year:2	plot BR-AXE-0002-year:2	plot BR-AXE-0003-year:2	plot BR-AXE-0004-year:2	plot BR-AXE-0005-year:2	plot BR-AXE-0006-year:2	plot BR-AXE-0007-year:2	plot BR-AXE-0008-year:2	plot BR-AXE-0009-year:2	plot BR-AXE-0010-year:2	plot BR-AXE-0011-year:2	plot BR-AXE-0012-year:2	plot BR-AXE-0013-year:2	plot BR-AXE-0014-year:2	plot BR-AXE-0015-year:2
	Betula nigra	3	2	1.5				1	2										
	Celtis laevigata	6	3	2									2				3	1	
	Cornus amomum	5	4	1.25	1	1		1			2								
	Fraxinus pennsylvanica	45	8	5.62	4	5	3	9	4		8	1				11			
	Juglans nigra	3	1	3									3						
	Liriodendron tulipifera	8	4	2				1		2		2		3					
	Platanus occidentalis	16	5	3.2	3	2	6	1	4										
	Quercus lyrata	18	3	6									6				7	5	
	Quercus michauxii	13	5	2.6	2				2	6				1	2				
	Quercus pagoda	25	7	3.57						1		6		3	7	2	1		5
	Quercus phellos	28	7	4						3			3	3	3	8		2	6
	Salix nigra	9	2	4.5			4	5											
	Salix sericea	8	2	4	7	1													
	Sambucus canadensis	1	1	1				1											
	Ulmus	1	1	1							1								
	Ulmus americana	1	1	1												1			
	Ulmus rubra	1	1	1							1								
TOT:	**17**	**191**	**17**		**17**	**9**	**13**	**19**	**12**	**12**	**12**	**9**	**14**	**10**	**12**	**22**	**11**	**8**	**11**

All Stems by Plot and Species

	Species	Total Stems	# plots	avg# stems	BR-AXE-0001-year:2	BR-AXE-0002-year:2	BR-AXE-0003-year:2	BR-AXE-0004-year:2	BR-AXE-0005-year:2	BR-AXE-0006-year:2	BR-AXE-0007-year:2	BR-AXE-0008-year:2	BR-AXE-0009-year:2	BR-AXE-0010-year:2	BR-AXE-0011-year:2	BR-AXE-0012-year:2	BR-AXE-0013-year:2	BR-AXE-0014-year:2	BR-AXE-0015-year:2
	Baccharis halimifolia	1	1	1												1			
	Betula nigra	7	3	2.33		1		3	3										
	Celtis laevigata	6	3	2									2				3	1	
	Cornus amomum	5	4	1.25	1	1		1			2								
	Fraxinus pennsylvanica	56	9	6.22	4	5	3	9	4		8	1			11	11			
	Juglans nigra	3	1	3									3						
	Liquidambar styraciflua	3	3	1	1	1		1											
	Quercus lyrata	18	3	6									6				7	5	
	Quercus michauxii	13	5	2.6	2				2	6				1	2				
	Quercus pagoda	25	7	3.57						1		6		3	7	2	1		5
	Quercus phellos	28	7	4						3			3	3	3	8		2	6
	Salix nigra	9	2	4.5			4	5											
	Salix sericea	8	2	4	7	1													
	Sambucus canadensis	1	1	1				1											
	Ulmus rubra	1	1	1							1								
	Liriodendron tulipifera	10	6	1.67	1		1	1		2		2		3					
	Pinus	9	3	3	3		3	3											
	Platanus occidentalis	30	5	6	4	5	16	1	4										
	Prunus serotina	1	1	1										1					
	Acer negundo	3	3	1								1	1			1			
	Ulmus	4	3	1.33			2	1			1								
	Ulmus americana	1	1	1												1			
TOT:	**22**	**242**	**22**		**23**	**14**	**29**	**26**	**13**	**12**	**12**	**10**	**15**	**11**	**23**	**24**	**11**	**8**	**11**

Bold Run Restoration Site
Year 2 (2008) Annual Monitoring
Vegetation Plot Photos (taken late July to early September 2008)

Bold Run Restoration Site
Year 2 (2008) Annual Monitoring
Vegetation Plot Photos (taken late July to early September 2008, continued)

APPENDIX B

GEOMORPHOLOGIC DATA

1. Table B1. Stream Problem Areas and Photographs
2. Fixed-Station Photos
3. Tables B2. Qualitative Visual Stability Assessment
4. Cross-section Plots and Tables
5. Longitudinal Profile Plots
6. Pebble Count Plots

Table B1. Stream Problem Areas

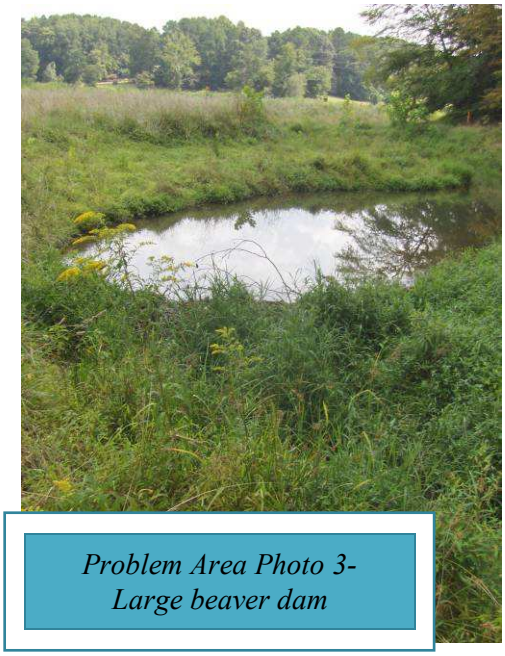
Bold Run Restoration Site (EEP Project Number 439)

Feature Issue	Station Numbers	Suspected Cause	Photo
Outer bend bank erosion/channel widening	24+00	Lack of deep-rooted vegetation, downstream beaver activity	Problem Area Photos 1-2
Large beaver dam causing backwater effects	Immediately downstream of Site on Bold Run Creek	Beaver activity	Problem Area Photo 3

Problem Area Photos

Taken August 15, 2008

Problem Area Photo 1- Channel widening at outerbend



Problem Area Photo 3- Large beaver dam

Problem Area Photo 2- Bank erosion

Bold Run Restoration Site

Fixed-Station Photographs

taken August 15, 2008

Bold Run Restoration Site

Fixed-Station Photographs

taken August 15, 2008 (continued)

Bold Run Restoration Site

Fixed-Station Photographs

taken August 15, 2008 (continued)

Table B2. Qualitative Visual Stability Assessment

Bold Run Restoration Site (EEP Project Number 439)

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	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	21	21	N/A	100%	
	2. Armor stable (e.g. no displacement)?	21	21	N/A	100%	
	3. Facet grade appears stable?	21	21	N/A	100%	
	4. Minimal evidence of embedding/fining?	21	21	N/A	100%	
	5. Length appropriate?	21	21	N/A	100%	**100%**
B. Pools	1. Present? (e.g. no severe aggradation)	15	15	N/A	100%	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	13	15	N/A	86.7%	
	3. Length appropriate?	15	15	N/A	100%	**95.6%**
C. Thalweg	1. Upstream of meander bend centering?	14	14	N/A	100%	
	2. Downstream of meander centering?	14	14	N/A	100%	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	14	14	N/A	100%	
	2. Of those eroding, # w/ concomitant point bar formation?	0	0	N/A		
	3. Apparent Rc within spec?	14	14	N/A	100%	
	4. Sufficient floodplain access and relief?	14	14	N/A	100%	**100%**
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0	100%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	1/20	99%	**99.5%**
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	1/30	98%	**98%**
G. Vanes	1. Free of back or arm scour?	8	8	N/A	100%	
	2. Height appropriate?	8	8	N/A	100%	
	3. Angle and geometry appear appropriate?	8	8	N/A	100%	
	4. Free of piping or other structural failures?	8	8	N/A	100%	**100%**
H. Wads / Boulders	1. Free of scour?	6	6	N/A	100%	
	2. Footing stable?	6	6	N/A	100%	**100%**

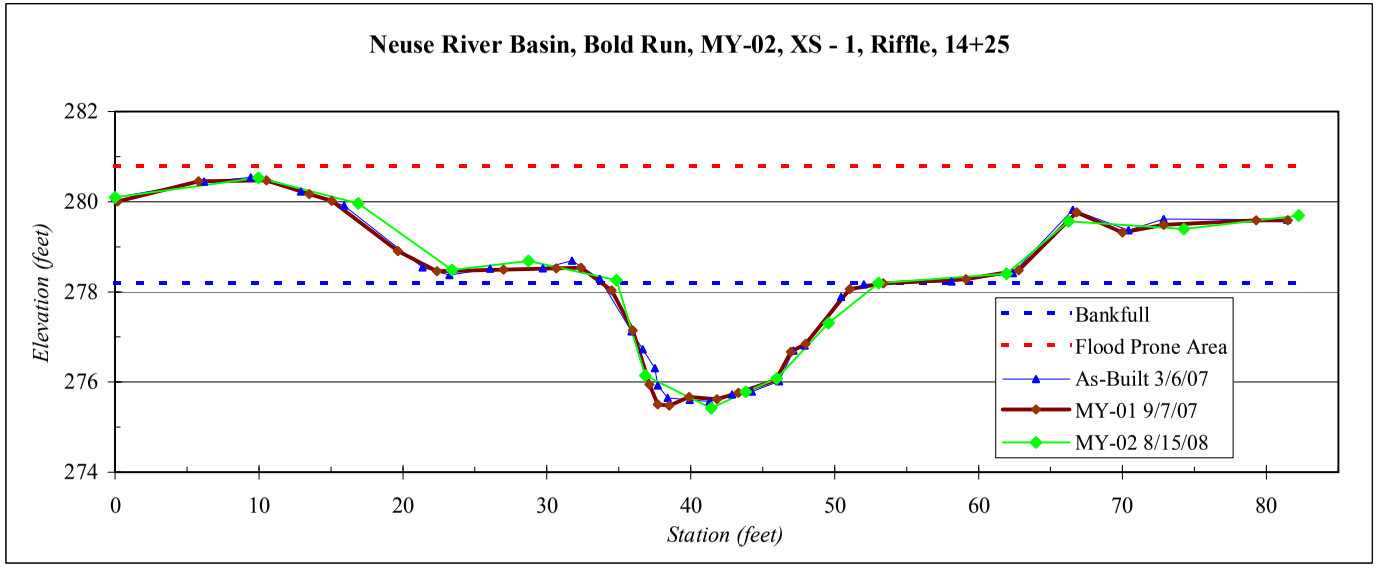
Appendix B4 - Cross-Section Plots

River Basin:	Neuse
Watershed:	Bold Run, MY-02
XS ID	XS - 1, Riffle, 14+25
Drainage Area (sq mi):	1.6
Date:	8/15/2008
Field Crew:	Adasme, Faquin

Station	Elevation
0	280.09
9.96680509	280.53
16.8931164	279.96
23.4059885	278.49
28.7326699	278.68
34.8485018	278.26
36.8359942	276.14
41.4317133	275.42
43.8126781	275.78
45.9878679	276.08
49.588359	277.31
53.0462318	278.20
61.932726	278.40
66.2626262	279.57
74.2637916	279.40
82.2484393	279.69

SUMMARY DATA	
Bankfull Elevation:	278.2
Bankfull Cross-Sectional Area:	31.1
Bankfull Width:	18.2
Flood Prone Area Elevation:	280.8
Flood Prone Width:	>80
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.7
W / D Ratio:	10.6
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E4

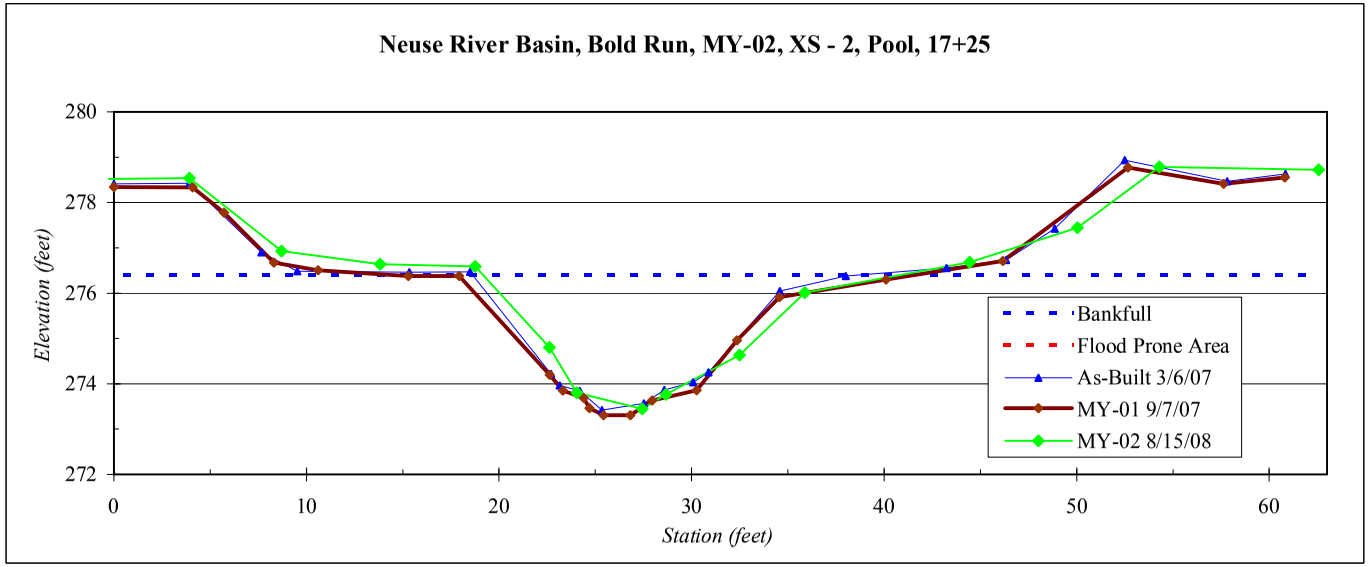


River Basin:	Neuse
Watershed:	Bold Run, MY-02
XS ID	XS - 2, Pool, 17+25
Drainage Area (sq mi):	1.6
Date:	8/15/2008
Field Crew:	Adasme, Faquin

Station	Elevation
-4.18	278.50
3.92	278.54
8.70	276.93
13.82	276.64
18.76	276.59
22.61	274.80
24.04	273.80
27.43	273.45
28.67	273.77
32.49	274.63
35.88	276.01
44.43	276.68
50.04	277.45
54.30	278.79
62.56	278.72

SUMMARY DATA	
Bankfull Elevation:	276.4
Bankfull Cross-Sectional Area:	24.3
Bankfull Width:	15.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	1.5
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E4

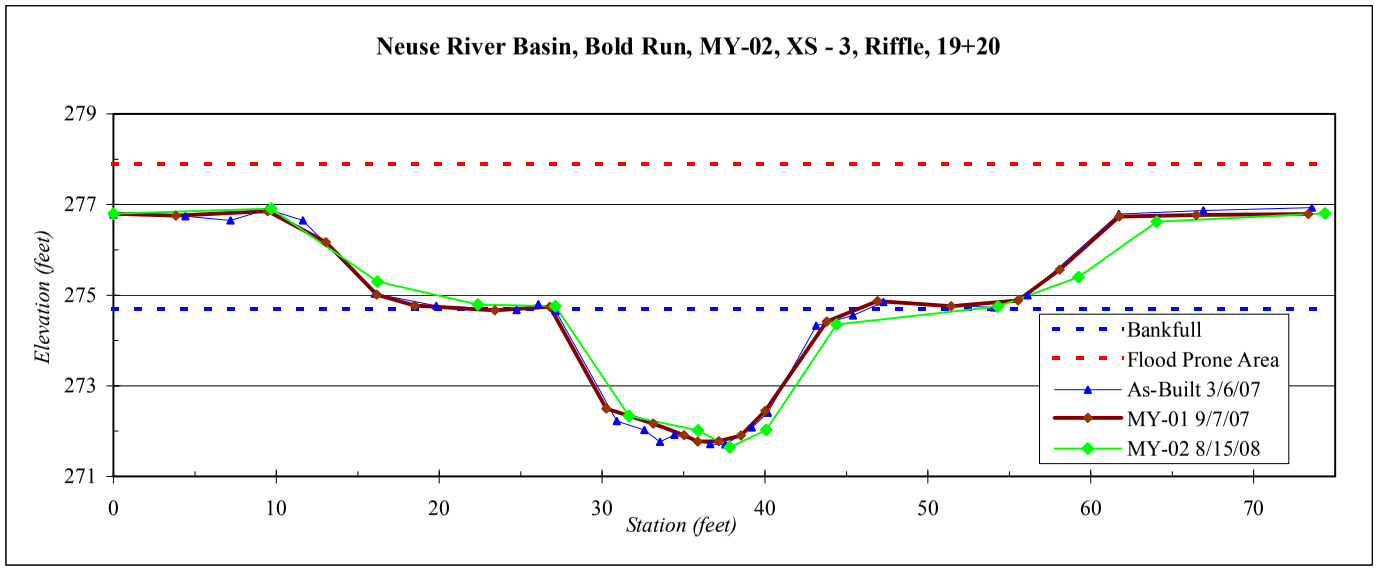


River Basin:	Neuse
Watershed:	Bold Run, MY-02
XS ID	XS - 3, Riffle, 19+20
Drainage Area (sq mi):	1.6
Date:	8/15/2008
Field Crew:	Adasme, Faquin

Station	Elevation
0.00	276.79
9.68	276.91
16.21	275.30
22.37	274.79
27.12	274.76
31.64	272.34
35.90	272.01
37.83	271.64
40.08	272.02
44.39	274.35
54.31	274.75
59.24	275.40
64.04	276.62
74.37	276.81

SUMMARY DATA	
Bankfull Elevation:	274.7
Bankfull Cross-Sectional Area:	28.7
Bankfull Width:	16.5
Flood Prone Area Elevation:	277.9
Flood Prone Width:	>74
Max Depth at Bankfull:	2.7
Mean Depth at Bankfull:	1.7
W / D Ratio:	9.5
Entrenchment Ratio:	>2
Bank Height Ratio:	1.0

Stream Type	E4

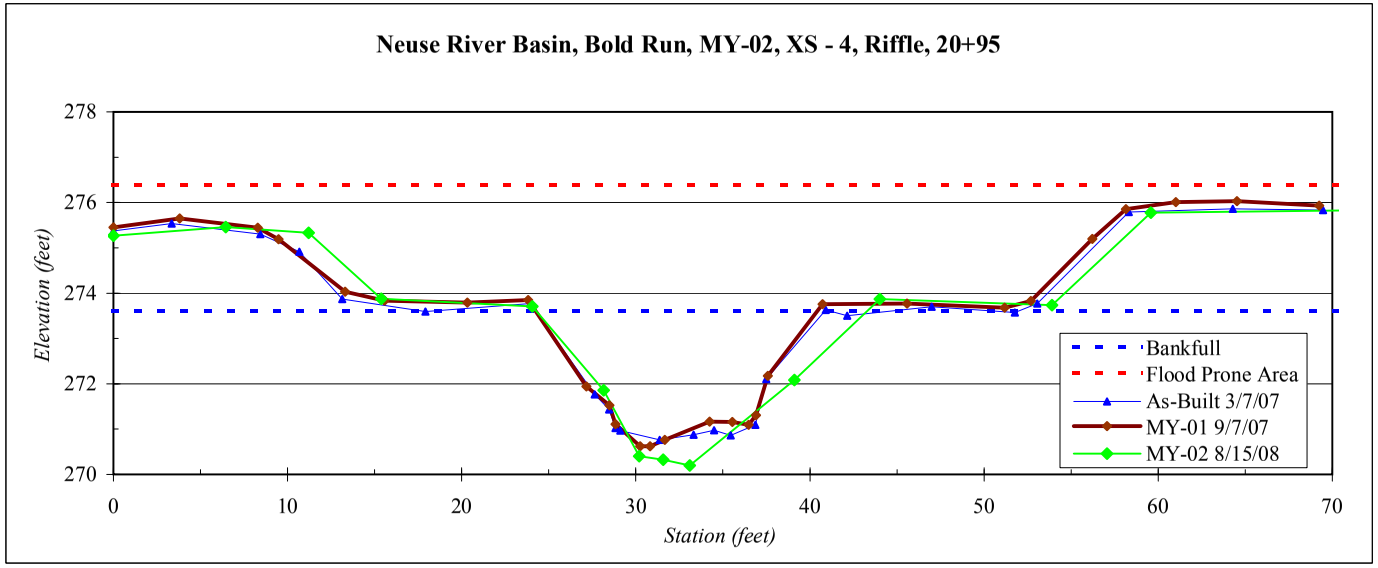


River Basin:	Neuse
Watershed:	Bold Run, MY-02
XS ID	XS - 4, Riffle, 20+95
Drainage Area (sq mi):	1.6
Date:	8/15/2008
Field Crew:	Adasme, Faquin

Station	Elevation
0.0	275.3
6.5	275.5
11.2	275.3
15.4	273.9
24.0	273.7
28.2	271.9
30.2	270.4
31.6	270.3
33.1	270.2
39.1	272.1
44.0	273.9
53.9	273.7
59.6	275.8
72.4	275.8

SUMMARY DATA	
Bankfull Elevation:	273.6
Bankfull Cross-Sectional Area:	38.0
Bankfull Width:	19.5
Flood Prone Area Elevation:	276.4
Flood Prone Width:	>70
Max Depth at Bankfull:	3.5
Mean Depth at Bankfull:	1.9
W / D Ratio:	10.0
Entrenchment Ratio:	>3
Bank Height Ratio:	1.0

Stream Type	E4

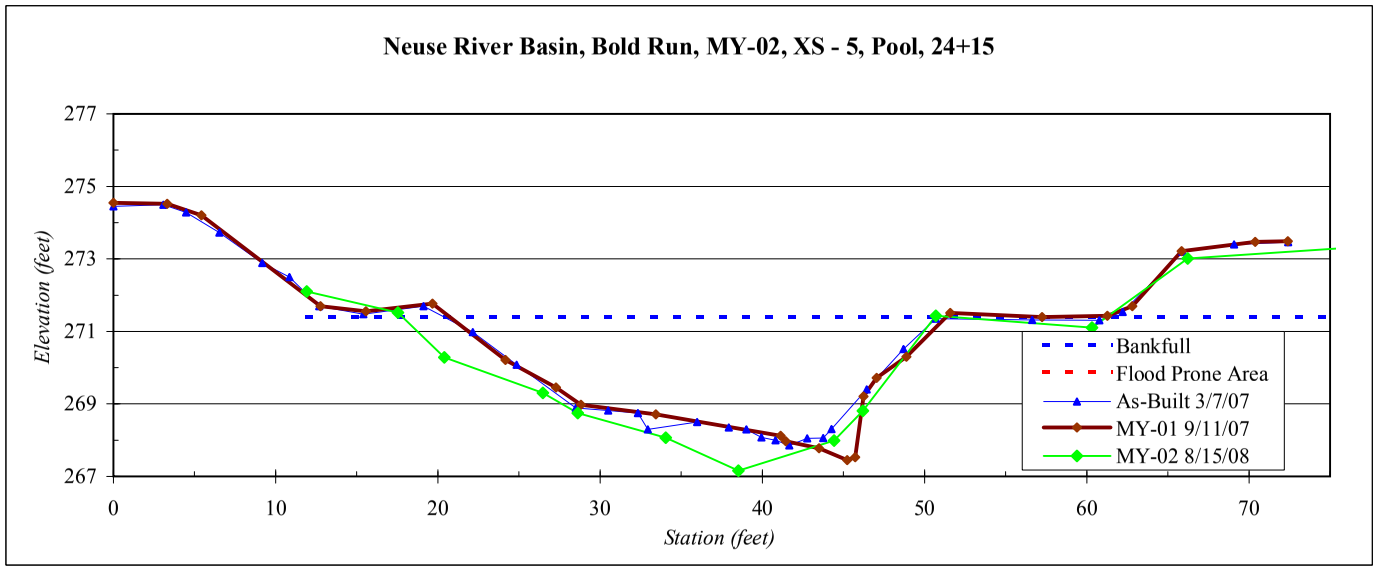


River Basin:	Neuse
Watershed:	Bold Run, MY-02
XS ID	XS - 5, Pool, 24+15
Drainage Area (sq mi):	1.6
Date:	8/15/2008
Field Crew:	Adasme, Faquin

Station	Elevation
11.9	272.1
17.5	271.5
20.4	270.3
26.5	269.3
28.6	268.7
34.1	268.1
38.5	267.2
44.4	268.0
46.2	268.8
50.7	271.4
60.3	271.1
66.2	273.0
76.9	273.3

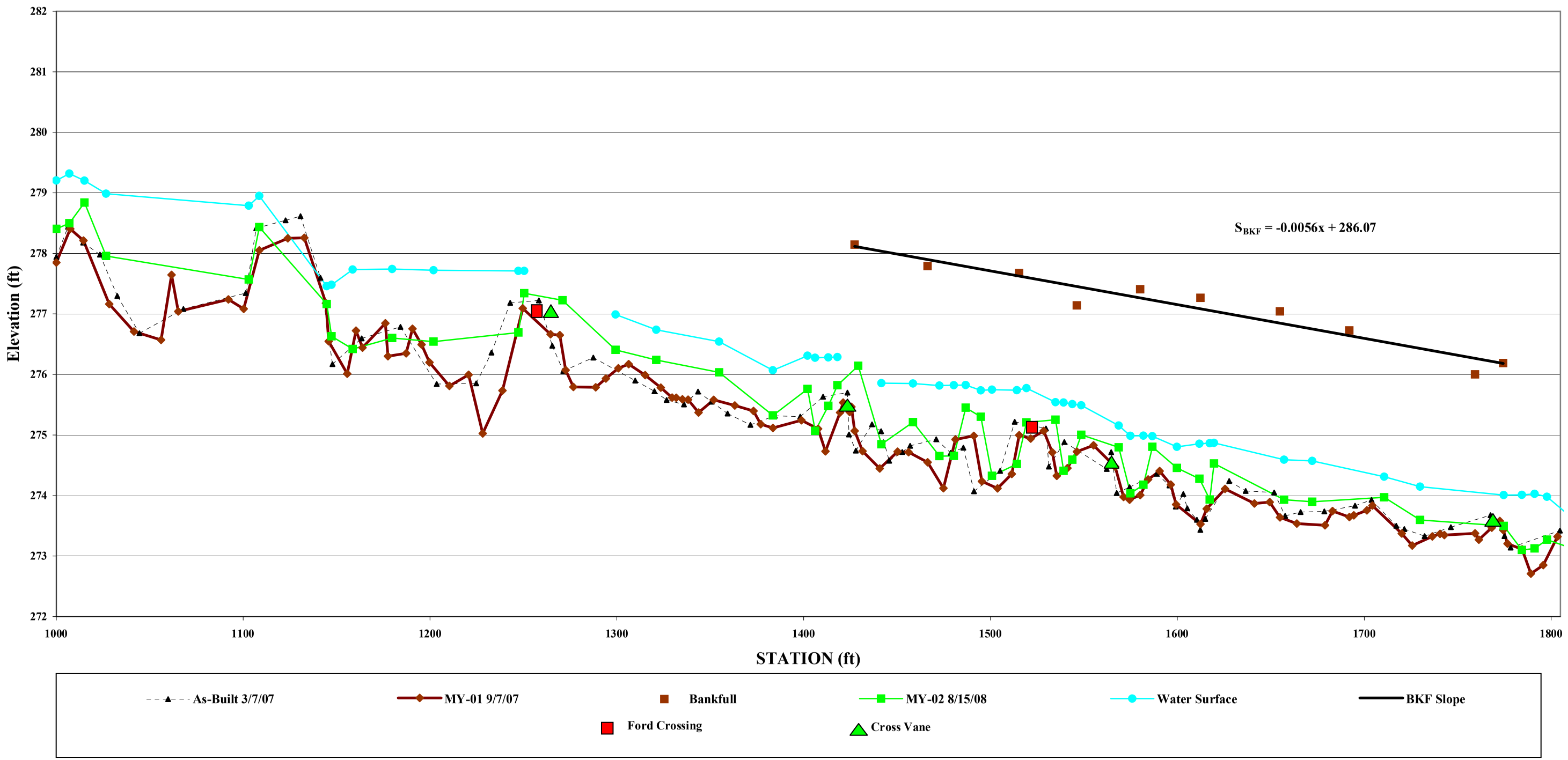
SUMMARY DATA	
Bankfull Elevation:	271.4
Bankfull Cross-Sectional Area:	84.1
Bankfull Width:	32.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	4.3
Mean Depth at Bankfull:	2.6
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E4

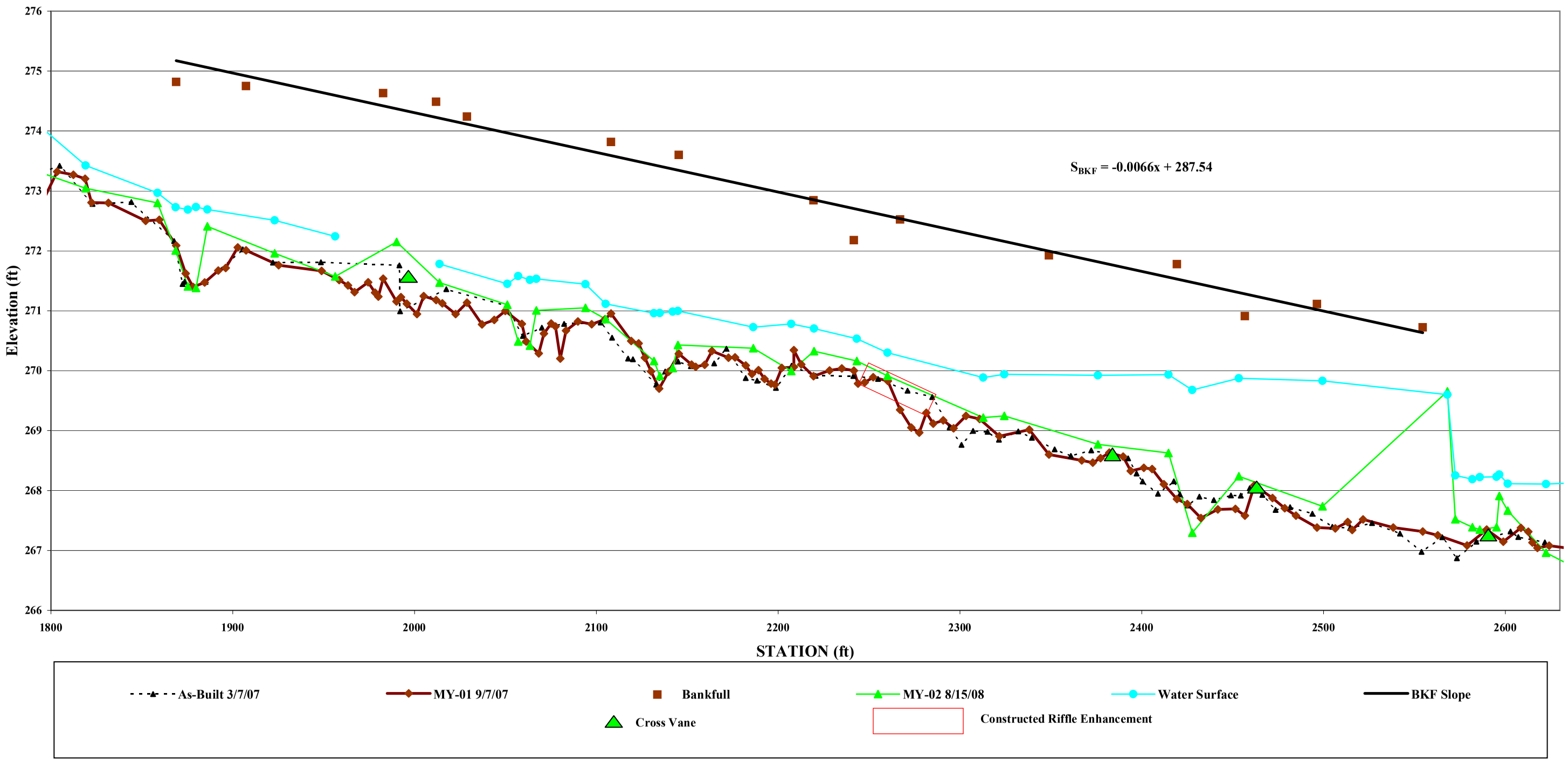


Appendix B5 - Longitudinal Plots

Longitudinal Profile
Bold Run Creek
EEP Project Number 439 MY-02
Stations 10+00 - 18+00



Longitudinal Profile
Bold Run Creek
EEP Project Number 439 MY-02
Stations 18+00 - 26+30



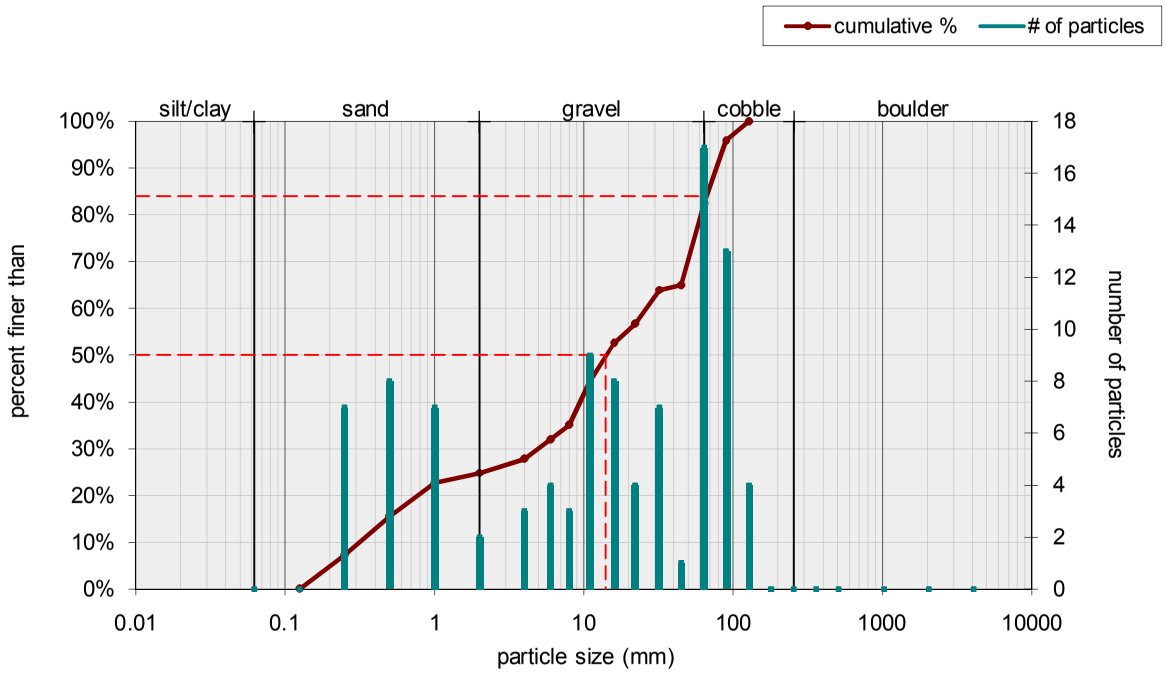
Appendix B - Pebble Counts

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	0
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	7
medium sand	0.25 - 0.5	8
coarse sand	0.5 - 1	7
very coarse sand	1 - 2	2
very fine gravel	2 - 4	3
fine gravel	4 - 6	4
fine gravel	6 - 8	3
medium gravel	8 - 11	9
medium gravel	11 - 16	8
coarse gravel	16 - 22	4
coarse gravel	22 - 32	7
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	17
small cobble	64 - 90	13
medium cobble	90 - 128	4
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		97
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		97

Note: XS-1

Bold Run, Year 2 (2008) - XS-1 Riffle



Size (mm)	
D16	0.53
D35	8
D50	14
D65	45
D84	67
D95	88

Size Distribution	
mean	6.0
dispersion	15.6
skewness	-0.26

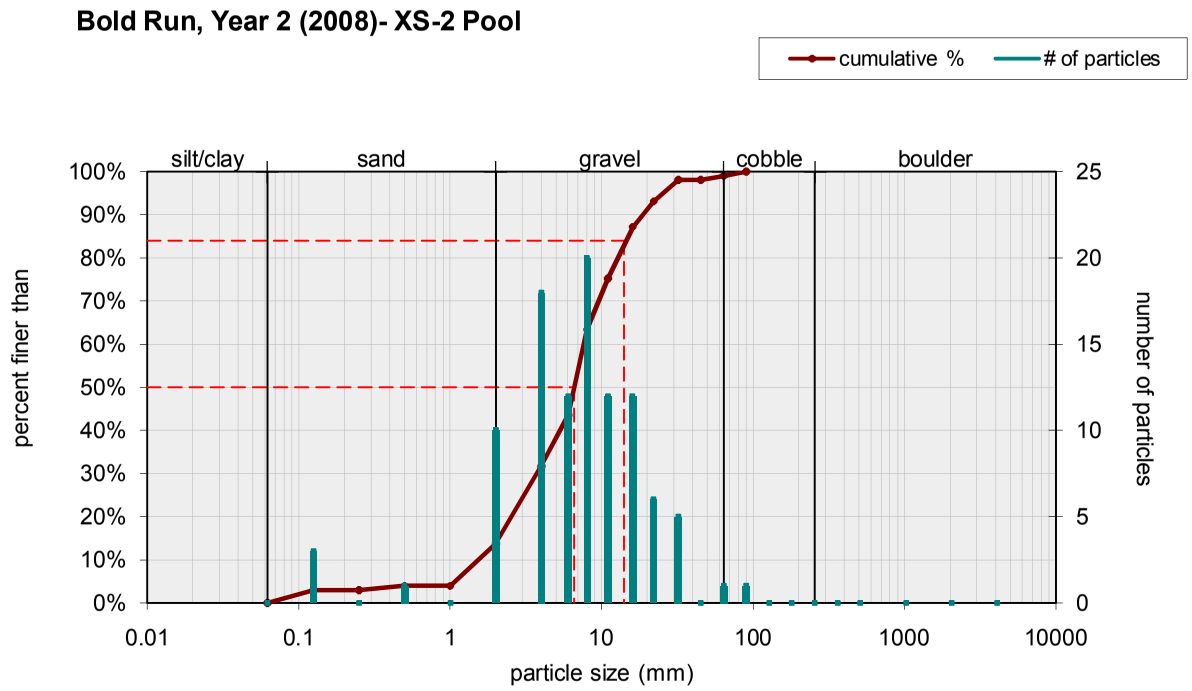
Type	
silt/clay	0%
sand	25%
gravel	58%
cobble	18%
boulder	0%

Appendix B - Pebble Counts

Bed Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	0
very fine sand	0.062 - 0.125	3
fine sand	0.125 - 0.25	0
medium sand	0.25 - 0.5	1
coarse sand	0.5 - 1	0
very coarse sand	1 - 2	10
very fine gravel	2 - 4	18
fine gravel	4 - 6	12
fine gravel	6 - 8	20
medium gravel	8 - 11	12
medium gravel	11 - 16	12
coarse gravel	16 - 22	6
coarse gravel	22 - 32	5
very coarse gravel	32 - 45	0
very coarse gravel	45 - 64	1
small cobble	64 - 90	1
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		101
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		101

Note: XS-2



Size (mm)	
D16	2.2
D35	4.5
D50	6.6
D65	8.4
D84	14
D95	25

Size Distribution	
mean	5.5
dispersion	2.6
skewness	-0.08

Type	
silt/clay	0%
sand	14%
gravel	85%
cobble	1%
boulder	0%

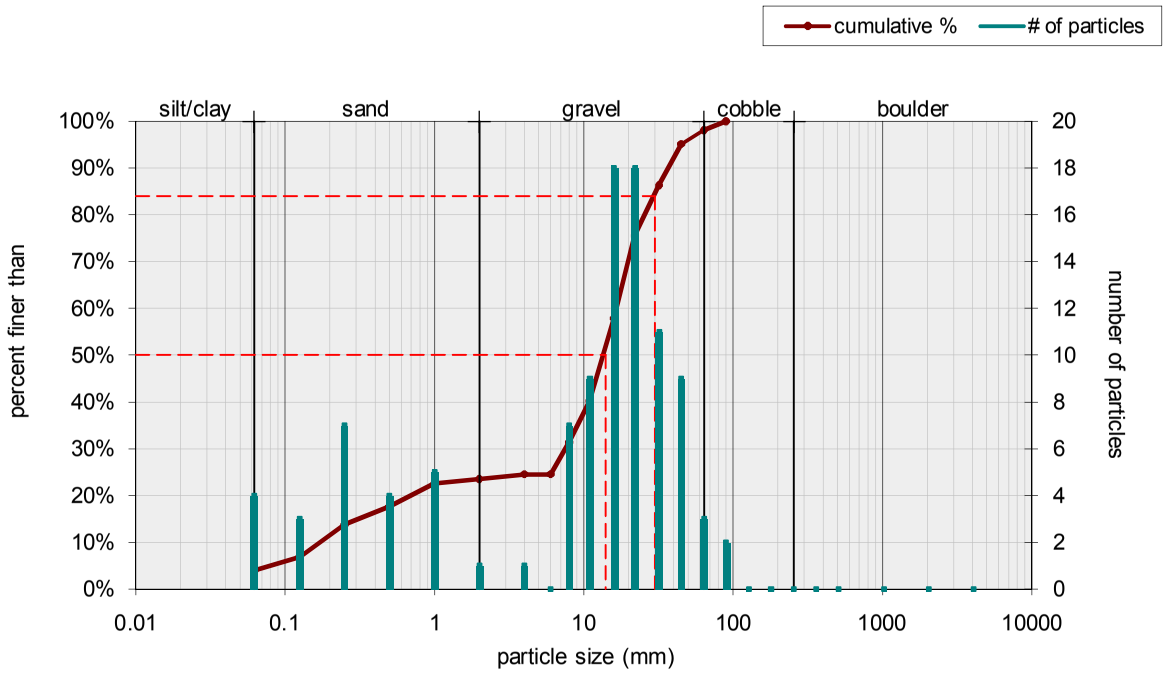
Appendix B - Pebble Counts

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	4
very fine sand	0.062 - 0.125	3
fine sand	0.125 - 0.25	7
medium sand	0.25 - 0.5	4
coarse sand	0.5 - 1	5
very coarse sand	1 - 2	1
very fine gravel	2 - 4	1
fine gravel	4 - 6	0
fine gravel	6 - 8	7
medium gravel	8 - 11	9
medium gravel	11 - 16	18
coarse gravel	16 - 22	18
coarse gravel	22 - 32	11
very coarse gravel	32 - 45	9
very coarse gravel	45 - 64	3
small cobble	64 - 90	2
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		102
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		102

Note: XS-3

Bold Run, Year 2 (2008) - XS-3 Riffle



Size (mm)	
D16	0.37
D35	9.1
D50	14
D65	18
D84	30
D95	45

Size Distribution	
mean	3.3
dispersion	20.0
skewness	-0.45

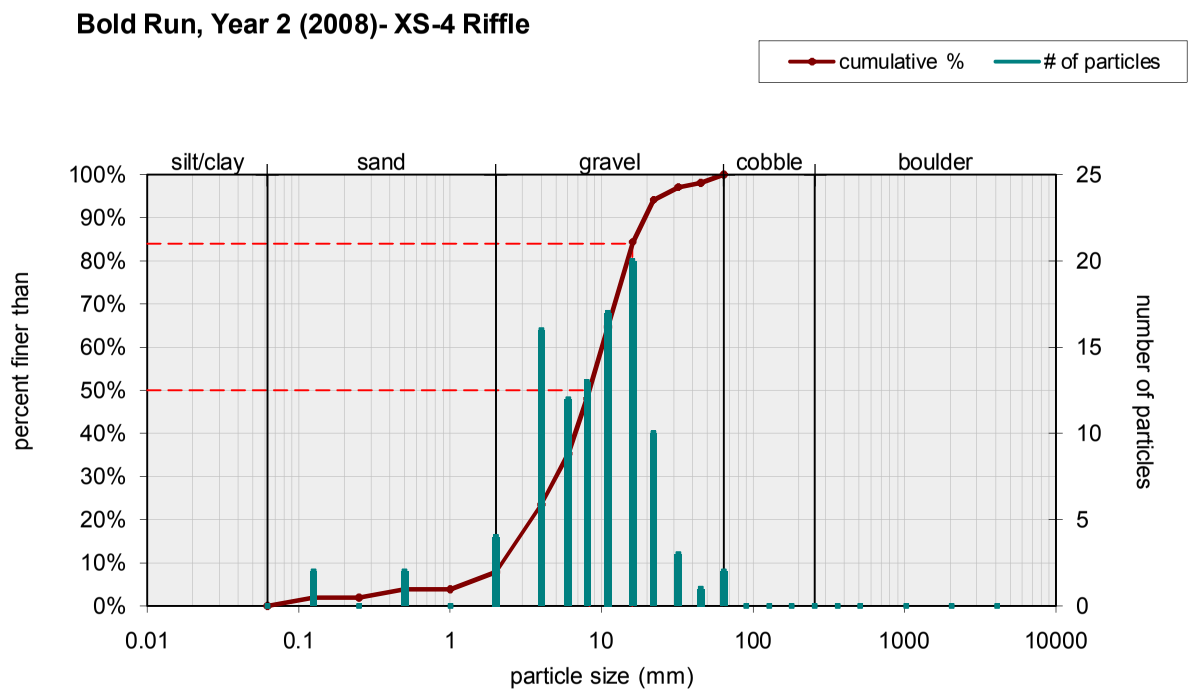
Type	
silt/clay	4%
sand	20%
gravel	75%
cobble	2%
boulder	0%

Appendix B - Pebble Counts

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	0
very fine sand	0.062 - 0.125	2
fine sand	0.125 - 0.25	0
medium sand	0.25 - 0.5	2
coarse sand	0.5 - 1	0
very coarse sand	1 - 2	4
very fine gravel	2 - 4	16
fine gravel	4 - 6	12
fine gravel	6 - 8	13
medium gravel	8 - 11	17
medium gravel	11 - 16	20
coarse gravel	16 - 22	10
coarse gravel	22 - 32	3
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	2
small cobble	64 - 90	0
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		102
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		102

Note: XS-4



Size (mm)	
D16	2.9
D35	5.9
D50	8.3
D65	11
D84	16
D95	25

Size Distribution	
mean	6.8
dispersion	2.4
skewness	-0.10

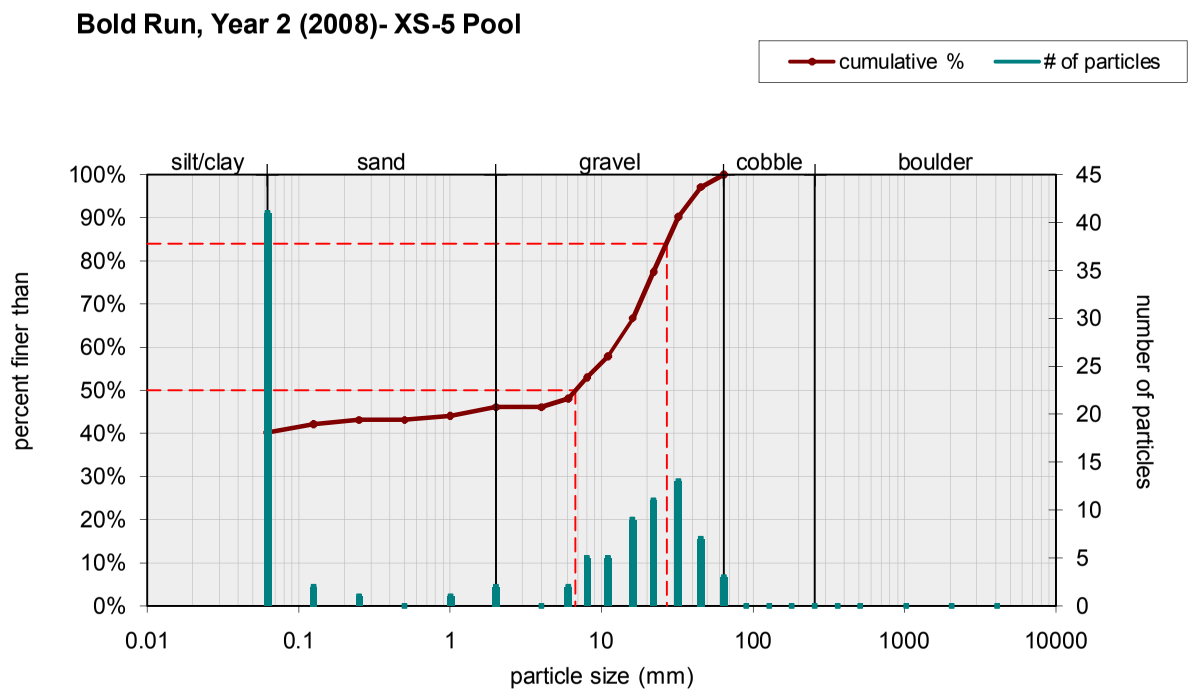
Type	
silt/clay	0%
sand	8%
gravel	92%
cobble	0%
boulder	0%

Appendix B - Pebble Counts

Bed Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	41
very fine sand	0.062 - 0.125	2
fine sand	0.125 - 0.25	1
medium sand	0.25 - 0.5	0
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	2
very fine gravel	2 - 4	0
fine gravel	4 - 6	2
fine gravel	6 - 8	5
medium gravel	8 - 11	5
medium gravel	11 - 16	9
coarse gravel	16 - 22	11
coarse gravel	22 - 32	13
very coarse gravel	32 - 45	7
very coarse gravel	45 - 64	3
small cobble	64 - 90	0
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		102
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		102

Note: XS-5



Size (mm)	
D16	0.062
D35	0.062
D50	6.7
D65	15
D84	27
D95	41

Size Distribution	
mean	1.3
dispersion	56.0
skewness	-0.44

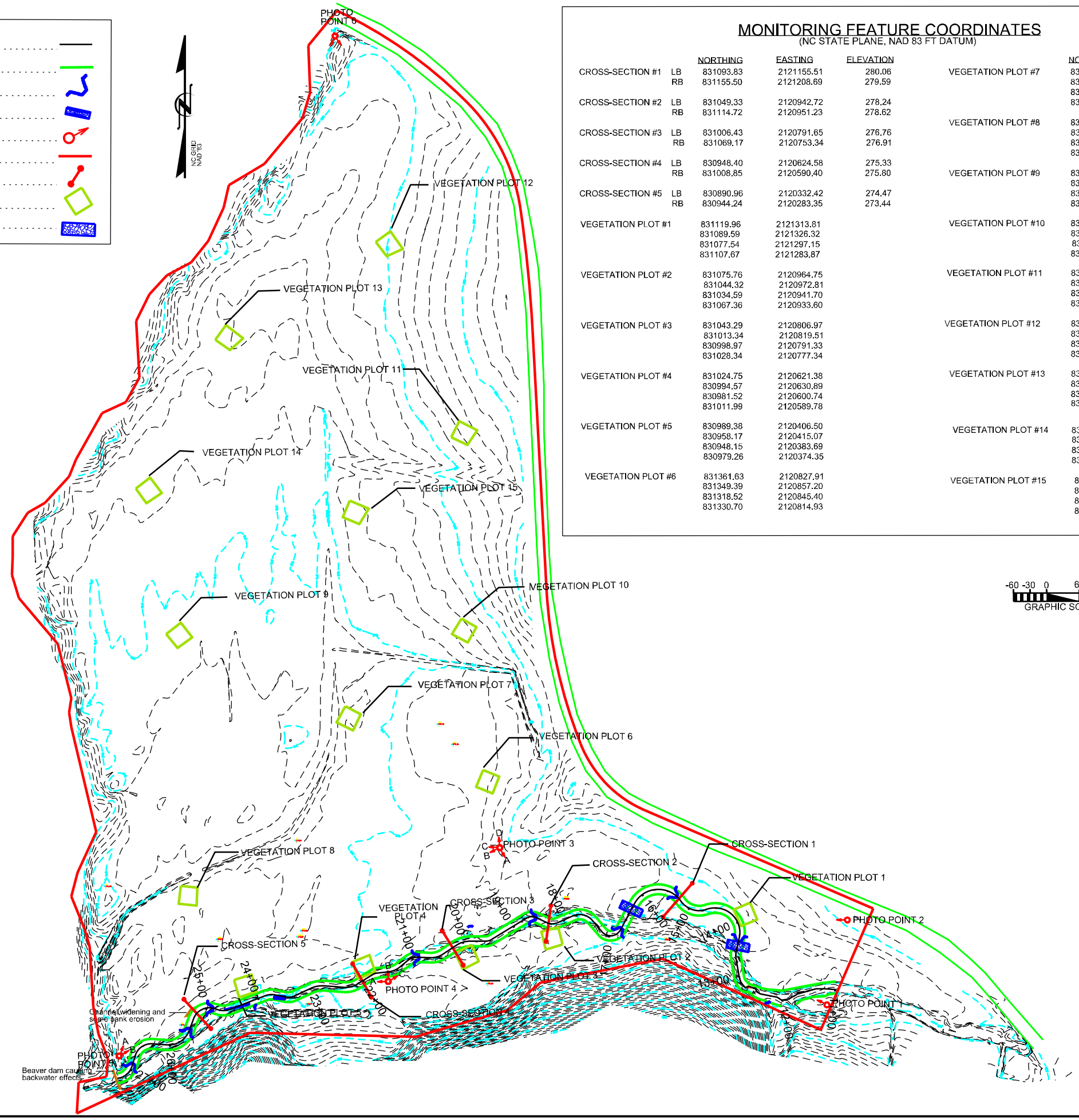
Type	
silt/clay	40%
sand	6%
gravel	54%
cobble	0%
boulder	0%

APPENDIX C

FIGURE C1. MONITORING PLAN VIEW

LEGEND

- STREAM THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT STRUCTURE
- RIFFLE ENHANCEMENT
- PHOTO REFERENCE POINT
- PROPERTY BOUNDARY
- CROSS-SECTION
- VEGETATION PLOT
- FORD CROSSING



MONITORING FEATURE COORDINATES

(NC STATE PLANE, NAD 83 FT DATUM)

		NORTHING	EASTING	ELEVATION
CROSS-SECTION #1	LB	831093.83	2121155.51	280.06
	RB	831155.50	2121208.69	279.59
CROSS-SECTION #2	LB	831049.33	2120942.72	278.24
	RB	831114.72	2120951.23	278.62
CROSS-SECTION #3	LB	831006.43	2120791.65	276.76
	RB	831069.17	2120753.34	276.91
CROSS-SECTION #4	LB	830948.40	2120624.58	275.33
	RB	831008.85	2120590.40	275.80
CROSS-SECTION #5	LB	830890.96	2120332.42	274.47
	RB	830944.24	2120283.35	273.44

	NORTHING	EASTING
VEGETATION PLOT #1	831119.96	2121313.81
	831089.59	2121326.32
	831077.54	2121297.15
	831107.67	2121283.87
VEGETATION PLOT #2	831075.76	2120964.75
	831044.32	2120972.81
	831034.59	2120941.70
	831067.36	2120933.60
VEGETATION PLOT #3	831043.29	2120806.97
	831013.34	2120819.51
	830998.97	2120791.33
	831028.34	2120777.34
VEGETATION PLOT #4	831024.75	2120621.38
	830994.57	2120630.89
	830981.52	2120600.74
	831011.99	2120589.78
VEGETATION PLOT #5	830989.38	2120406.50
	830958.17	2120415.07
	830948.15	2120383.69
	830979.26	2120374.35
VEGETATION PLOT #6	831361.63	2120827.91
	831349.39	2120857.20
	831318.52	2120845.40
	831330.70	2120814.93
VEGETATION PLOT #7	831477.30	2120576.84
	831463.10	2120605.34
	831433.44	2120590.84
	831448.33	2120561.39
VEGETATION PLOT #8	831147.63	2120307.85
	831114.72	2120306.17
	831118.41	2120273.86
	831159.80	2120277.98
VEGETATION PLOT #9	831629.35	2120277.54
	831602.71	2120298.24
	831583.56	2120271.75
	831609.01	2120251.28
VEGETATION PLOT #10	831636.97	2120788.53
	831621.65	2120815.67
	831593.37	2120799.71
	831609.09	2120769.69
VEGETATION PLOT #11	831996.48	2120784.37
	831979.80	2120817.15
	831952.65	2120799.07
	831966.75	2120769.69
VEGETATION PLOT #12	832341.97	2120658.90
	832309.92	2120681.60
	832296.51	2120652.76
	832322.25	2120632.55
VEGETATION PLOT #13	832171.07	2120359.42
	832147.09	2120366.83
	832125.57	2120366.83
	832144.28	2120340.27
VEGETATION PLOT #14	831873.35	2120195.95
	831893.48	2120221.92
	831865.44	2120242.78
	831846.92	2120215.30
VEGETATION PLOT #15	831851.69	2120584.90
	831836.83	2120620.00
	831808.82	2120602.25
	831821.30	2120572.14

NOTES/REVISIONS

Project:

Bold Run Restoration Site

Project No. 439
Year 2 (2008) Monitoring Report
Wake County
North Carolina

Title:

Monitoring Plan View

Scale: As Shown

Date: Oct 2008

Project No.: 08-001

FIGURE NO.

C1