Glen Raven Stream Restoration
Monitoring Report – MY01
Alamance County, NC
Basin 03030002 - Contract # D05011-1

Submitted to:

Ecosystem Enhancement PROGRAM

NCEEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

November 2007

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EXECUTIVE SUMMARY

The Glen Raven Stream Restoration Site is a full-delivery project that was developed for the North Carolina Ecosystem Enhancement Program (EEP). Construction was completed in March 2007 on an unnamed tributary to the Haw River (UTHR) and two of its tributaries (UT1 and UT2). The 697 acre watershed is located within the USGS 14-digit HUC 03030002030010 and the NCDWQ Sub-basin 03-06-02 in the Cape Fear River Basin. The project restored approximately 3,317 linear feet of channel using a combination of Priority 2 and 3 approaches, and enhanced 450 linear feet using a Priority 2 approach, generating 3,405 stream mitigation units. The design addressed vertical instability problems and a lack of bed variability by stabilizing stream banks, installing in-stream structures, adjusting stream planform, and clearing and replanting the riparian areas with native vegetation. This report describes the results from the findings of the first year of monitoring that took place in 2007.

The riparian buffer was planted with fifteen different species of bare root trees and shrubs and four different species of live stakes. Eight vegetation monitoring plots were established during the as-built survey. Riparian vegetation must meet a minimum survival success rate of 320 stems/acre after five years. These plots were monitored during the first-year monitoring period. The first year monitoring counted an average of 740 stems per acre. Some invasive species were noted in the restored stream buffer and will continue to be monitored to determine if corrective action is necessary. The first year monitoring found the vegetation component of the project to be successful.

The stream assessment completed during first-year monitoring found the stream to be stable and functioning properly. Channel dimensions have not changed significantly from the as-built conditions over the course of the growing season. Small portions of localized bank erosion have been noted during the first-year monitoring. None of the erosion was severe and is mostly at the toe of the bank, where erosion is typical following construction. These areas of erosion have been documented in the Current Conditions Plan View. The on-site stream gauges have recorded 2 bankfull events since the project was constructed in March 2007.

1.0 PROJECT BACKGROUND

1.1 Project Objectives

- Establish a stable C4 stream channel on the UTHR and a B4c stream channel on UT1 and UT2
- Create a heterogeneous stream bed with distinct pool and riffle features
- Plant a riparian buffer with site-appropriate native trees and shrubs

1.2 Project Structure, Restoration Type, and Approach

The project site became degraded as a result of agricultural activities (poor grazing management) and human disturbances (removal of riparian vegetation and development in the watershed). As a result, the ecological diversity and water quality of the site were adversely affected. The project restored 3,317 linear feet of channel using a combination of Priority 2 and 3 approaches, and enhanced 450 linear feet using a Priority 2 approach. The UTHR was restored to a Rosgen stream type C4, and UT1 and UT2 were restored to stream type B4c. The riparian buffer was planted with native trees and shrubs.

1.3 Location and Setting

The Glen Raven Stream Restoration Site is located 1.5 miles northwest of Burlington, North Carolina in Alamance County. The land use of the 697-acre watershed is comprised of suburban residential development, forests, and agriculture. The watershed has a high potential for future development.

From Raleigh, proceed west on Interstate-40 (I-40). Continue on I-40 West/ I-85 South after they merge near Hillsborough. Take Exit 148 and turn right towards Burlington. Proceed to the split of NC-54/49 and NC-87/100. Turn right heading northwest on NC-87/100. Proceed to the split of NC-87 and NC-100 in Glen Raven. Turn right and travel north 0.15 mile on NC-87. Make a left onto Power Line Road and proceed 0.7 mile. The project site begins just downstream of the Power Line Road culvert (Figure 1).

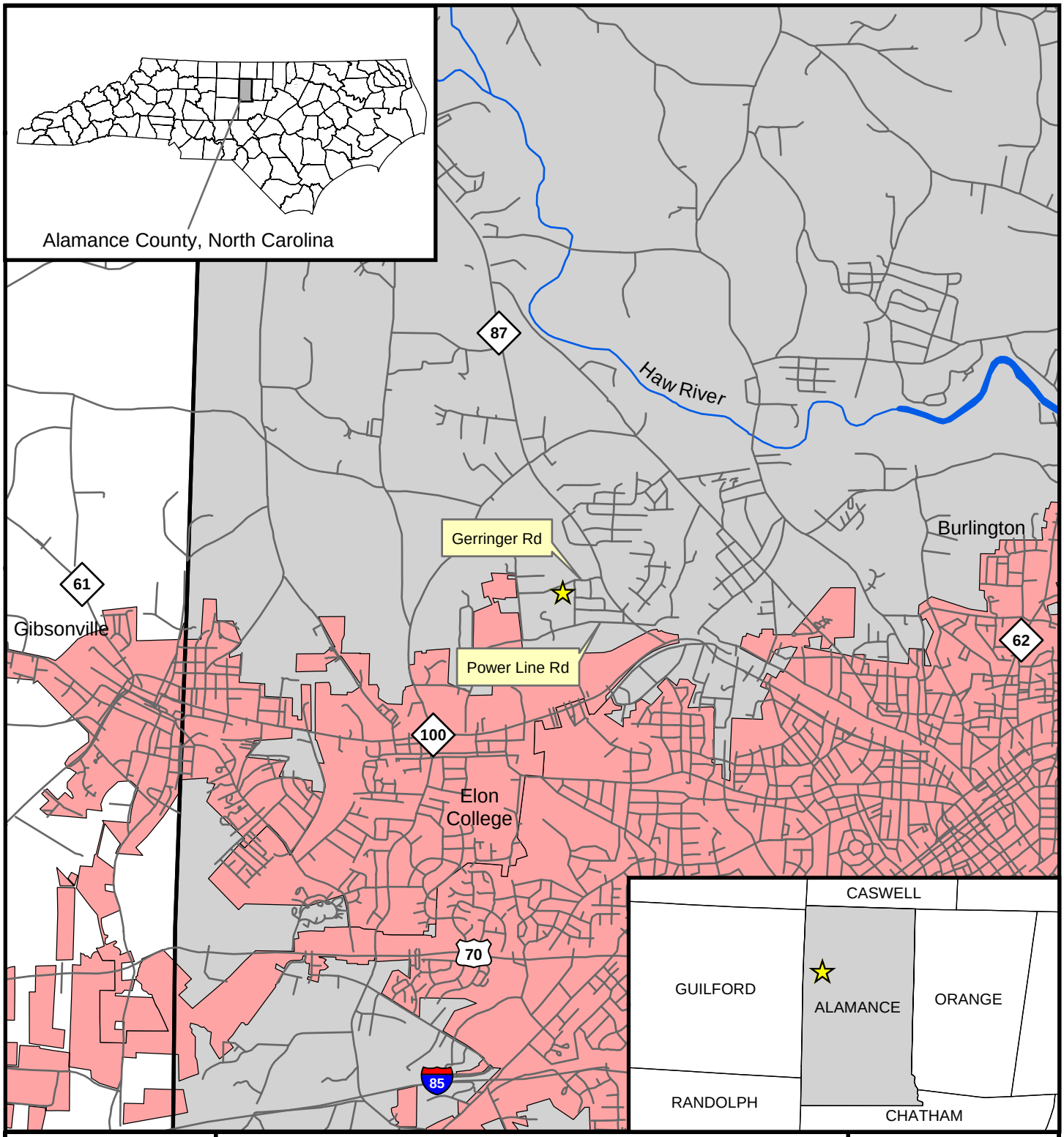


Figure 1. Vicinity Map

- Project Site Location
- Roads
- Major Rivers
- Cities and Towns
- County Boundaries
- Alamance County

N
W E
S

1:63,360
1 inch equals 1 miles

1 0.5 0 1 Miles

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

1.4 Project History and Background

Table 1. Project Restoration Components
Project Name: Glen Raven

Project Segment / Reach ID	Pre-Restoration Linear Footage	Type	Approach	As-Built Linear Footage	Eligible Footage	Mitigation Ratio	Mitigation Units	Stationing
Reach I	300	R	P2	275 lf	275 lf	1.0	275	10+00 - 12+75
Reach II	483	EI	P2	450 lf	446 lf	1.5	297	12+75 - 17+25
Reach III	1,028	R	P2	1,071 lf	1,014 lf	1.0	1,014	17+25 - 27+96
Reach IV	1,045	R	P2	1,059 lf	1,000 lf	1.0	1,000	27+97 - 38+56
Trib 1	524	R	P3	542 lf	501 lf	1.0	501	40+00 - 45+42
Trib 2	315	R	P3	370 lf	318 lf	1.0	318	50+00 - 53+70

Mitigation Unit Summations

Stream (lf)	Riparian Wetland	Nonriparian		Total Wetland	Buffer (Ac)
3,405	0	0		0	0

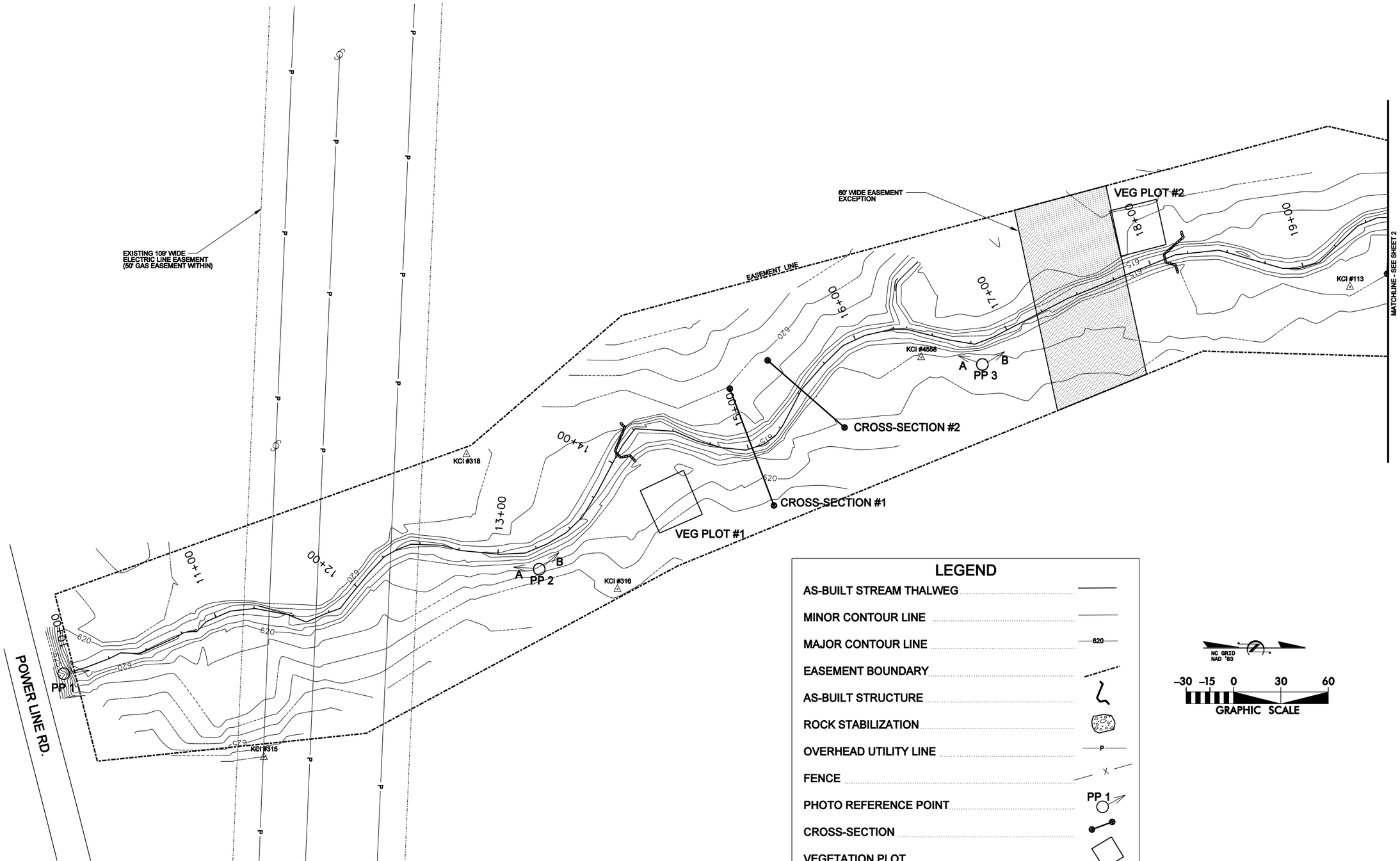
R = Restoration
EI = Enhancement 1
P2 = Priority 2
P3 = Priority 3

Table 2. Project Activity and Reporting History
Project Name: Glen Raven

Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	Jan 06	Aug 06
Final Design - Construction Plans	N/A	Oct 06
Construction	N/A	Apr 07
Temporary seed mix applied to entire project area	N/A	Mar 07
Permanent seed mix applied to entire project area	N/A	Apr 07
Tree plantings completed	N/A	Apr 07
Mitigation Plan / As-Built (Year 0 Monitoring - Baseline)	May 07	May 07
Year 1 Monitoring	Oct 07	Nov 07

Table 3. Project Contact Table **Project Name: Glen Raven**	
Design Firm	KCI Associates of NC, P.A. Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 783-9214 Fax: (919) 783-9266
Construction Contractor	Environmental Technologies and Construction (ETC) Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Dan Kramer Phone: (919) 783-9214 Fax: (919) 783-9266
Planting Contractor	H & J Forest Services PO Box 458 Holly Ridge, NC 28445 Contact: Mr. Brian Jarvenin Phone: (910) 512-6754
Seeding Contractor	N/A
Seed Mix Sources	Evergreen Seed
Nursery Stock Suppliers	International Paper and Cure Nursery
Monitoring Performers	
MY-0 - MY-5	KCI Associates of NC, P.A. Landmark Center, II Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 783-9214 Fax: (919) 783-9266

Table 4. Project Background Table **Project Name: Glen Raven**	
Project County	Alamance County
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Cape Fear
USGS HUC for Project and Reference	03030002030010 (Cape Fear) UTHR
	03030002060110 (Cape Fear) Long Branch - Reference
	03030002050100 (Cape Fear) UT to Wilkinson - Reference
NCDWQ Sub-basin for Project and Reference	03-06-02 (Cape Fear) UTHR
	03-06-05 (Cape Fear) Long Branch - Reference
	03-06-04 (Cape Fear) UT to Wilkinson - Reference
Drainage Area	697 Acres
Stream Order	Second Order - UTHR; First Order - UTI & UT2
Watershed Type (Rural, Urban, Developing, etc.)	Developing
Watershed LULC Distribution — Urban	43%
Agriculture-Row Crop	9%
Agriculture-Livestock	7%
Forest	37%
Water/Wetlands	4%
Watershed impervious cover (%)	43%
Rosgen Classification of As-built	C4 (UTHR); B4c (UT1, UT2)
Reference Site ID	Long Branch Creek, UT to Wilkinson Creek
NCDWQ Classification for Project	Class C, NSW
Within EEP Watershed Plan?	Yes, Travis, Tickle, and Little Alamance WP
Total project acreage of easement	9.6 Acres
Total vegetated acreage within easement	9.0 Acres
Total planted acreage	9.0 Acres
Dominant Soil Types	Worsham Sandy Loam
Project soil characteristics	Poorly drained soils
% of Project Easement Fenced	0%



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE (620)
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE (P)
- FENCE
- PHOTO REFERENCE POINT (PP 1)
- CROSS-SECTION
- VEGETATION PLOT
- CONTROL POINT (KCI #3)

NC GRID
NAD '83

–30 –15 0 30 60
GRAPHIC SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

KCI TECHNOLOGIES
ENGINEERS • PLANNERS • ECOLOGISTS
SUITE 220 LANDMARK CENTER II
4601 SIX FORKS RD., RALEIGH, NC

GLEN RAVEN - UT TO HAW RIVER STREAM RESTORATION PROJECT

BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA
STATION 10+00 TO STATION 19+62

DATE: NOVEMBER 2007
SCALE: 1"=30'

MONITORING PLAN VIEW

SHEET 1 OF 5

NC GRID
NAD '83

-30 -15 0 30 60
GRAPHIC SCALE

CROSS-SECTION #3
CROSS-SECTION #4
EASEMENT LINE
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00
615
620
KCI #4560
KCI #4561
KCI #4555
KCI #4532
KCI #4527
KCI #4564
KCI #4533
A
B
PP 4
PP 5
PP 6
PP 11
VEG PLOT #3
VEG PLOT #4
GERRINGER RD.
40' WIDE EASEMENT EXCEPTION
50' WIDE EASEMENT EXCEPTION
MATCHLINE - SEE SHEET 1
MATCHLINE - SEE SHEET 3
SEE SHEET 4

LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE — 620
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE — P
- FENCE
- PHOTO REFERENCE POINT — PP 1
- CROSS-SECTION
- VEGETATION PLOT
- CONTROL POINT — KCI #3

SYM.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

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GLEN RAVEN - UT TO HAW RIVER STREAM RESTORATION PROJECT

BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA

STATION 19+62 TO STATION 28+75

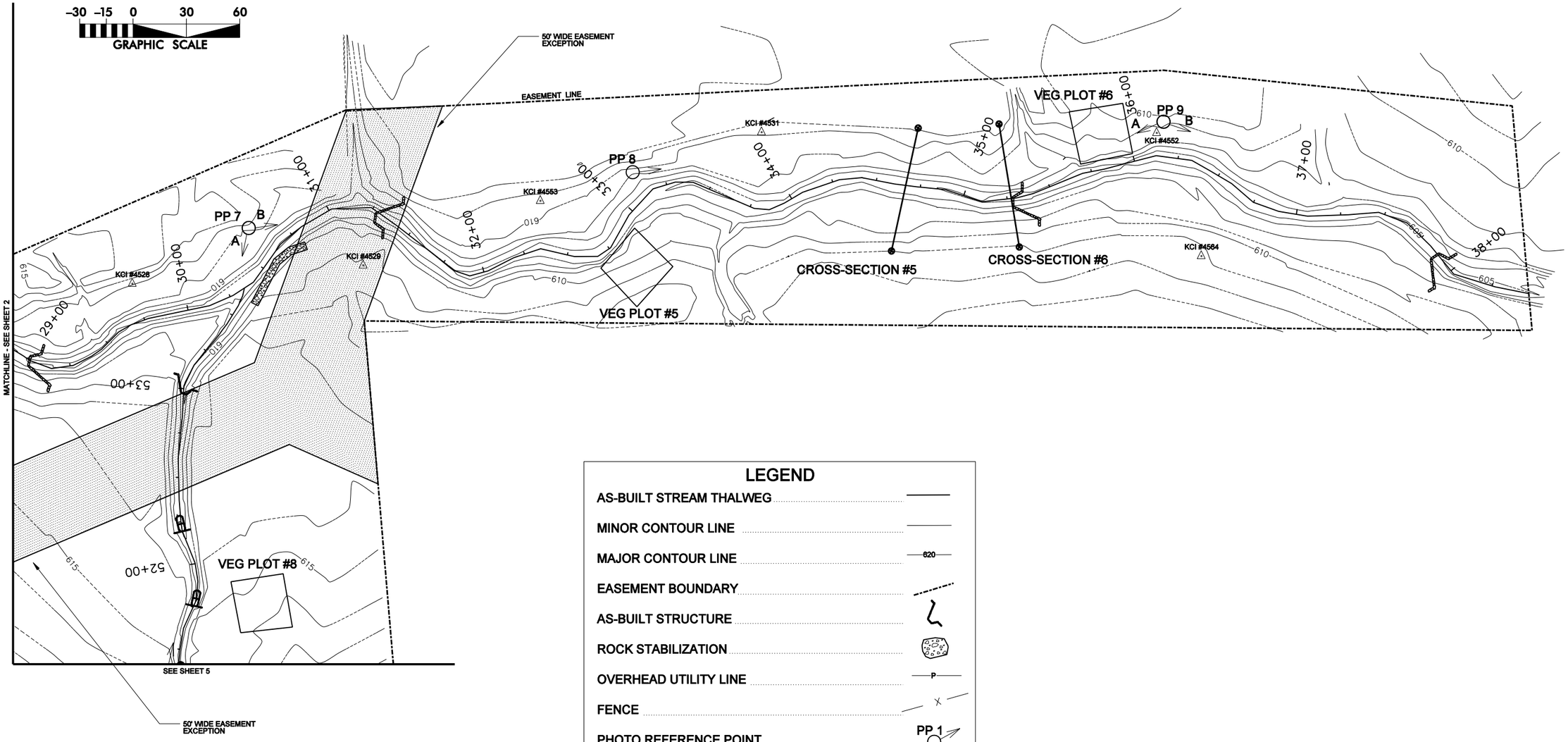
DATE: NOVEMBER 2007
SCALE: 1"=30'

MONITORING PLAN VIEW

SHEET 2 OF 5

NC GRID
NAD '83

–30 –15 0 30 60
GRAPHIC SCALE



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE (620)
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE (P)
- FENCE
- PHOTO REFERENCE POINT (PP 1)
- CROSS-SECTION
- VEGETATION PLOT
- CONTROL POINT (KCI #3)

REVISIONS			
SYM.	DATE	DESCRIPTION	APPROVED

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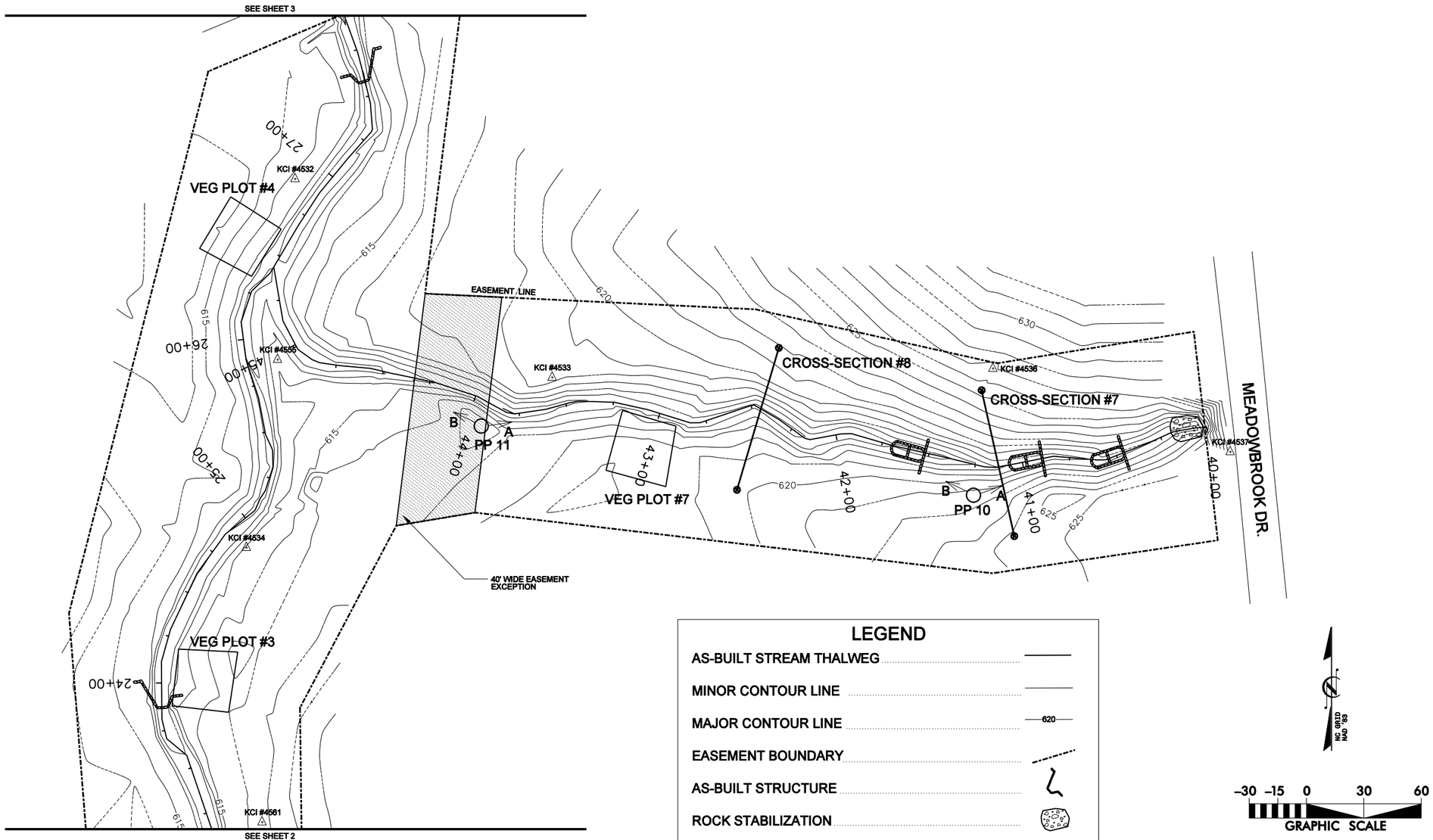
GLEN RAVEN - UT TO HAW RIVER
STREAM RESTORATION PROJECT
BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA
STATION 28+75 TO STATION 38+52

DATE: NOVEMBER 2007
SCALE: 1"=30'

MONITORING
PLAN VIEW

SHEET 3 OF 5



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE — 620
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE — P
- FENCE — X
- PHOTO REFERENCE POINT — PP 1
- CROSS-SECTION
- VEGETATION PLOT
- CONTROL POINT — KCI #3

NC 83FD NAD '83

–30 –15 0 30 60

GRAPHIC SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

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GLEN RAVEN - UT TO HAW RIVER STREAM RESTORATION PROJECT

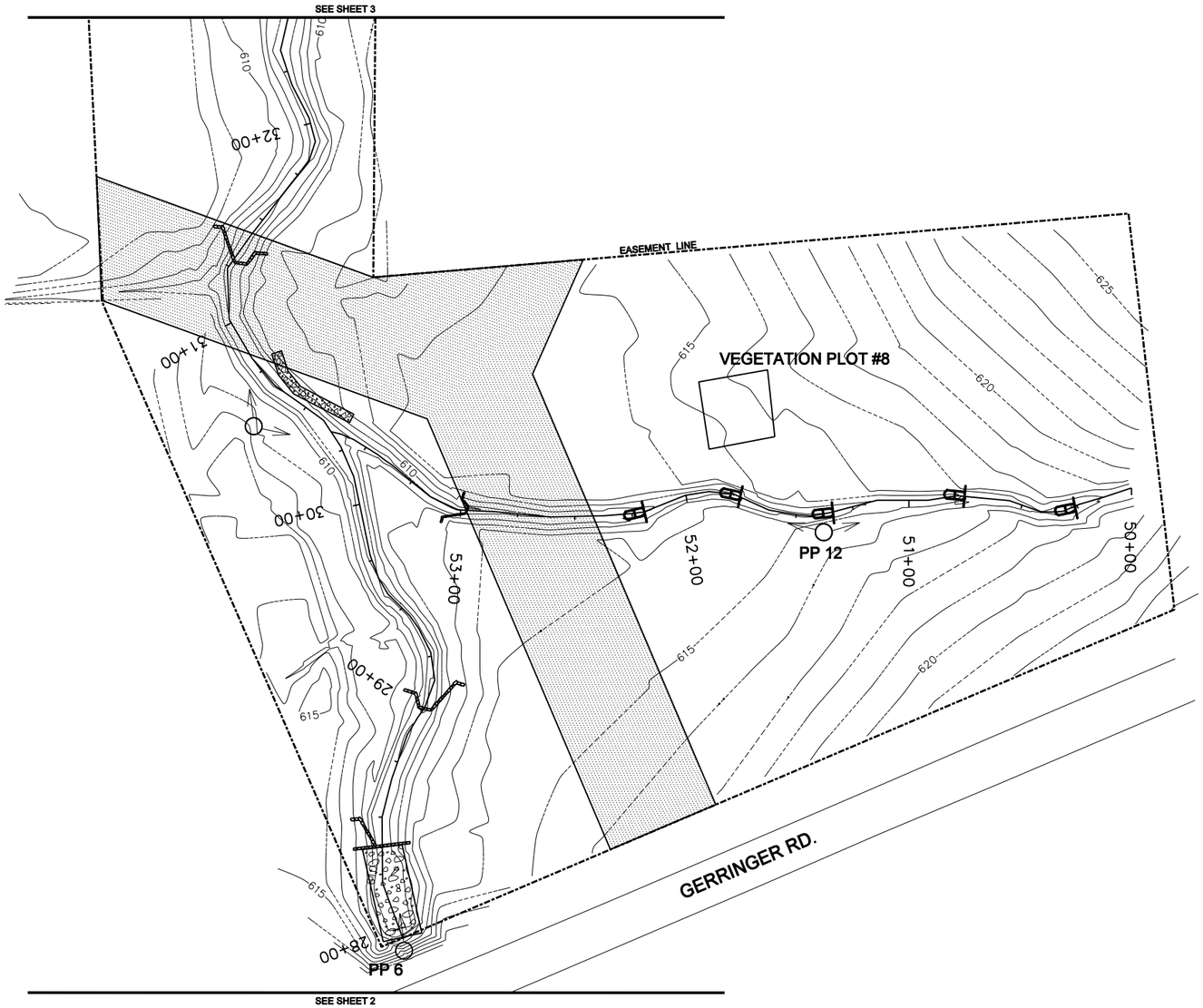
BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA

STATION 40+00 TO STATION 45+56

DATE: NOVEMBER 2007

SCALE: 1"=30'

MONITORING PLAN VIEW



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE (620)
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE (P)
- FENCE
- PHOTO REFERENCE POINT
- VEGETATION PLOT

N
NC GRID
NAD '83

–30 –15 0 30 60
GRAPHIC SCALE

REVISIONS

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GLEN RAVEN - UT TO HAW RIVER
STREAM RESTORATION PROJECT
BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA
STATION 50+00 TO STATION 53+70

DATE: NOVEMBER 2007
SCALE: 1"=30'

MONITORING
PLAN VIEW

SHEET 5 OF 5

2.0 PROJECT CONDITIONS AND MONITORING RESULTS

2.1 Vegetation Assessment

See vegetation assessment in Appendix A and Current Conditions Plan View in Appendix C.

2.2 Stream Assessment

See stream assessment in Appendix B and Current Conditions Plan View in Appendix C.

2.2.1 Bankfull Events

Table 5. Verification of Bankfull Events
Project Name: Glen Raven

Date of Data Collection	Date of Occurrence	Method	Photo Number
10/10/2007	10/10/2007	Stream Gauge	N/A
10/27/2007	10/27/2007	Stream Gauge	N/A

2.2.2 Quantitative Measures Summary Tables

Table 6a. Baseline UTHR Upstream Summary (10+00 - 27+96)
Project Name: Glen Raven

Parameter	Pre-existing Conditions			Project Reference			Design		As-built		
Dimension	Min	Mean	Max	Min	Mean	Max	Min	Max	Min	Mean	Max
Bankfull Width (ft)	9.5		15.4	14.8		18.8	15.9		15.0	15.8	16.6
Floodprone Width (ft)	>70		>90		>50		>40			>62	
Bankfull Cross-Sectional Area (ft^2)	14.7		23.6		25.0		21.0		21.2	24.7	28.0
Bankfull Mean Depth (ft)	1.3		1.7	1.3		1.8	1.3		1.4	1.6	1.7
Bankfull Max Depth (ft)	1.9		3.0	1.9		2.4	2.4		2.5	2.6	2.7
Width/Depth Ratio	6.1		11.5	9.0		14.0	12.0		9.8	10.2	10.6
Entrenchment Ratio	>5.0		>7.5		>2.5		>2.5			>3.6	
Bank Height Ratio	1.0		1.1				1.0		1.0	1.0	1.0
Pattern											
Channel Beltwidth (ft)	32		58		60		64	80	40		59
Radius of Curvature (ft)	16		43	0.9		5.9	48	80	26		84
Meander Wavelength (ft)	86		205	66		191	80	239	93		199
Meander Width Ratio	3.3		6.1		4.1		5	15	6		13
Profile											
Riffle Length (ft)									3	19.9	51
Riffle Slope (ft/ft)	0.004		0.05	0.013		0.035	0.010	0.019	0.001	0.017	0.041
Pool Length (ft)	10		47	14		33	24	40	5	18	45
Pool Spacing (ft)	20		80	50		105	40	119	17	76	241
Substrate											
d50 (mm)									12.1		
d84 (mm)									38.5		
Additional Reach Parameters											
Channel Length (ft)	1,811			N/A			1,779		1,796		
Sinuosity	1.2			1.3			1.3		1.1		
Water Surface Slope (ft/ft)	0.0043			0.005			0.0038		0.0048		
Rosgen Classification	E4/C4			C4			C4		C4		

Table 6b. Baseline UTHR Downstream Summary (27+97 - 38+56)
Project Name: Glen Raven

Parameter	Pre-existing Conditions			Project Reference			Design		As-built		
Dimension	Min	Mean	Max	Min	Mean	Max	Min	Max	Min	Mean	Max
Bankfull Width (ft)	14.6		18.3	14.8		18.8	17.3			20.9	
Floodprone Width (ft)	25		43		>50		>43			>70.7	
Bankfull Cross-Sectional Area (ft2)	20.8		27.2		25.0		25.0			28.0	
Bankfull Mean Depth (ft)	1.4		1.5	1.3		1.8	1.4			1.3	
Bankfull Max Depth (ft)	1.8		2.5	1.9		2.4	2.7			2.5	
Width/Depth Ratio	10.3		12.3	9.0		14.0	12.0			15.6	
Entrenchment Ratio	1.4		2.9		>2.5		>2.5			>2.5	
Bank Height Ratio	1.0		2.4				1.0			1.0	
Pattern											
Channel Beltwidth (ft)	34		53		60		69	87	31		64
Radius of Curvature (ft)	24		43	0.9		5.9	52	87	25		84
Meander Wavelength (ft)	75		112	66		191	87	260	73		136
Meander Width Ratio	2.3		3.6		4.1		4.0	5.0	3.5		6.5
Profile											
Riffle Length (ft)									7	21	44
Riffle Slope (ft/ft)	0.003		0.01	0.013		0.035	0.010	0.019	0.001	0.009	0.029
Pool Length (ft)	6		87	14		33	26	43	6	11	20
Pool Spacing (ft)	20		110	50		105	43	130	32	65	152
Substrate											
d50 (mm)									0.5		
d84 (mm)									28		
Additional Reach Parameters											
Channel length (ft)	1,045						1,073		1,059		
Sinuosity	1.25			1.3			1.3		1.1		
Water Surface Slope (ft/ft)	0.0043			0.005			0.0038		0.0032		
Rosgen Classification	E4/C4/F4			C4			C4		C4		

Table 6c. Baseline UT1
Project Name: Glen Raven

Parameter	Pre-existing Conditions			Project Reference			Design		As-built		
Dimension	Min	Mean	Max	Min	Mean	Max	Min	Max	Min	Mean	Max
Bankfull Width (ft)	2.1		5.5	7.7		10.8	8.4			10.0	
Floodprone Width (ft)	4.0		18.0	13.0		16.0	16.0			24.5	
Bankfull Cross-Sectional Area (ft^2)	0.9		4.9	6.1		8.8	0.8			0.9	
Bankfull Mean Depth (ft)	0.2		0.9	0.7		0.9	1.7			1.6	
Bankfull Max Depth (ft)	0.4		1.8	1.1		1.4	7.0			8.7	
Width/Depth Ratio	4.9		26.7	8.5		11.4	10.0			11.5	
Entrenchment Ratio	1.9		3.5	1.6		2.1	1.9			2.5	
Bank Height Ratio										1.5	
Pattern											
Channel Beltwidth (ft)	8		25		22		17	24	14		22
Radius of Curvature (ft)	28		138	1.0		3.0	8.0	25	12		32
Meander Wavelength (ft)	50		107	49		59	38	65	49		95
Meander Width Ratio	1.5		11.9	2.0		2.9	4.5	7.7	4.9		9.5
Substrate											
d50 (mm)									14		
d84 (mm)									45		
Additional Reach Parameters											
Channel length (ft)	524						556		542		
Sinuosity	1.1			1.2			1.2		1.1		
Water Surface Slope (ft/ft)	0.005			0.012			0.009		0.018		
Rosgen Classification	C4/G4			B4c			B4c		B4c		

Table 7a. Morphology and Hydraulic Monitoring Summary
Project Name: Glen Raven

Parameter	Cross-Section 1 Pool						Cross-Section 2 Riffle						Cross-Section 3 Pool					
Reach	UTHR (Upstream)						UTHR (Upstream)						UTHR (Upstream)					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	22.7	25.2					16.6	16.4					20.0	19.7				
Floodprone Width (ft)	-	-					>64	>64					-	-				
Bankfull Cross Sectional Area (ft^2)	44.2	45.2					28.0	27.4					29.6	27.1				
Bankfull Mean Depth (ft)	1.9	1.8					1.7	1.7					1.5	1.4				
Bankfull Max Depth (ft)	3.7	3.6					2.7	2.7					2.9	2.4				
Width/Depth Ratio	-	-					9.8	9.8					-	-				
Entrenchment Ratio	-	-					>3.6	>3.6					-	-				
Bank Height Ratio	-	-					1.0	1.0					-	-				
Wetted Perimeter (ft)	-	-					18.1	17.6					-	-				
Hydraulic Radius (ft)	-	-					1.5	1.6					-	-				
Substrate																		
d50 (mm)	0.4	1.1					17	18					0.6	3.4				
d84 (mm)	0.7	5.4					31	32					12	18				

Table 7b. Morphology and Hydraulic Monitoring Summary continued
Project Name: Glen Raven

Parameter	Cross-Section 4 Riffle						Cross-Section 5 Riffle						Cross-Section 6 Pool					
Reach	UTHR (Upstream)						UTHR (Downstream)						UTHR (Downstream)					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	15.0	15.4					20.9	20.0					20.6	22.2				
Floodprone Width (ft)	>62	>62					>71	>71					-	-				
Bankfull Cross Sectional Area (ft^2)	21.2	20.7					28.0	27.0					27.3	26.4				
Bankfull Mean Depth (ft)	1.4	1.3					1.3	1.4					1.3	1.2				
Bankfull Max Depth (ft)	2.5	2.5					2.5	2.6					2.9	2.9				
Width/Depth Ratio	10.6	11.5					15.6	14.8					-	-				
Entrenchment Ratio	>4	>4					>3	>3					-	-				
Bank Height Ratio	1.0	1.0					1.0	1.0					-	-				
Wetted Perimeter (ft)	-						21.7	20.8										
Hydraulic Radius (ft)	-						1.3	1.3										
Substrate																		
d50 (mm)	7.1	18					14	5.1					0.6	3.0				
d84 (mm)	46	54					45	45					18	13				

Table 7c. Morphology and Hydraulic Monitoring Summary con't.												
Project Name: Glen Raven												
Parameter	Cross-Section 7						Cross-Section 8					
	Riffle						Pool					
Reach	UT1						UT1					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	10	9.7					14.9	14.6				
Floodprone Width (ft)	25	25					-	-				
Bankfull Cross Sectional Area (ft^2)	8.7	9.2					14.1	12.7				
Bankfull Mean Depth (ft)	0.9	0.9					0.9	0.9				
Bankfull Max Depth (ft)	1.6	1.6					2.0	1.9				
Width/Depth Ratio	11.5	10.2					-	-				
Entrenchment Ratio	2.5	2.5					-	-				
Bank Height Ratio	1.0	1.0					-	-				
Wetted Perimeter (ft)	10.6	10.3					-	-				
Hydraulic Radius (ft)	0.8	0.9					-	-				
Substrate												
d50 (mm)	0.5	16					0.49	6.1				
d84 (mm)	28	50					20	25				

Table 7d. Morphology and Hydraulic Monitoring Summary continued
Project Name: Glen Raven

UTHR Upstream															
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)	40		59												
Radius of Curvature (ft)	26		84												
Meander Wavelength (ft)	93		199												
Meander Width Ratio	6		13												
Profile															
Riffle Length (ft)	3	49	15												
Riffle Slope (ft/ft)	0.005	0.042	0.015												
Pool Length (ft)	4	41	18												
Pool Spacing (ft)	23	199	74												
Additional Reach Parameters															
Channel Length (ft)	1,796														
Sinuosity	1.1														
Water Surface Slope (ft/ft)	0.0048														
Rosgen Classification	C4														

Table 7e. Morphology and Hydraulic Monitoring Summary continued
Project Name: Glen Raven

UTHR Downstream															
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)	31		64												
Radius of Curvature (ft)	25		84												
Meander Wavelength (ft)	73		136												
Meander Width Ratio	3.5		6.5												
Profile															
Riffle Length (ft)	3	35	15												
Riffle Slope (ft/ft)	0.001	0.071	0.013												
Pool Length (ft)	7	28	14												
Pool Spacing (ft)	29	195	51												
Additional Reach Parameters															
Channel Length (ft)	1,059														
Sinuosity	1.1														
Water Surface Slope (ft/ft)	0.0032														
Rosgen Classification	C4														

Table 7f. Morphology and Hydraulic Monitoring Summary continued
Project Name: Glen Raven

UT1															
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)	14		22												
Radius of Curvature (ft)	12		32												
Meander Wavelength (ft)	49		95												
Meander Width Ratio	4.9		9.5												
Profile															
Riffle Length (ft)	*	*	*												
Riffle Slope (ft/ft)	*	*	*												
Pool Length (ft)	2	15	6												
Pool Spacing (ft)	29	56	47												
Additional Reach Parameters															
Channel Length (ft)	542														
Sinuosity	1.1														
Water Surface Slope (ft/ft)	0.018														
Rosgen Classification	B4c														

*No riffle measurements due to no stream flow

Appendix A
Vegetation Data

Appendix A1: Vegetation Data

Table A1. Stem counts arranged by plot.
Project Name: Glen Raven

Species	Plots								Initial Totals	Year 1 Totals	Survival %
	1	2	3	4	5	6	7	8			
Shrubs											
Callicarpa americana	4								5	4	80%
Cephalanthus occidentalis						2	2		4	4	100%
Ilex verticillata	3	1			1		1		6	6	100%
Lindera benzoin		1	1		2		1		5	5	100%
Symphoricarpos orbiculatas	1	1	1		2			1	6	6	100%
Trees											
Betula nigra	1				1			2	4	4	100%
Carya aquatica				3		1			4	4	100%
Celtis laevigata			3		1				4	4	100%
Cornus amomum			1	3	1		1	4	10	10	100%
Diospyros virginiana	6		2	2					10	10	100%
Fraxinus pennsylvanica	1	1	1				6		10	9	90%
Juglans nigra				8		5			13	13	100%
Platanus occidentalis			3						4	3	75%
Quercus falcata						2			2	2	100%
Quercus michauxii		6	1		2		4	9	23	22	96%
Quercus pagoda				4					4	4	100%
Quercus phellos			2		2		3	1	8	8	100%
Salix nigra			4	1	2		3		10	10	100%
Salix sericea			2	1	1			4	8	8	100%
Unknown	2	1	2	1	3	3			23	12	52%

Table A2. Vegetation History (stems/acre)
Project Name: Glen Raven

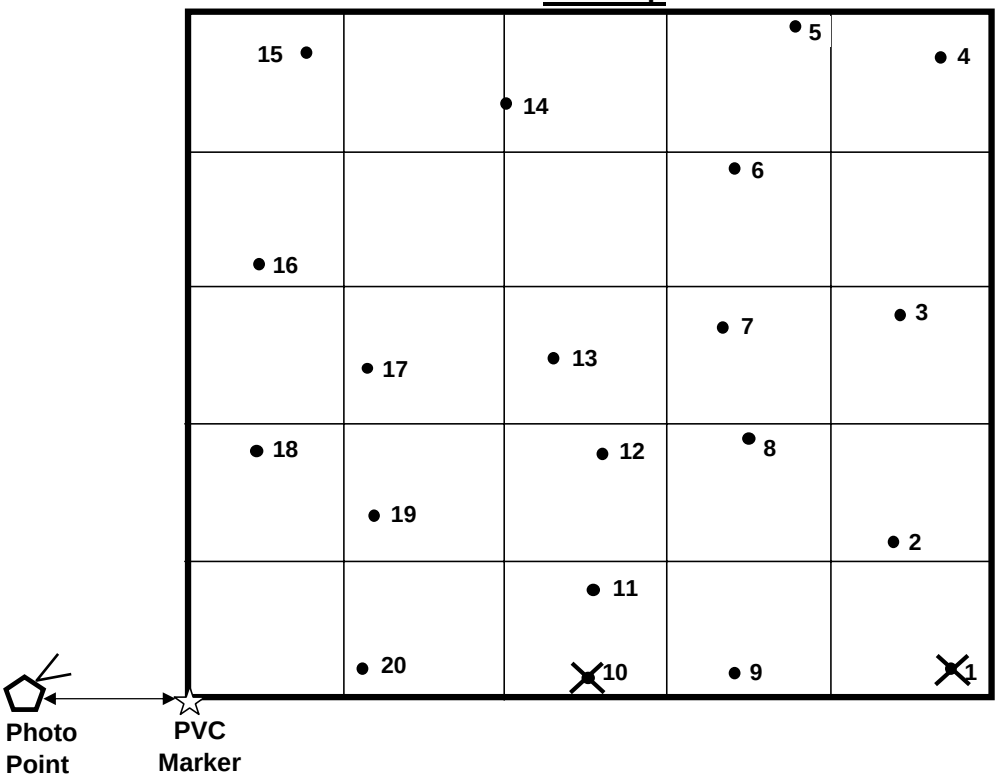
Plot Number	MY-00	MY-01	MY-02	MY-03	MY-04	MY-05
1	840	720				
2	720	440				
3	1,120	920				
4	920	920				
5	920	720				
6	600	520				
7	880	840				
8	840	840				

The planted vegetation on the site is growing well with high rates of survival. The poor survivability of the unknown category of planted stems is due to many of these trees being properly identified and put into the appropriate species category during the first year monitoring. Most of the floodplain and stream banks have established vegetation. Some invasive species have been identified on the site, which include Chinese lespedeza (*Lespedeza cuneata*), multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*). Due to the suburban nature of the project site, most of these exotic plants are likely introduced from properties adjacent to the project. The exotic vegetation is not widespread across the project, but these populations will be monitored to determine if control measures will be required in the future.

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 1 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	*Quercus sp.*			Dead
2	Persimmon (*Diospyros virginiana*)	0.70	2	Browsed
3	Unknown	0.38	1	Browsed (no leaves)
4	Beautyberry (*Callicarpa americana)*	0.62	1	
5	Coralberry (*Symphoricarpos obiculatas*)	0.69	2	
6	Persimmon (*Diospyros virginiana*)	0.62	2	Browsed
7	Winterberry (*Ilex verticillata*)	0.20	2	
8	Persimmon (*Diospyros virginiana*)	0.63	4	
9	River Birch (*Betula nigra)*	0.70	2	Browsed
10	Green Ash (*Fraxinus pennsylvanica*)			Dead
11	Beautyberry (*Callicarpa americana)*	0.54	4	
12	Winterberry (*Ilex verticillata*)	0.28	3	
13	Unknown	0.59	1	Browsed (no leaves)
14	Persimmon (*Diospyros virginiana*)	0.50	3	
15	Beautyberry (*Callicarpa americana)*	0.47	1	Browsed
16	Beautyberry (*Callicarpa americana)*	0.51	3	
17	Persimmon (*Diospyros virginiana*)	0.49	1	
18	Winterberry (*Ilex verticillata*)	0.15	1	
19	Persimmon (*Diospyros virginiana*)	0.52	3	
20	Green Ash (*Fraxinus pennsylvanica*)	0.58	3	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Coralberry (*Symphoricarpos obiculatas*)	5.6%
River Birch (*Betula nigra*)	5.6%
Green Ash (*Fraxinus pennsylvanica*)	5.6%
Beautyberry (*Callicarpa americana*)	22.2%
Winterberry (*Ilex verticillata*)	16.7%
Persimmon (*Diospyros virginiana*)	33.3%
Unknown	11.1%

Density:

Total Number of Trees **18** / **0.025 acres** = **720** **trees / acre**

Survivability:

Total Number of Trees **18** / **20 trees** **x** **100** = **90** **% survivability**

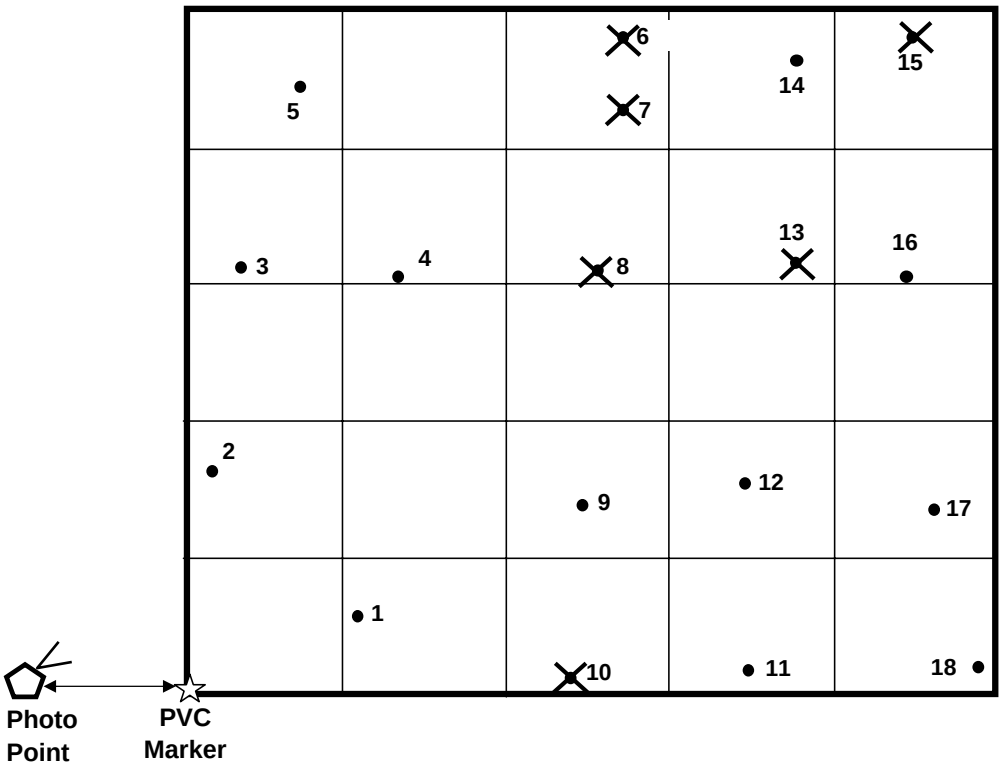
Previous

Current

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 2 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Winterberry (*Ilex verticillata*)	0.26	2	Browsed
2	Swamp Chestnut Oak (*Quercus michauxii*)	0.47	2	
3	Spicebush (*Lindera benzoin*)	0.49	3	Browsed
4	Coralberry (*Symphoricarpos obiculatas*)	0.57	4	
5	*Quercus sp.*			Dead
6	*Quercus sp.*			Dead
7	*Quercus sp.*			Dead
8	Swamp Chestnut Oak (*Quercus michauxii*)			Dead
9	Swamp Chestnut Oak (*Quercus michauxii*)	0.53	3	
10	Swamp Chestnut Oak (*Quercus michauxii*)			Dead
11	Unknown	0.62	1	No leaves
12	Swamp Chestnut Oak (*Quercus michauxii*)	0.57	3	
13	Green Ash (*Fraxinus pennsylvanica*)			Missing
14	Green Ash (*Fraxinus pennsylvanica*)	0.58	3	
15	Unknown			Missing
16	Swamp Chestnut Oak (*Quercus michauxii*)	0.55	3	
17	Swamp Chestnut Oak (*Quercus michauxii*)	0.52	2	Browsed
18	Swamp Chestnut Oak (*Quercus michauxii*)	0.48	3	Browsed

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green Ash (*Fraxinus pennsylvanica*)	9.1%
Winterberry (*Ilex verticillata*)	9.1%
Swamp Chestnut Oak (*Quercus michauxii*)	54.5%
Coralberry (*Symphoricarpos obiculatas*)	9.1%
Spicebush (*Lindera benzoin*)	9.1%
Unknown	9.1%

Density:

Total Number of Trees **11** / **0.025 acres** = **440** **trees / acre**

Survivability:

Total Number of Trees **11** / **18 trees** **x** **100** = **61** **% survivability**

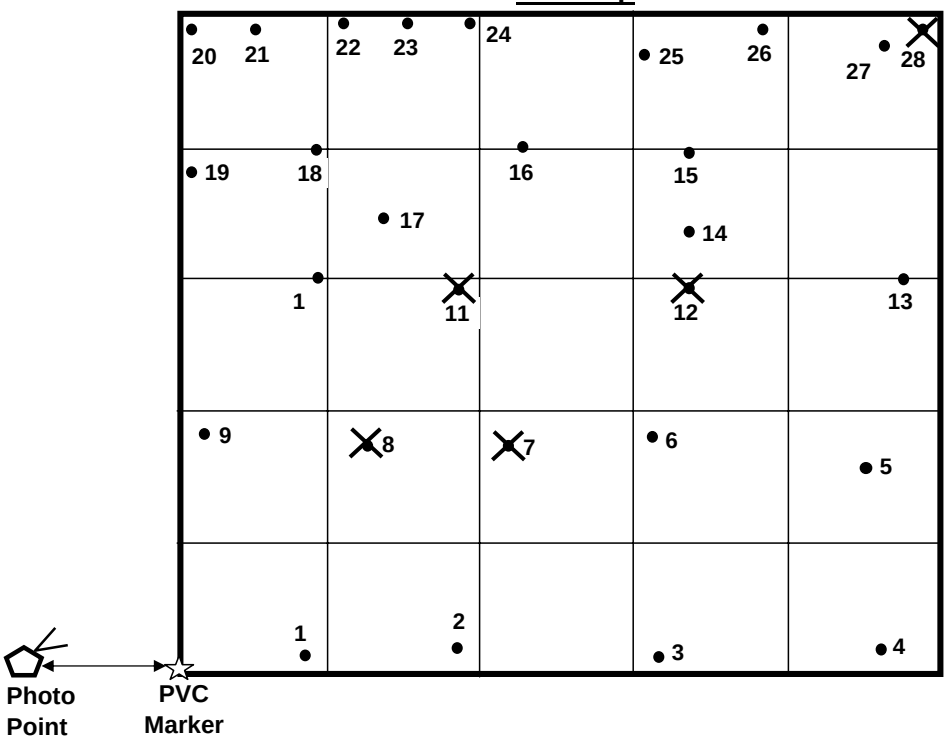
Previous

Current

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 3 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Sugarberry (*Celtis laevigata*)	0.41	3	Resprout
2	Sugarberry (*Celtis laevigata*)	0.25	3	Resprout
3	Sugarberry (*Celtis laevigata*)	0.24	3	Resprout
4	Unknown	0.67	1	No leaves
5	Persimmon (*Diospyros viginiana*)	0.50	3	
6	Persimmon (*Diospyros viginiana*)	0.16	2	Resprout
7	Unknown			Dead
8	Unknown			Dead
9	Willow Oak (*Quercus phellos*)	0.14	2	Resprout
10	Swamp Chestnut Oak (*Quercus michauxii*)	0.51	3	
11	Unknown			Dead
12	Unknown			Dead
13	Willow Oak (*Quercus phellos*)	0.58	2	
14	Spicebush (*Lindera benzoin)*	0.45	4	
15	Sycamore (*Platanus occidentalis)*	0.55	3	Browsed
16	Sycamore (*Platanus occidentalis)*	0.53	3	Browsed
17	Coralberry (*Symphoricarpos orbiculatas)*	0.64	4	
18	Sycamore (*Platanus occidentalis)*	0.55	2	
19	Green Ash (*Fraxinus pennsylvanica)*	0.97	3	
20	Black Willow (*Salix nigra)*	0	4	Live Stake
21	Black Willow (*Salix nigra)*	0	3	Live Stake
22	Black Willow (*Salix nigra)*	0	4	Live Stake
23	Unknown	0	1	Live Stake (no leaves)
24	Silky Dogwood (*Cornus amomum*)	0	3	Live Stake
25	Black Willow (*Salix nigra)*	0	3	Live Stake
26	Silky Willow (*Salix sericea)*	0	4	Live Stake
27	Silky Willow (*Salix sericea)*	0	4	Live Stake
28	Unknown			Dead

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Spicebush (*Lindera benzoin*)	4.3%
Swamp Chestnut Oak (*Quercus michauxii*)	4.3%
Sycamore (*Platanus occidentalis*)	13.0%
Coralberry (*Symphoricarpos orbiculatas*)	4.3%
Green Ash (*Fraxinus pennsylvanica*)	4.3%
Black Willow (*Salix nigra*)	17.4%
Silky Willow (*Salix sericea*)	8.7%
Sugarberry (*Celtis laevigata*)	13.0%
Persimmon (*Diospyros viginiana*)	8.7%
Silky Dogwood (*Cornus amomum*)	4.3%
Willow Oak (*Quercus phellos*)	8.7%
Unknown	8.7%

Density:

Total Number of Trees **23** / **0.025 acres** = **920** **trees / acre**

Survivability:

Total Number of Trees **23** / **28 trees** **x** **100** = **82** **% survivability**

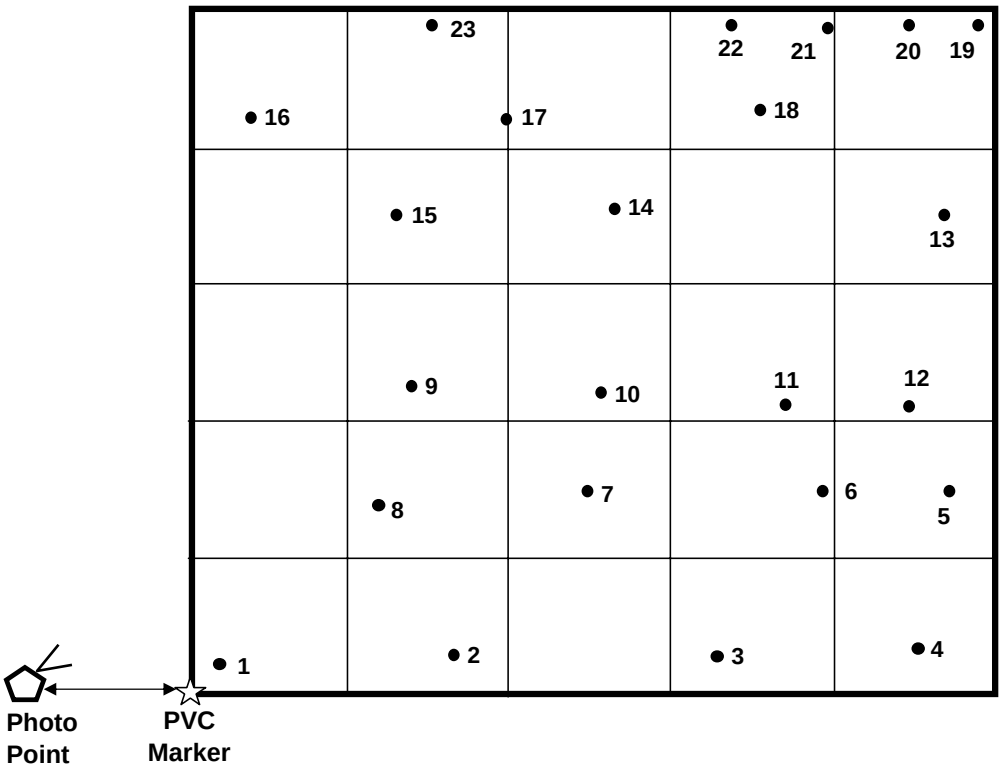
Previous

Current

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 4 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Cherrybark Oak (*Quercus pagoda*)	0.10	2	Resprout
2	Black Walnut (*Juglans nigra)*	0.39	3	
3	Black Walnut (*Juglans nigra)*	0.39	2	
4	Cherrybark Oak (*Quercus pagoda*)	0.15	3	Resprout
5	Cherrybark Oak (*Quercus pagoda*)	0.39	3	
6	Black Walnut (*Juglans nigra)*	0.56	3	
7	Black Walnut (*Juglans nigra)*	0.54	3	
8	Black Walnut (*Juglans nigra)*	0.30	3	
9	Shagbark Hickory (*Carya ovata)*	0.19	3	
10	Shagbark Hickory (*Carya ovata*)	0.47	2	
11	Persimmon (*Diospyros virginana*)	0.76	3	
12	Shagbark Hickory (*Carya ovata)*	0.16	3	
13	Persimmon (*Diospyros virginana*)	0.72	4	
14	Unknown	0.38	1	No leaves
15	Cherrybark Oak (*Quercus pagoda*)	0.70	3	
16	Black Walnut (*Juglans nigra)*	0.56	3	
17	Black Walnut (*Juglans nigra)*	0.20	1	
18	Black Walnut (*Juglans nigra)*	0.52	3	
19	Silky Dogwood (*Cornus amomum*)	0	3	Live Stake
20	Silky Dogwood (*Cornus amomum*)	0	3	Live Stake
21	Silky Willow (*Salix sericea)*	0	2	Live Stake
22	Black Willow (*Salix nigra)*	0	3	Live Stake
23	Silky Dogwood (*Cornus amomum*)	0	2	Live Stake

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Black Walnut (*Juglans nigra*)	34.8%
Shagbark Hickory (*Carya ovata*)	13.0%
Silky Willow (*Salix sericea*)	4.3%
Black Willow (*Salix nigra*)	4.3%
Persimmon (*Diospyros virginana*)	8.7%
Cherrybark Oak (*Quercus pagoda*)	17.4%
Silky Dogwood (*Cornus amomum*)	13.0%
Unknown	4.3%

Density:

Total Number of Trees **23** / **0.025 acres** = **920** **trees / acre**

Survivability:

Total Number of Trees **23** / **23 trees** x **100** = **100** **% survivability**

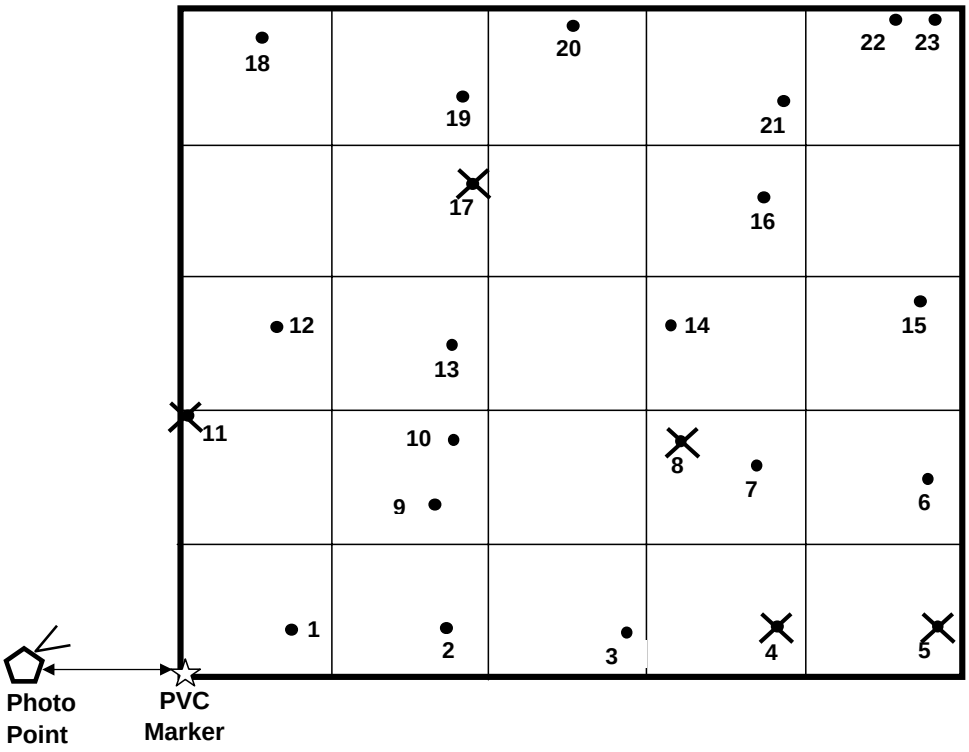
Previous

Current

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 5 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Willow Oak (*Quercus phellos*)	0.35	3	Resprout
2	River Birch *(Betula nigra)*	0.74	2	
3	Unknown	0.25	1	No leaves
4	Unknown			Dead
5	Unknown			Dead
6	Unknown	0.58	1	No leaves
7	Coralberry *(Symphoricarpos orbiculatas)*	0.65	4	
8	Unknown			Dead
9	Coralberry *(Symphoricarpos orbiculatas)*	0.67	3	
10	Unknown	0.46	1	No leaves
11	Unknown			Dead
12	Sugarberry (*Celtis laevigata*)	0.36	2	Top died back
13	Swamp Chestnut Oak (*Quercus michauxii*)	0.55	3	
14	Swamp Chestnut Oak (*Quercus michauxii*)	0.45	3	
15	Spicebush (*Lindera benzoin*)	0.35	3	Main stem died back
16	Willow Oak (*Quercus phellos*)	0.49	3	
17	Unknown			Dead
18	Black Willow *(Salix nigra)*	0	3	Live Stake
19	Winterberry *(Ilex verticulata)*	0.54	3	
20	Silky Willow *(Salix sericea)*	0	4	Live Stake
21	Spicebush *(Lindera benzoin)*	0.26	2	Browsed
22	Black Willow *(Salix nigra)*	0	2	Live Stake
23	Silky Dogwood (*Cornus amomum)*	0	3	Live Stake

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
River Birch (*Betula nigra*)	5.6%
Coralberry (*Symphoricarpos orbiculatas*)	11.1%
Black Willow (*Salix nigra*)	11.1%
Swamp Chestnut Oak (*Quercus michauxii*)	11.1%
Winterberry (*Ilex verticulata*)	5.6%
Silky Willow (*Salix sericea*)	5.6%
Silky Dogwood (*Cornus amomum*)	5.6%
Spicebush (*Lindera benzoin*)	11.1%
Willow Oak (*Quercus phellos*)	11.1%
Sugarberry (*Celtis laevigata*)	5.6%
Unknown	16.7%

Density:

Total Number of Trees **18** / **0.025 acres** = **720** **trees / acre**

Survivability:

Total Number of Trees **18** / **23 trees** x **100** = **78** **% survivability**

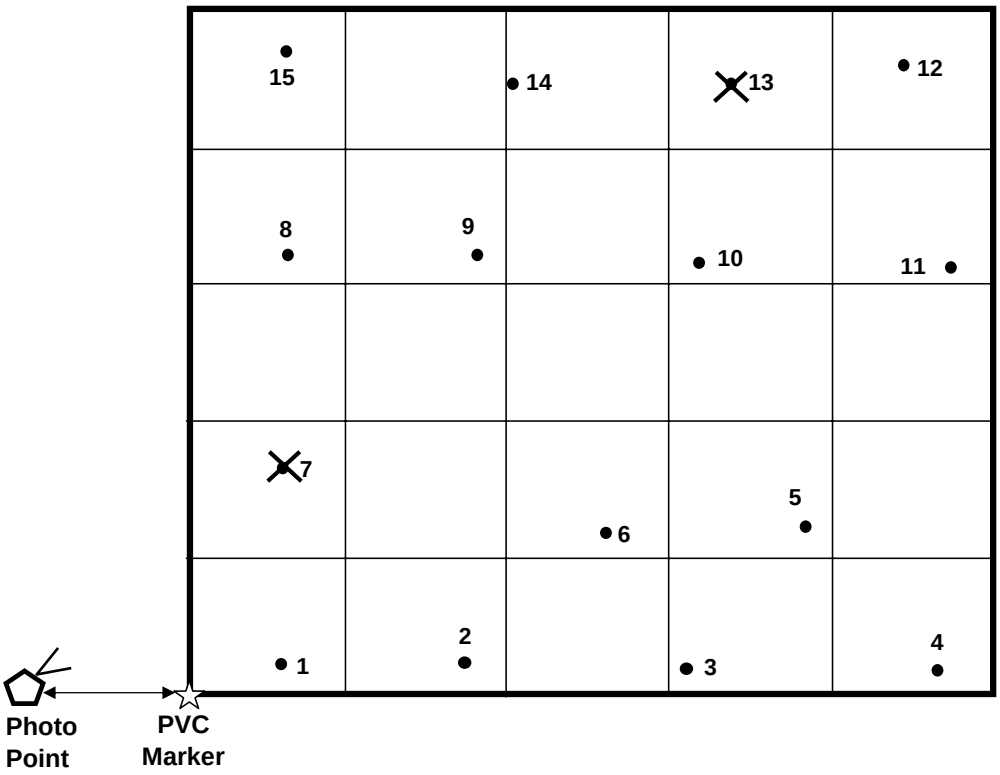
Previous

Current

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 6 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Buttonbush (*Cephalanthus occidentalis*)	0.23	1	Top died back
2	Black Walnut (*Juglans nigra*)	0.47	3	
3	Persimmon (*Diospyros virginiana*)	0.38	3	
4	Black Walnut (*Juglans nigra*)	0.46	2	
5	Black Walnut (*Juglans nigra*)	0.48	3	
6	Southern Red Oak (*Quercus falcata*)	0.58	3	
7	Shagbark Hickory (*Carya ovata*)			Missing
8	Unknown	0.38	1	No leaves
9	Black Walnut (*Juglans nigra*)	0.23	1	
10	Unknown	0.37	1	No leaves
11	Unknown	0.70	1	No leaves
12	Black Walnut (*Juglans nigra*)	0.52	3	
13	Unknown			Dead
14	Buttonbush (*Cephalanthus occidentalis*)	0.51	3	
15	Southern Red Oak (*Quercus falcata*)	0.38	2	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Black Walnut (*Juglans nigra*)	38.5%
Southern Red Oak (*Quercus falcata*)	15.4%
Shagbark Hickory (*Carya ovata*)	7.7%
Buttonbush (*Cephalanthus occidentalis*)	15.4%
Unknown	23.1%

Density:

Total Number of Trees **13** / **0.025 acres** = **520** **trees / acre**

Survivability:

Total Number of Trees **13** / **15 trees** x **100** = **87** **% survivability**

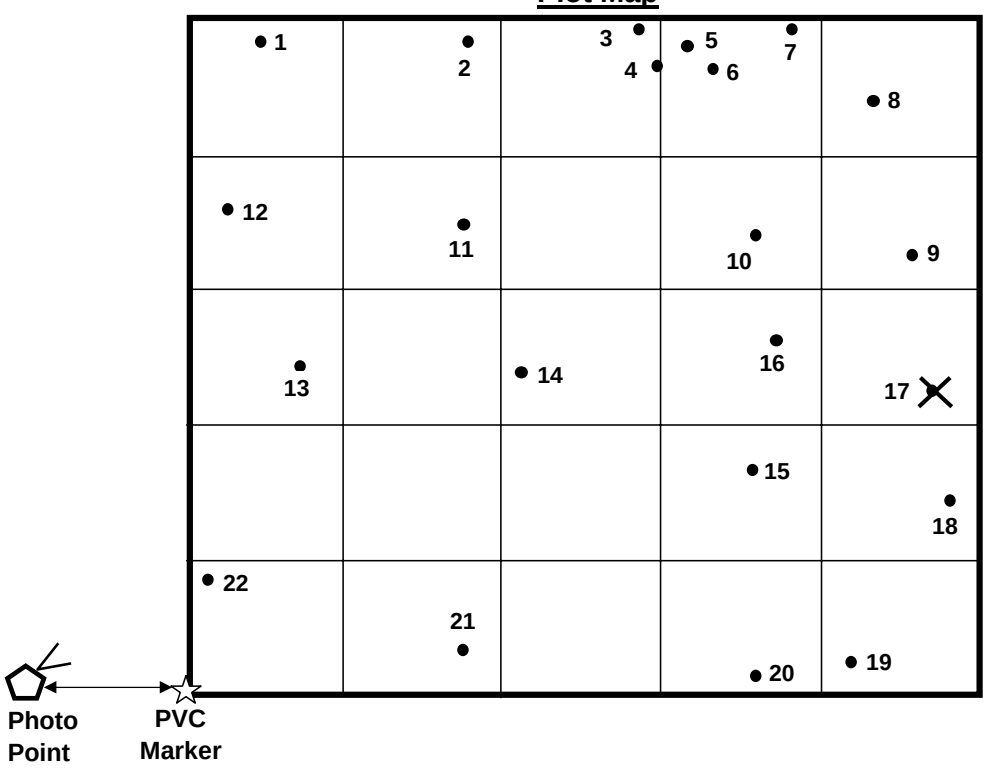
Previous

Current

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 7 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Willow Oak (*Quercus phellos*)	0.62	4	
2	Swamp Chestnut Oak (*Quercus michauxii*)	0.70	4	
3	Black Willow (*Salix nigra*)	0	3	Live Stake
4	Black Willow (*Salix nigra*)	0	2	Live Stake
5	Black Willow (*Salix nigra*)	0	2	Live Stake
6	Black Willow (*Salix nigra*)	0	2	Live Stake
7	Silky Dogwood (*Cornus amomum*)	0	3	Live Stake
8	Winterberry (*Ilex verticulata*)	0.27	3	
9	Green Ash (*Fraxinus pennsylvanica*)	0.79	4	
10	Green Ash (*Fraxinus pennsylvanica*)	0.58	3	
11	Green Ash (*Fraxinus pennsylvanica*)	0.60	3	Browsed
12	Swamp Chestnut Oak (*Quercus michauxii*)	0.55	3	
13	Green Ash (*Fraxinus pennsylvanica*)	0.69	3	
14	Willow Oak (*Quercus phellos*)	0.77	3	
15	Green Ash (*Fraxinus pennsylvanica*)	0.53	3	
16	Swamp Chestnut Oak (*Quercus michauxii*)	0.57	3	
17	Green Ash (*Fraxinus pennsylvanica*)			Missing
18	Willow Oak (*Quercus phellos*)	0.69	3	
19	Buttonbush (*Cephalanthus occidentalius*)	0.32	3	
20	Swamp Chestnut Oak (*Quercus michauxii*)	0.51	4	
21	Buttonbush (*Cephalanthus occidentalius*)	0.43	3	
22	Green Ash (*Fraxinus pennsylvanica*)	0.68	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Willow Oak (*Quercus phellos*)	14.3%
Green Ash (*Fraxinus pennsylvanica*)	28.6%
Swamp Chestnut Oak (*Quercus michauxii*)	19.0%
Black Willow (*Salix nigra*)	14.3%
Silky Dogwood (*Cornus amomum*)	4.8%
Winterberry (*Ilex verticulata*)	4.8%
Spicebush (*Lindera benzoin*)	4.8%
Buttonbush (*Cephalanthus occidentalius*)	9.5%

Density:

Total Number of Trees **21** / **0.025 acres** = **840** **trees / acre**

Survivability:

Total Number of Trees **21** / **22 trees** **x** **100** = **95** **% survivability**

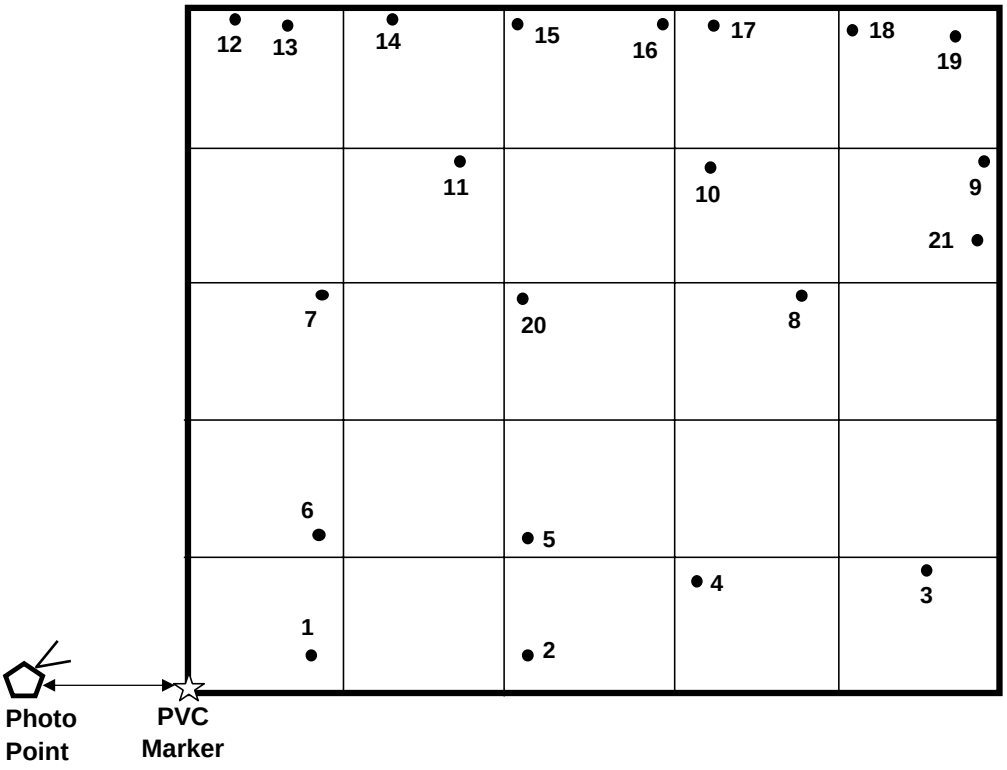
Previous

Current

Vegetation Monitoring Worksheet

Site: Glen Raven **Plot:** 8 **Date:** 9/12/2007

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	River Birch (*Betula nigra*)	0.62	4	
2	Willow Oak (*Quercus phellos*)	0.48	3	
3	River Birch (*Betula nigra*)	0.55	3	
4	Swamp Chestnut Oak (*Quercus michauxii*)	0.36	3	
5	Swamp Chestnut Oak (*Quercus michauxii*)	0.58	3	
6	Swamp Chestnut Oak (*Quercus michauxii*)	0.67	4	
7	Swamp Chestnut Oak (*Quercus michauxii*)	0.62	3	
8	Swamp Chestnut Oak (*Quercus michauxii*)	0.39	3	
9	Swamp Chestnut Oak (*Quercus michauxii*)	0.54	3	
10	Swamp Chestnut Oak (*Quercus michauxii*)	0.52	3	
11	Swamp Chestnut Oak (*Quercus michauxii*)	0.60	3	
12	Silky Willow (*Salix sericea*)	0	3	Live Stake
13	Silky Dogwood (*Cornus amomum*)	0	3	Live Stake
14	Silky Dogwood (*Cornus amomum*)	0	1	Live Stake
15	Silky Dogwood (*Cornus amomum*)	0	3	Live Stake
16	Silky Willow (*Salix sericea*)	0	3	Live Stake
17	Silky Dogwood (*Cornus amomum*)	0	3	Live Stake
18	Silky Willow (*Salix sericea*)	0	2	Live Stake
19	Silky Willow (*Salix sericea*)	0	2	Live Stake
20	Swamp Chestnut Oak (*Quercus michauxii*)	0.57	3	
21	Coralberry (*Symphoricarpos orbiculatas*)	0.5	2	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
River Birch (*Betula nigra*)	9.5%
Swamp Chestnut Oak (*Quercus michauxii*)	42.9%
Silky Dogwood (*Cornus amomum*)	19.0%
Silky Willow (*Salix sericea*)	19.0%
Willow Oak *(Quercus phellos)*	4.8%
Coralberry (*Symphoricarpos orbiculatas*)	4.8%

Density:

Total Number of Trees **21** / **0.025 acres** = **840** **trees / acre**

Survivability:

Total Number of Trees **21** / **21 trees** **x** **100** = **100** **% survivability**

Previous

Current

Appendix B
Geomorphologic Data

Appendix B1: Representative Stream Problem Area Photos

SP1 – Problem area #1. Erosion on toe of bank beneath matting. 10/3/07 - MY 01

SP2 – Problem Area #4. Bank erosion beneath washed away matting. 10/3/07 - MY 01

SP3 – Problem Area #11. Bank erosion on toe of bank beneath matting. 10/3/07 - MY 01

SP4 – Problem Area #17. Bank and floodplain erosion beneath washed away matting and remaining matting. 10/3/07 - MY 01

Appendix B2 –Stream Photo Station Photos

Photo Point 1: View looking north from Power Line Road. 11/16/07 – MY-01

Photo Point 2a: View looking south near Station 13+25. 11/16/07 – MY-01

Photo Point 2b: View looking north near Station 13+25. 11/16/07 – MY-01

Photo Point 3a: View looking south near Station 16+75. 11/16/07 – MY-01

Photo Point 3b: View looking north toward vegetation plot #2. 11/16/07 – MY-01

Photo Point 4a: View looking south near Station 22+75. 11/16/07 – MY-01

Photo Point 4b: View looking north toward vegetation plot #3. 11/16/07 – MY-01

Photo Point 5: View looking south from Gerringer Road culvert. 11/16/07 – MY-01

Photo Point 6: View looking north from Gerringer Road culvert. 11/16/07 – MY-01

Photo Point 7a: View looking south at confluence of UT2 and UTHR. 11/16/07 – MY-01

Photo Point 7b: View looking north near Station 31+15. 11/16/07 – MY-01

Photo Point 8: View looking south near vegetation plot #7. 11/16/07 – MY-01

Photo Point 9a: View looking north toward vegetation plot #8. 11/16/07 – MY-01

Photo Point 9b: View looking north toward end of project. 11/16/07 – MY-01

Photo Point 10a: View looking upstream on UT1 near Station 41+25. 11/16/07 – MY-01

Photo Point 10b: View looking downstream on UT1 near Station 41+25. 11/16/07 – MY-01

Photo Point 11a: View looking east on UT1 with vegetation plot #4 on right. 11/16/07 – MY-01

Photo Point 11b: View looking downstream on UT1 before it enters UTHR. 11/16/07 – MY-01

Photo Point 12a: View looking upstream on UT2. 11/16/07 – MY-01

Photo Point 12b: View looking downstream on UT2 before it enters UTHR. 11/16/07 – MY-01

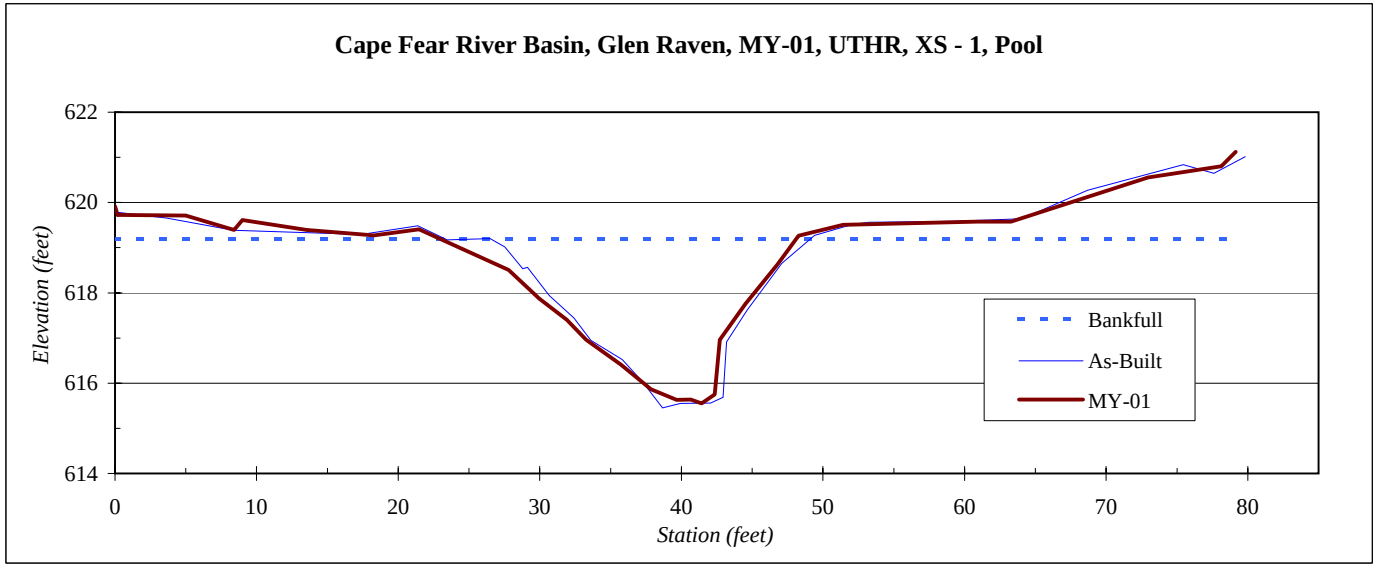
Appendix B3: Cross Section Plots

River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UTHR
XS ID	XS - 1, Pool
Drainage Area (sq mi):	1.09
Date:	9/26/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	619.9
0.2	619.7
5.0	619.7
8.4	619.4
9.0	619.6
13.5	619.4
18.3	619.3
21.5	619.4
27.8	618.5
29.9	617.9
31.9	617.4
33.3	617.0
35.7	616.4
37.9	615.9
39.7	615.6
40.7	615.6
41.4	615.6
42.4	615.8
42.7	617.0
44.5	617.8
46.8	618.6
48.3	619.3
51.4	619.5
60.9	619.6
63.3	619.6
72.9	620.6
78.1	620.8
79.1	621.1

SUMMARY DATA	
Bankfull Elevation:	619.2
Bankfull Cross-Sectional Area:	45.2
Bankfull Width:	25.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.6
Mean Depth at Bankfull:	1.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C4

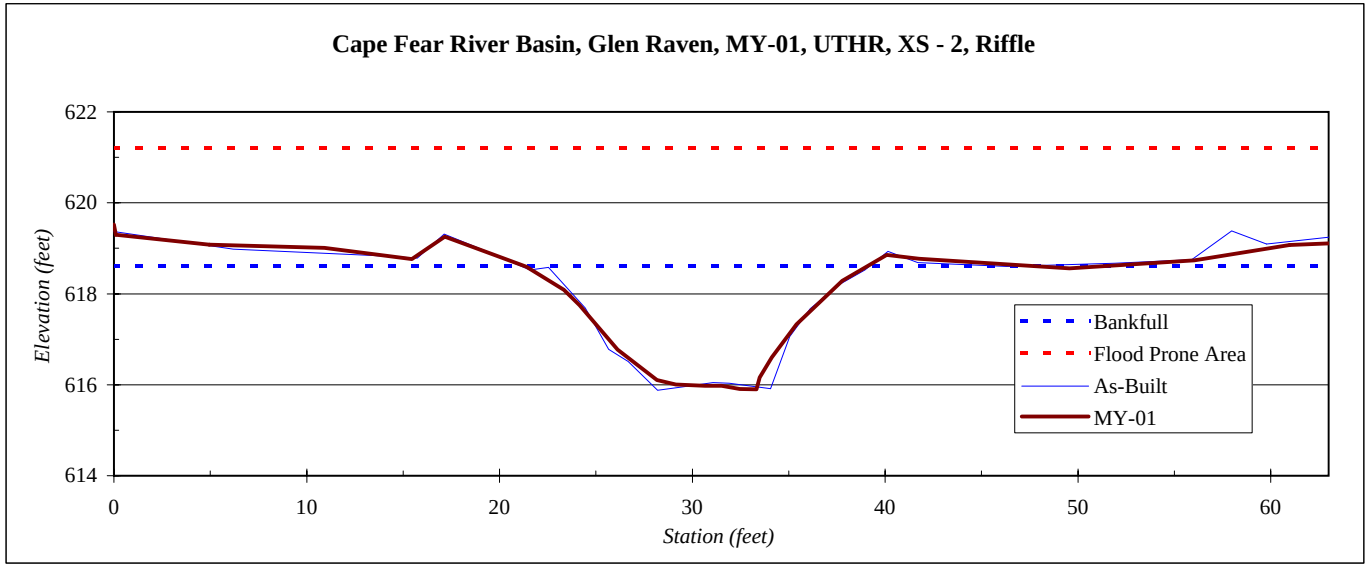


River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UTHR
XS ID	XS - 2, Riffle
Drainage Area (sq mi):	1.09
Date:	9/26/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	619.5
0.1	619.3
5.0	619.1
10.9	619.0
15.5	618.8
17.2	619.3
21.4	618.6
23.3	618.1
24.2	617.7
26.1	616.8
28.2	616.1
29.1	616.0
30.7	616.0
31.5	616.0
32.5	615.9
33.3	615.9
33.5	616.2
34.1	616.6
35.4	617.3
37.8	618.3
40.1	618.9
41.8	618.8
49.6	618.6
56.0	618.7
61.0	619.1
64.6	619.1
64.9	619.4

SUMMARY DATA	
Bankfull Elevation:	618.6
Bankfull Cross-Sectional Area:	27.4
Bankfull Width:	16.4
Flood Prone Area Elevation:	621.2
Flood Prone Width:	>65
Max Depth at Bankfull:	2.7
Mean Depth at Bankfull:	1.7
W / D Ratio:	9.8
Entrenchment Ratio:	>3.6
Bank Height Ratio:	1.0

Stream Type	C4

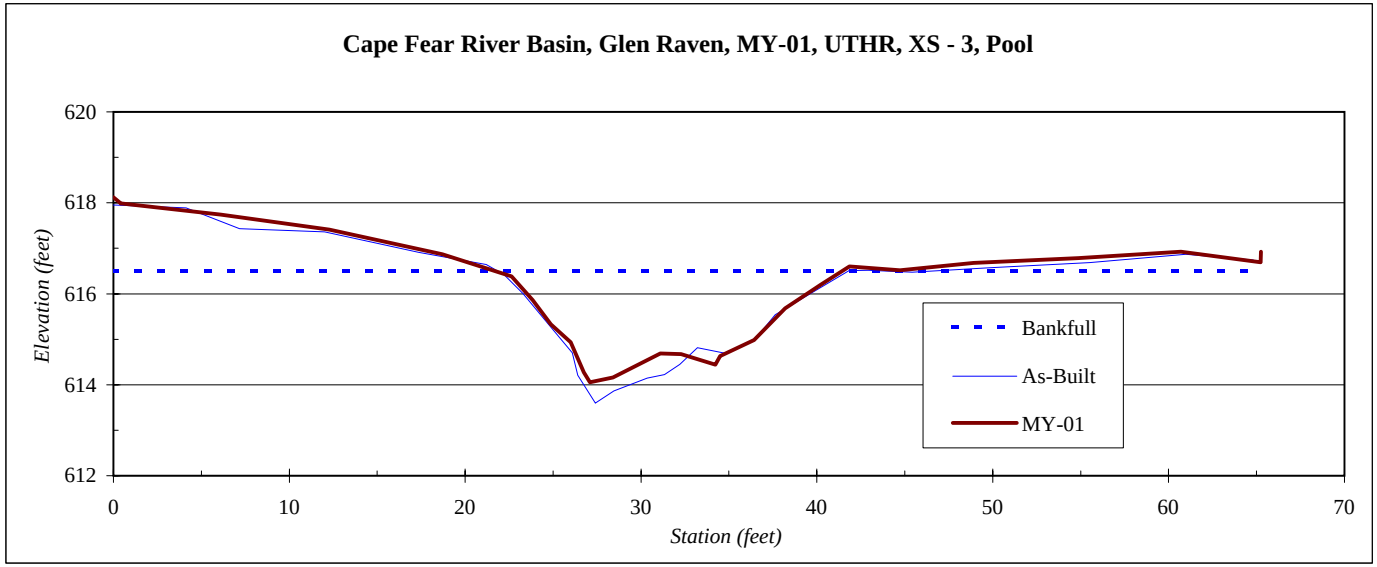


River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UTHR
XS ID	XS - 3, Pool
Drainage Area (sq mi):	1.09
Date:	9/27/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	618.0
4.1	617.9
7.2	617.4
12.0	617.4
17.4	616.9
21.2	616.6
22.2	616.4
23.3	616.0
25.0	615.2
26.1	614.7
26.4	614.2
27.4	613.6
28.5	613.9
30.3	614.1
31.3	614.2
32.2	614.4
33.2	614.8
34.9	614.7
36.4	615.0
37.6	615.5
39.9	616.1
41.8	616.5
42.9	616.5
45.4	616.5
49.8	616.6
55.5	616.7
61.0	616.9
64.8	616.7

SUMMARY DATA	
Bankfull Elevation:	616.5
Bankfull Cross-Sectional Area:	27.1
Bankfull Width:	19.7
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	1.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C4

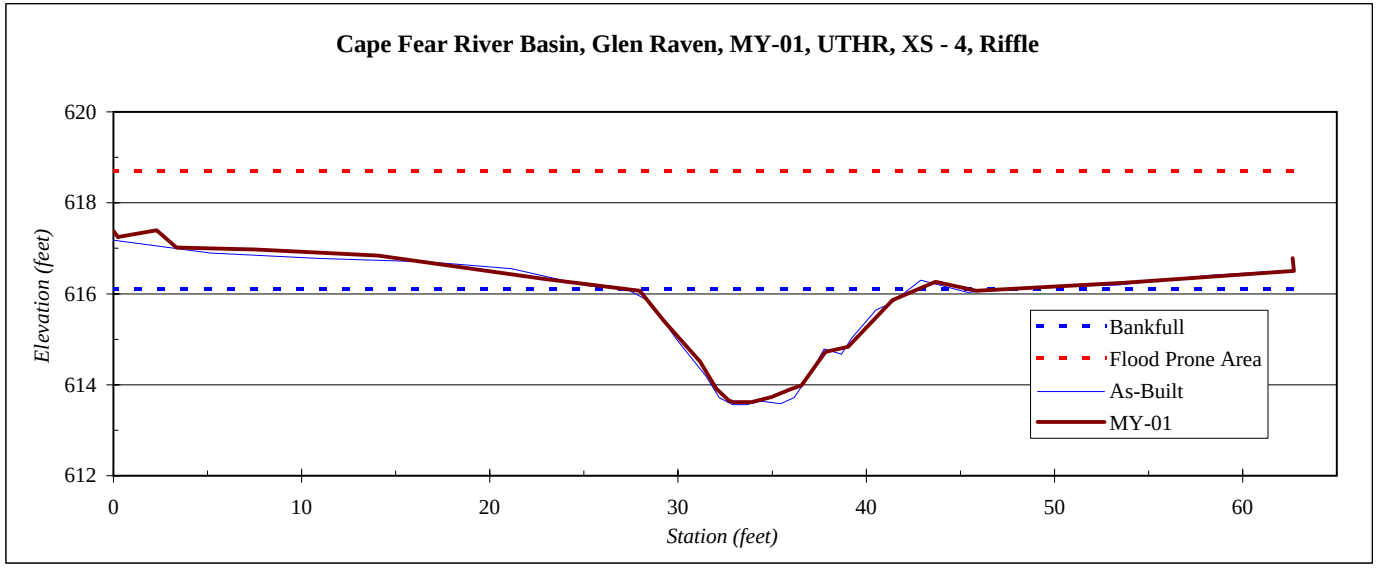


River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UTHR
XS ID	XS - 4, Riffle
Drainage Area (sq mi):	1.09
Date:	9/27/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	617.4
0.2	617.3
2.3	617.4
3.3	617.0
7.5	617.0
14.0	616.8
23.0	616.3
28.0	616.1
29.2	615.4
31.2	614.5
32.0	613.9
32.7	613.7
32.9	613.6
33.9	613.6
35.0	613.7
36.0	613.9
36.5	614.0
37.8	614.7
39.0	614.8
41.4	615.9
43.7	616.3
45.9	616.1
53.7	616.2
62.7	616.5
62.7	616.8

SUMMARY DATA	
Bankfull Elevation:	616.1
Bankfull Cross-Sectional Area:	20.7
Bankfull Width:	15.4
Flood Prone Area Elevation:	618.7
Flood Prone Width:	>62
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	1.3
W / D Ratio:	11.5
Entrenchment Ratio:	>4
Bank Height Ratio:	1.0

Stream Type	C4

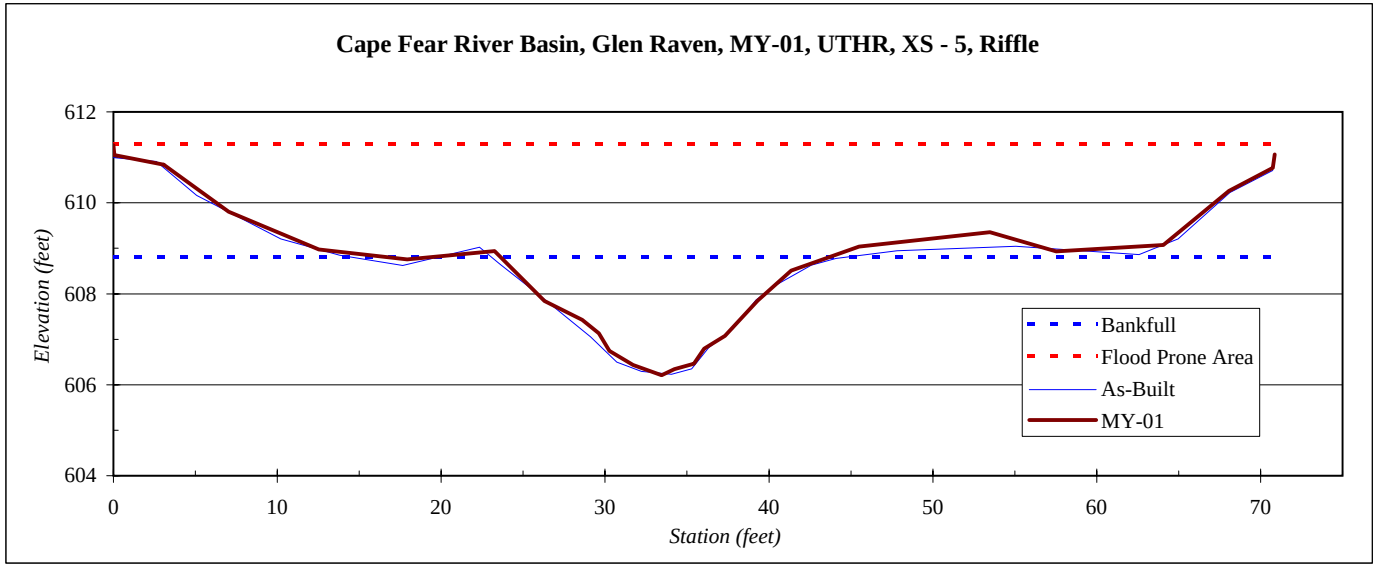


River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UTHR
XS ID	XS - 5, Riffle
Drainage Area (sq mi):	1.09
Date:	9/28/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	611.3
0.0	611.1
3.1	610.8
7.0	609.8
12.5	609.0
17.9	608.8
23.2	608.9
26.3	607.8
28.6	607.4
29.6	607.1
30.3	606.7
31.7	606.4
33.5	606.2
34.2	606.3
35.4	606.5
36.0	606.8
37.3	607.1
39.3	607.8
41.4	608.5
45.5	609.0
53.5	609.4
57.5	608.9
64.1	609.1
68.1	610.3
70.7	610.8
70.9	611.1

SUMMARY DATA	
Bankfull Elevation:	608.8
Bankfull Cross-Sectional Area:	27.0
Bankfull Width:	20.0
Flood Prone Area Elevation:	611.3
Flood Prone Width:	>71
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	1.4
W / D Ratio:	14.8
Entrenchment Ratio:	>3
Bank Height Ratio:	1.0

Stream Type	C4

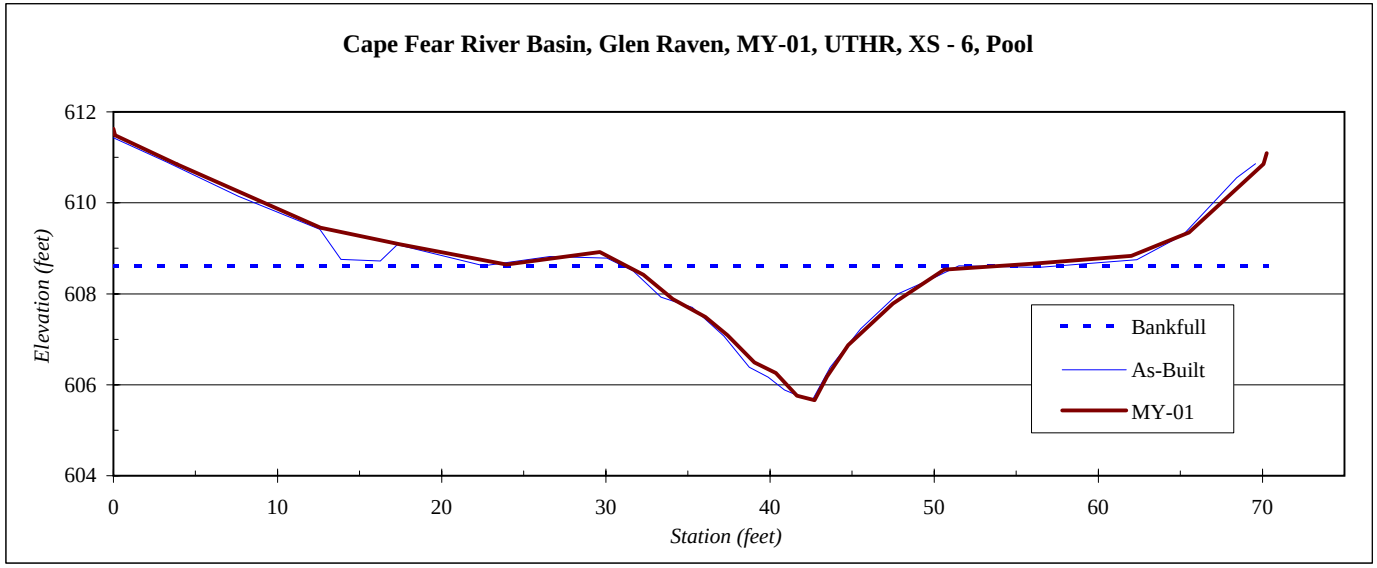


River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UTHR
XS ID	XS - 6, Pool
Drainage Area (sq mi):	1.09
Date:	9/28/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	611.6
0.1	611.5
3.9	610.8
12.6	609.5
17.5	609.1
23.9	608.6
29.6	608.9
32.3	608.4
34.1	607.9
36.1	607.5
37.4	607.1
39.1	606.5
40.4	606.3
41.7	605.8
42.7	605.7
43.5	606.2
44.8	606.9
47.5	607.8
50.6	608.5
56.1	608.7
62.0	608.8
65.5	609.3
70.1	610.9
70.3	611.1

SUMMARY DATA	
Bankfull Elevation:	608.6
Bankfull Cross-Sectional Area:	26.4
Bankfull Width:	22.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.9
Mean Depth at Bankfull:	1.2
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C4

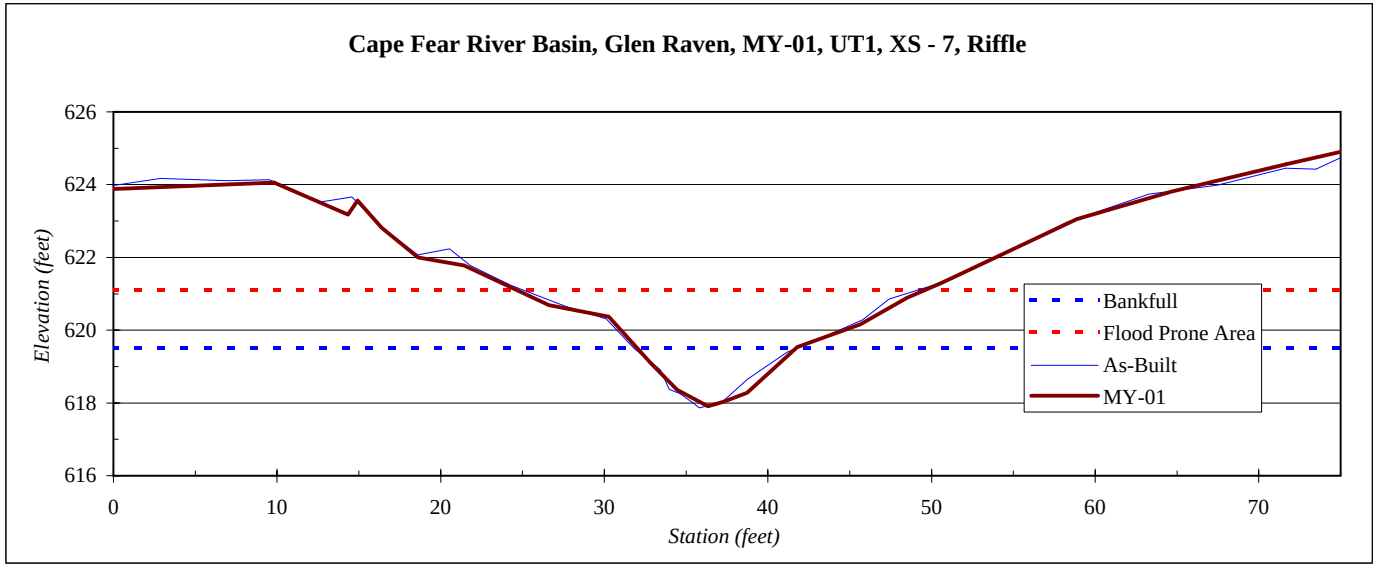


River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UT1
XS ID	XS - 7, Riffle
Drainage Area (sq mi):	1.09
Date:	9/27/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	623.9
9.8	624.1
14.3	623.2
14.9	623.6
16.4	622.8
18.6	622.0
21.4	621.8
26.6	620.7
30.3	620.4
32.8	619.1
34.5	618.4
36.3	617.9
37.3	618.0
38.7	618.3
41.8	619.5
45.7	620.2
48.5	620.9
50.6	621.3
58.9	623.1
64.7	623.8
71.6	624.6
77.8	625.2
78.1	625.4

SUMMARY DATA	
Bankfull Elevation:	619.5
Bankfull Cross-Sectional Area:	9.2
Bankfull Width:	9.7
Flood Prone Area Elevation:	621.1
Flood Prone Width:	24.9
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.9
W / D Ratio:	10.2
Entrenchment Ratio:	2.5
Bank Height Ratio:	1.0

Stream Type	B4c

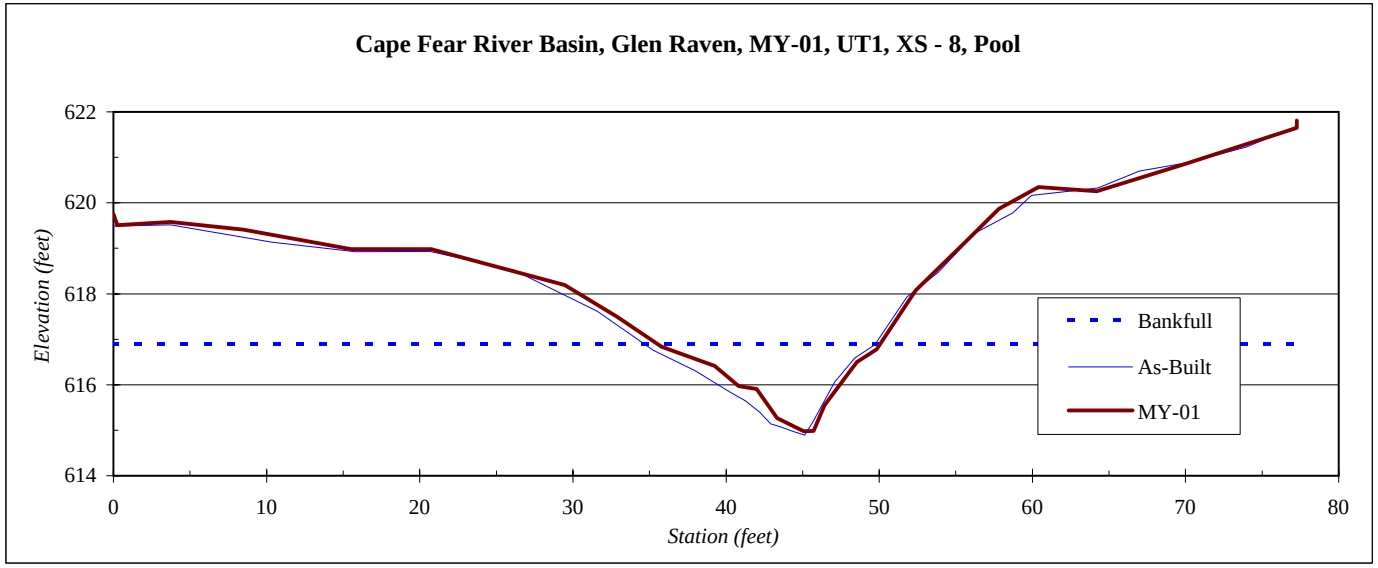


River Basin:	Cape Fear
Watershed:	Glen Raven, MY-01, UT1
XS ID	XS - 8, Pool
Drainage Area (sq mi):	1.09
Date:	9/27/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	619.8
0.3	619.5
3.7	619.6
8.5	619.4
15.5	619.0
20.7	619.0
29.5	618.2
32.9	617.5
35.8	616.8
39.3	616.4
40.8	616.0
42.0	615.9
43.3	615.3
45.1	615.0
45.7	615.0
46.4	615.6
48.5	616.5
49.8	616.8
52.4	618.1
55.7	619.2
57.8	619.9
60.4	620.3
64.2	620.3
69.8	620.8
77.3	621.6
77.3	621.8

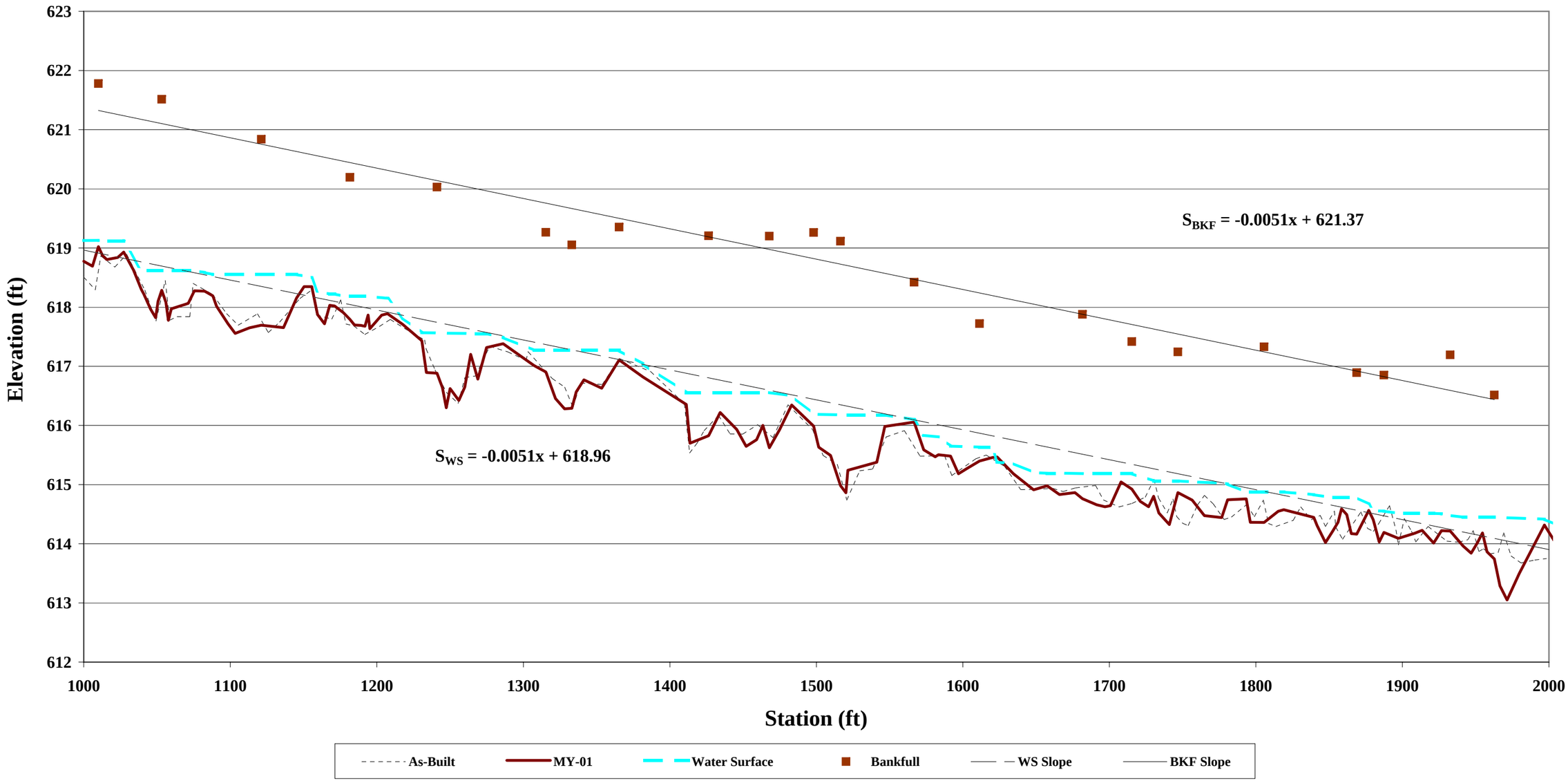
SUMMARY DATA	
Bankfull Elevation:	616.9
Bankfull Cross-Sectional Area:	12.7
Bankfull Width:	14.6
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	0.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	B4c

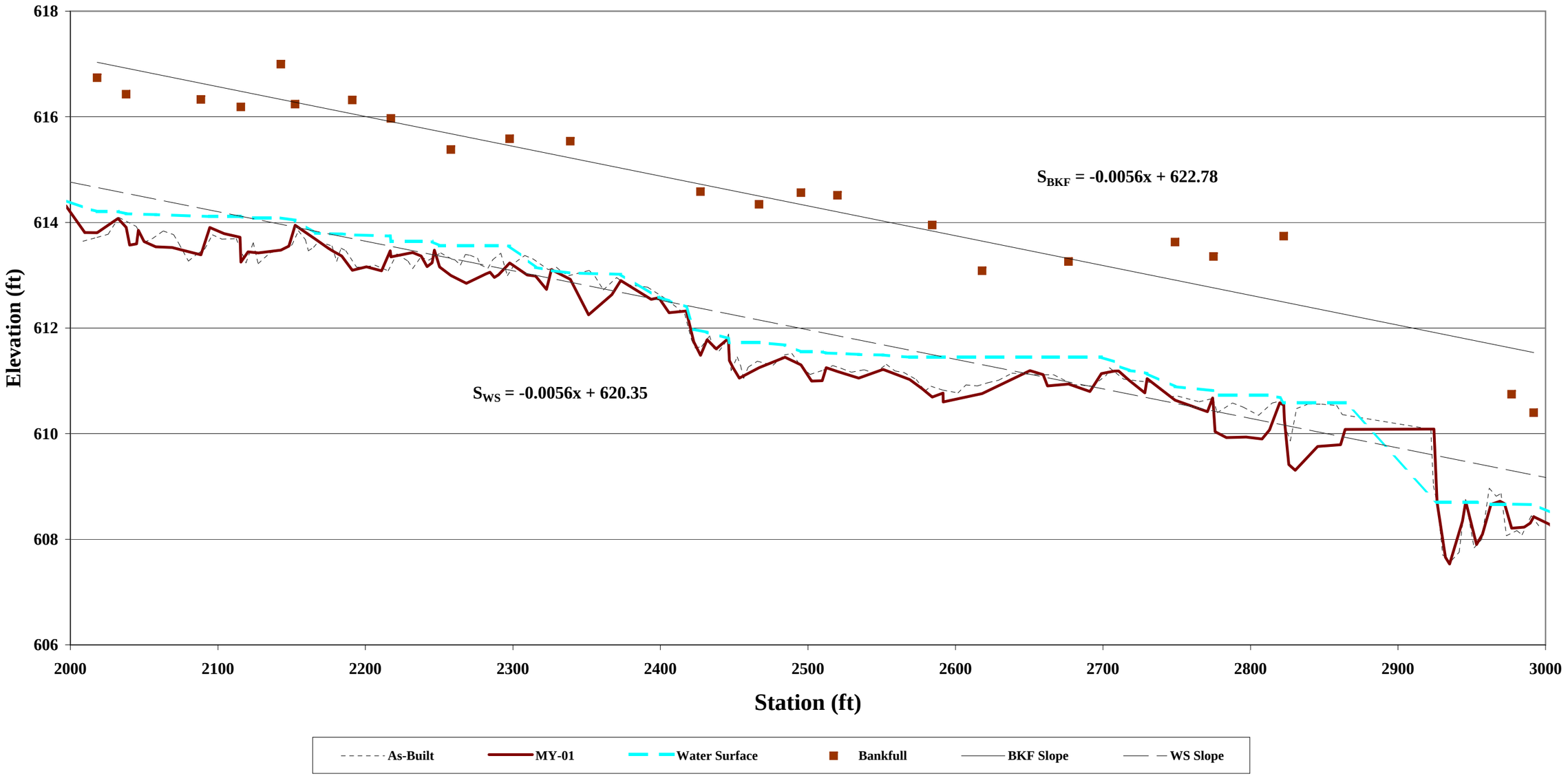


Appendix B4: Longitudinal Profile

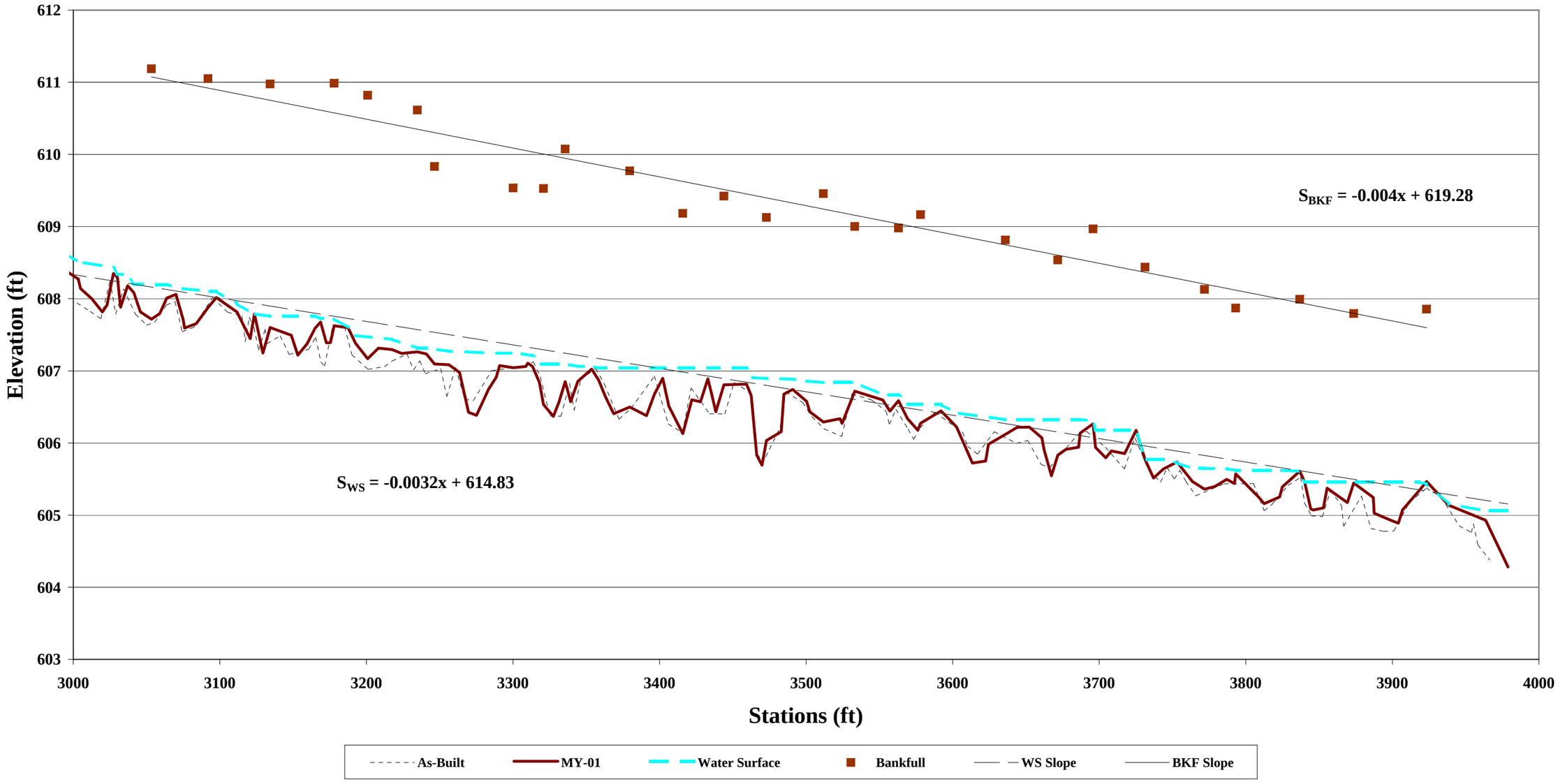
Longitudinal Profile
UTHR MY-01
Stations 10+00 - 20+00



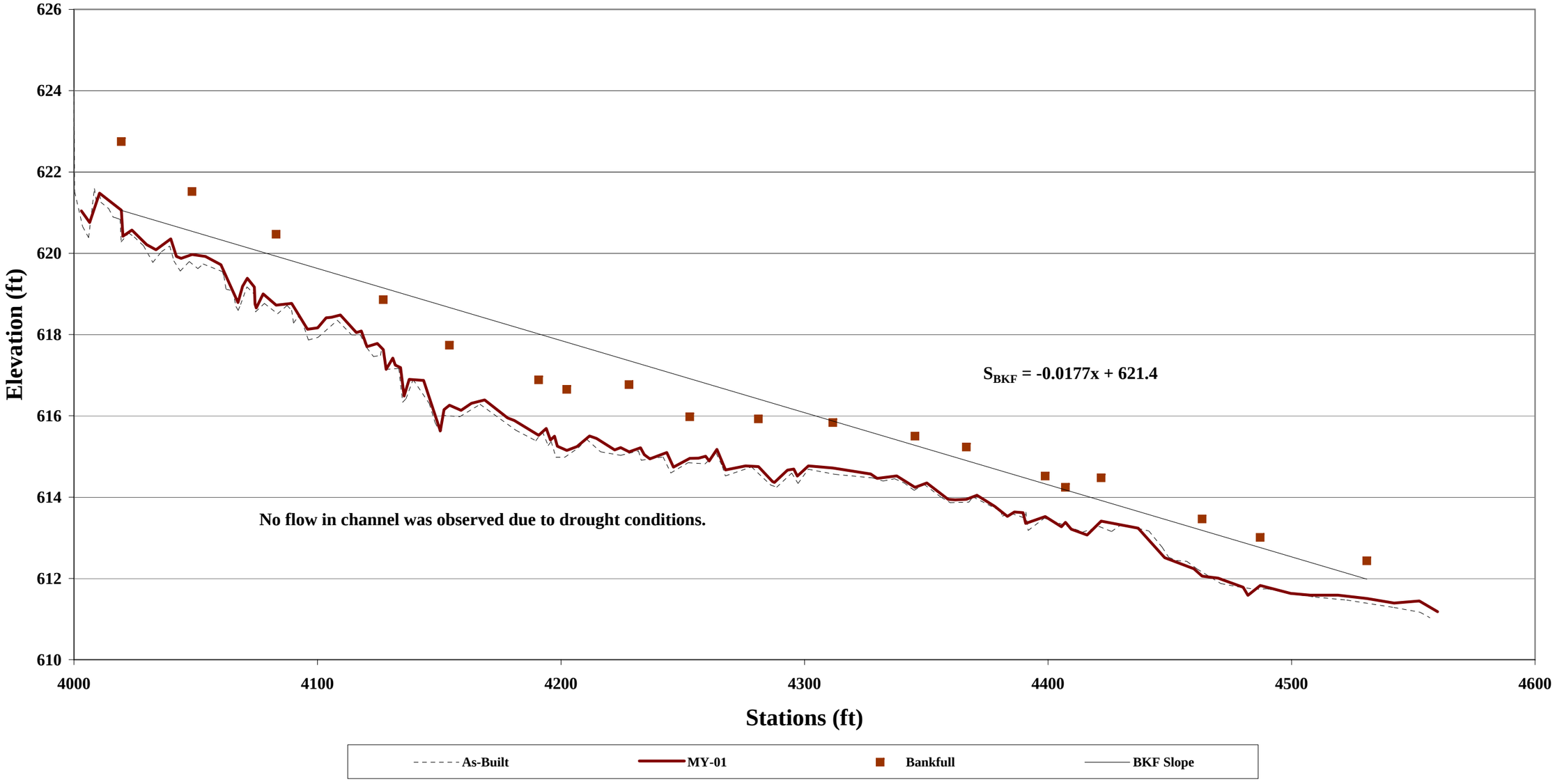
Longitudinal Profile
UTHR MY-01
Stations 20+00 - 30+00



Longitudinal Profile
UTHR MY-01
Stations 30+00 - 40+00



Longitudinal Profile
UT1 MY-01
Stations 40+00 - 46+00



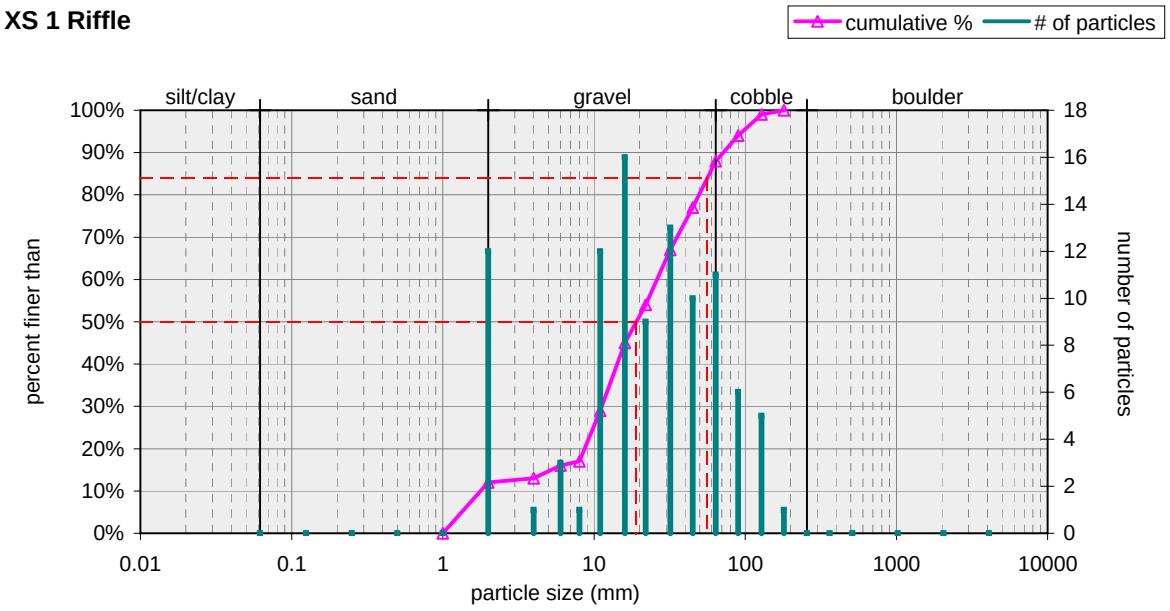
App B5 - Pebble Count Plots

Riffle

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	**0**
medium sand	0.25 - 0.5	**0**
coarse sand	0.5 - 1	**0**
very coarse sand	1 - 2	**12**
very fine gravel	2 - 4	**1**
fine gravel	4 - 6	**3**
fine gravel	6 - 8	**1**
medium gravel	8 - 11	**12**
medium gravel	11 - 16	**16**
coarse gravel	16 - 22	**9**
coarse gravel	22 - 32	**13**
very coarse gravel	32 - 45	**10**
very coarse gravel	45 - 64	**11**
small cobble	64 - 90	**6**
medium cobble	90 - 128	**5**
large cobble	128 - 180	**1**
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:		100
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		100

Note:

Brown Bark Park, MY02
XS 1 Riffle



Size (mm)	
D16	6
D35	13
D50	19
D65	30
D84	56
D95	97

Size Distribution	
mean	18.3
dispersion	3.1
skewness	-0.02

Type	
silt/clay	0%
sand	12%
gravel	76%
cobble	12%
boulder	0%

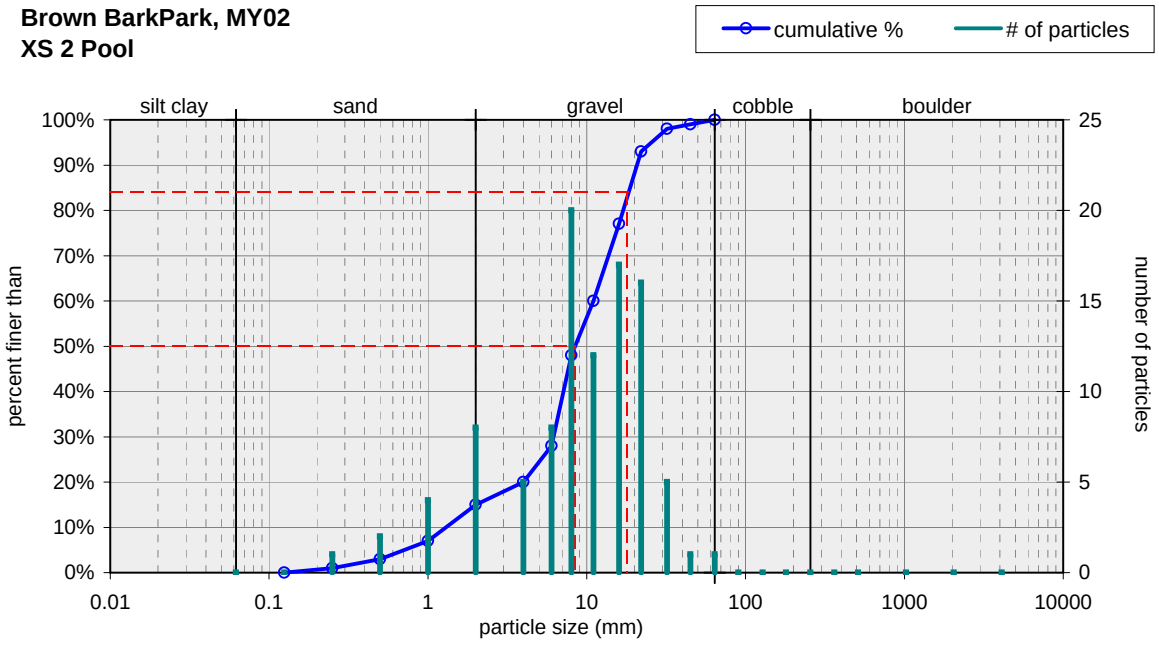
Pool

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	**1**
medium sand	0.25 - 0.5	**2**
coarse sand	0.5 - 1	**4**
very coarse sand	1 - 2	**8**
very fine gravel	2 - 4	**5**
fine gravel	4 - 6	**8**
fine gravel	6 - 8	**20**
medium gravel	8 - 11	**12**
medium gravel	11 - 16	**17**
coarse gravel	16 - 22	**16**
coarse gravel	22 - 32	**5**
very coarse gravel	32 - 45	**1**
very coarse gravel	45 - 64	**1**
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:	100
bedrock ----------	
clay hardpan ----------	
detritus/wood ----------	
artificial ----------	
total count:	100

Note:

Brown BarkPark, MY02
XS 2 Pool



Size (mm)	
D16	2.3
D35	6.6
D50	8.4
D65	12
D84	18
D95	26

Size Distribution	
mean	6.4
dispersion	2.9
skewness	-0.12

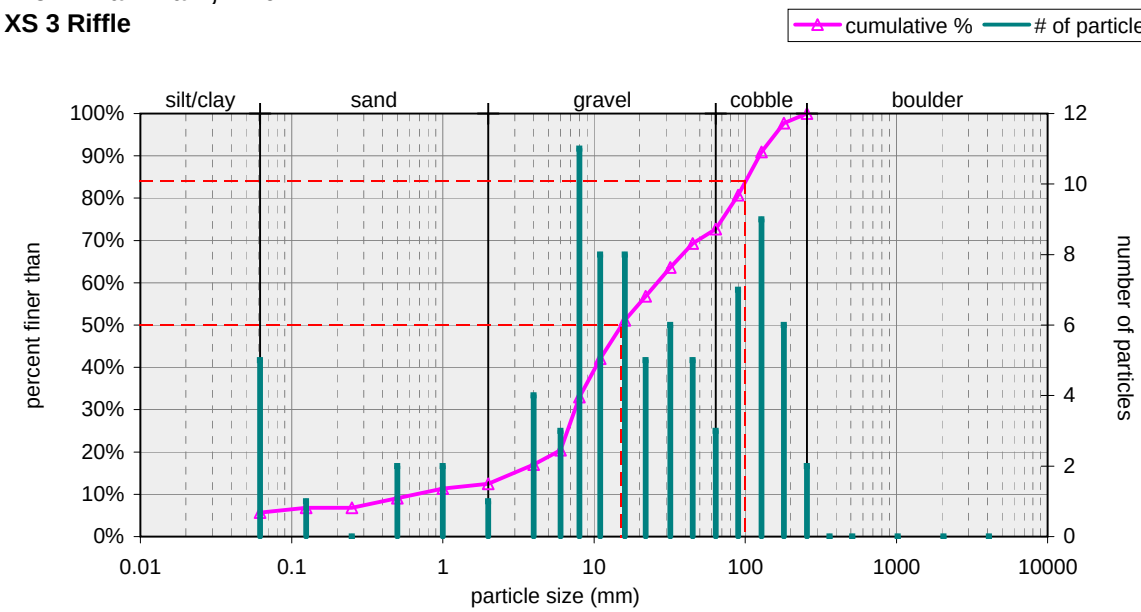
Type	
silt/clay	0%
sand	15%
gravel	85%
cobble	0%
boulder	0%

Riffle

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	**5**
very fine sand	0.062 - 0.125	**1**
fine sand	0.125 - 0.25	**0**
medium sand	0.25 - 0.5	**2**
coarse sand	0.5 - 1	**2**
very coarse sand	1 - 2	**1**
very fine gravel	2 - 4	**4**
fine gravel	4 - 6	**3**
fine gravel	6 - 8	**11**
medium gravel	8 - 11	**8**
medium gravel	11 - 16	**8**
coarse gravel	16 - 22	**5**
coarse gravel	22 - 32	**6**
very coarse gravel	32 - 45	**5**
very coarse gravel	45 - 64	**3**
small cobble	64 - 90	**7**
medium cobble	90 - 128	**9**
large cobble	128 - 180	**6**
very large cobble	180 - 256	**2**
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:		88
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		88

Note:

Brown Bark Park, MY02
XS 3 Riffle



Size (mm)	
D16	3.4
D35	8.6
D50	15
D65	35
D84	100
D95	160

Size Distribution	
mean	18.4
dispersion	5.5
skewness	0.07

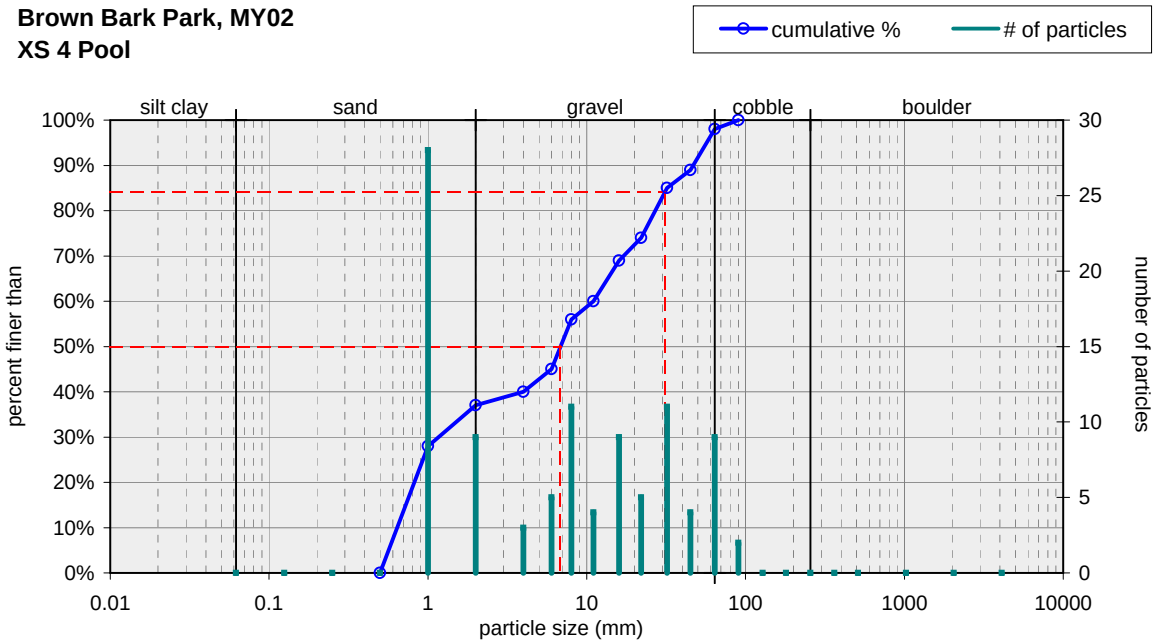
Type	
silt/clay	6%
sand	7%
gravel	60%
cobble	27%
boulder	0%

Pool

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	**0**
medium sand	0.25 - 0.5	**0**
coarse sand	0.5 - 1	**28**
very coarse sand	1 - 2	**9**
very fine gravel	2 - 4	**3**
fine gravel	4 - 6	**5**
fine gravel	6 - 8	**11**
medium gravel	8 - 11	**4**
medium gravel	11 - 16	**9**
coarse gravel	16 - 22	**5**
coarse gravel	22 - 32	**11**
very coarse gravel	32 - 45	**4**
very coarse gravel	45 - 64	**9**
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:		100
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		100

Note:

Brown Bark Park, MY02
XS 4 Pool



Size (mm)	
D16	0.74
D35	1.7
D50	6.8
D65	14
D84	31
D95	57

Size Distribution	
mean	4.8
dispersion	6.9
skewness	-0.12

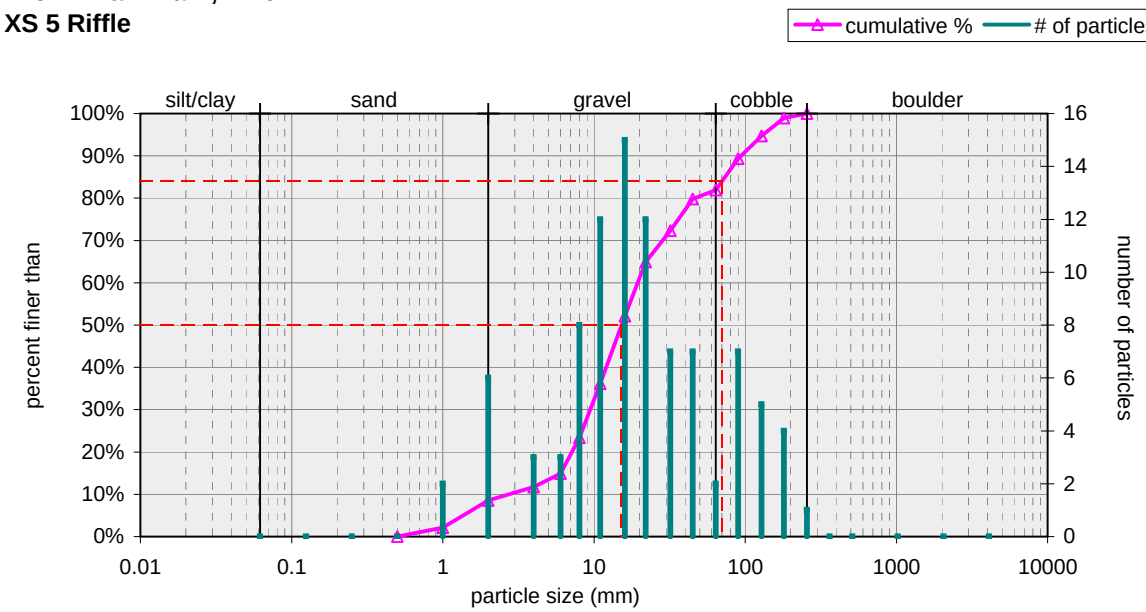
Type	
silt/clay	0%
sand	37%
gravel	61%
cobble	2%
boulder	0%

Riffle

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	**0**
medium sand	0.25 - 0.5	**0**
coarse sand	0.5 - 1	**2**
very coarse sand	1 - 2	**6**
very fine gravel	2 - 4	**3**
fine gravel	4 - 6	**3**
fine gravel	6 - 8	**8**
medium gravel	8 - 11	**12**
medium gravel	11 - 16	**15**
coarse gravel	16 - 22	**12**
coarse gravel	22 - 32	**7**
very coarse gravel	32 - 45	**7**
very coarse gravel	45 - 64	**2**
small cobble	64 - 90	**7**
medium cobble	90 - 128	**5**
large cobble	128 - 180	**4**
very large cobble	180 - 256	**1**
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:		94
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		94

Note:

Brown Bark Park, MY02
XS 5 Riffle



Size (mm)	
D16	6.2
D35	11
D50	15
D65	22
D84	70
D95	130

Size Distribution	
mean	20.8
dispersion	3.5
skewness	0.14

Type	
silt/clay	0%
sand	9%
gravel	73%
cobble	18%
boulder	0%

Riffle

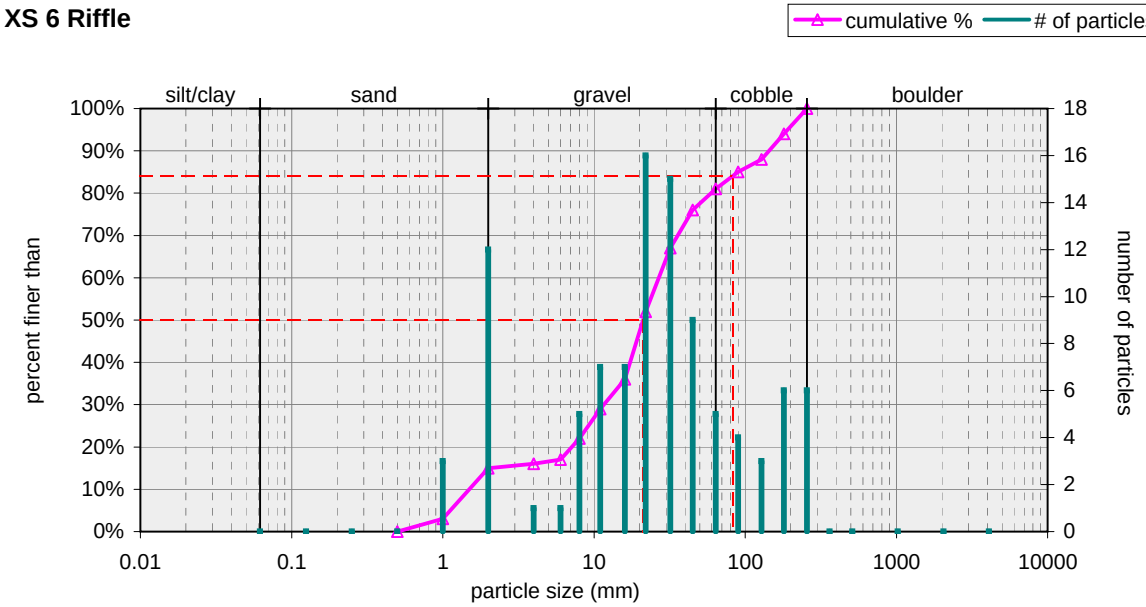
Material	Size Range (mm)	Count
silt/clay	0 - 0.062	**0**
very fine sand	0.062 - 0.125	**0**
fine sand	0.125 - 0.25	**0**
medium sand	0.25 - 0.5	**0**
coarse sand	0.5 - 1	**3**
very coarse sand	1 - 2	**12**
very fine gravel	2 - 4	**1**
fine gravel	4 - 6	**1**
fine gravel	6 - 8	**5**
medium gravel	8 - 11	**7**
medium gravel	11 - 16	**7**
coarse gravel	16 - 22	**16**
coarse gravel	22 - 32	**15**
very coarse gravel	32 - 45	**9**
very coarse gravel	45 - 64	**5**
small cobble	64 - 90	**4**
medium cobble	90 - 128	**3**
large cobble	128 - 180	**6**
very large cobble	180 - 256	**6**
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:		100

bedrock ----------	
clay hardpan ----------	
detritus/wood ----------	
artificial ----------	

total count: 100

Note:

Brown Bark Park, MY02
XS 6 Riffle

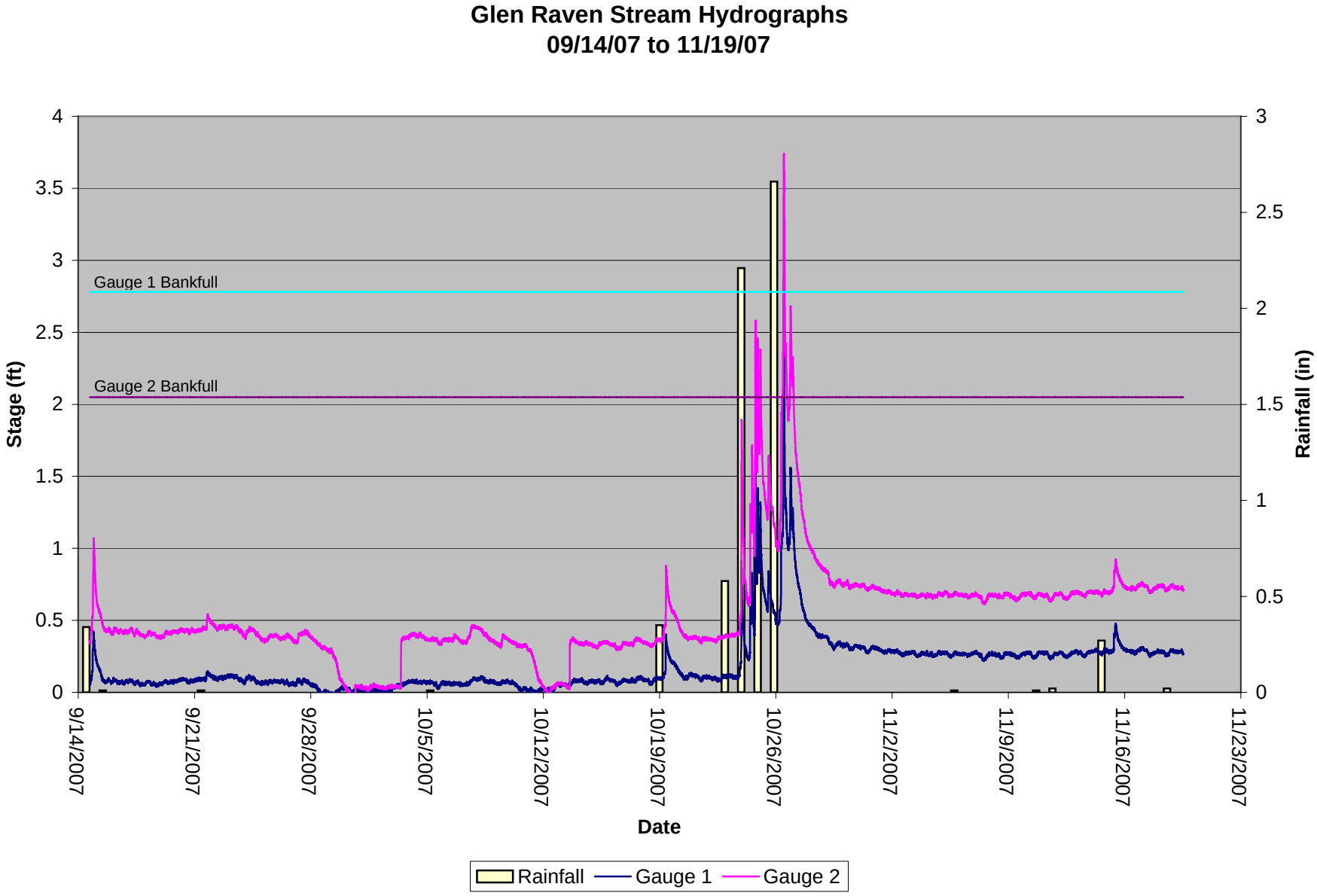


Size (mm)	
D16	4
D35	15
D50	21
D65	30
D84	83
D95	190

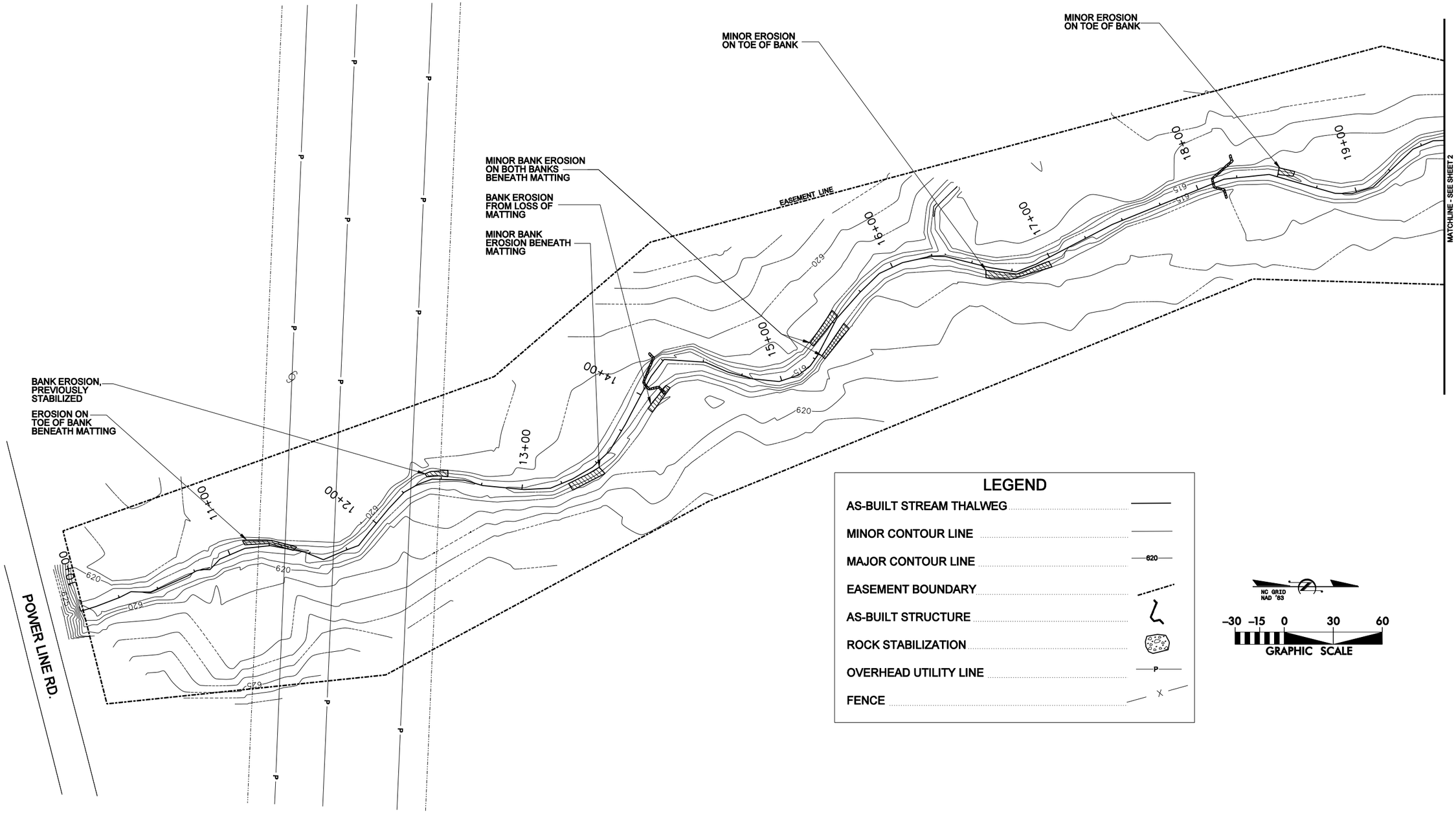
Size Distribution	
mean	18.2
dispersion	4.6
skewness	-0.05

Type	
silt/clay	0%
sand	15%
gravel	66%
cobble	19%
boulder	0%

Appendix B6: Stream Hydrograph



Appendix C
Current Conditions Plan View



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE — 620
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE — P
- FENCE — X

NC GRID NAD '83

–30 –15 0 30 60

GRAPHIC SCALE

SYM.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

Ecosystem Enhancement Program

KCI TECHNOLOGIES
ENGINEERS • PLANNERS • ECOLOGISTS
SUITE 220, LANDMARK CENTER II
4601 SIX FORKS RD., RALEIGH, NC

GLEN RAVEN - UT TO HAW RIVER STREAM RESTORATION PROJECT

BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA

STATION 10+00 TO STATION 19+62

DATE: NOVEMBER 2007

SCALE: 1"=30'

CURRENT CONDITIONS PLAN VIEW

SHEET 1 OF 5

MINOR EROSION ON TOE OF BANK

MINOR EROSION ON TOE OF BANK

MINOR EROSION ON TOE OF BANK

BANK EROSION, HAS BEEN STABILIZED

SCOUR IN RIFFLE, HAS BEEN STABILIZED

FLOODPLAIN AND BANK EROSION UNDER MATTING

NC GRID NAD '83

–30 –15 0 30 60

GRAPHIC SCALE

EASEMENT LINE

20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 44+00

615 620

GERRINGER RD.

MATCHLINE - SEE SHEET 1

MATCHLINE - SEE SHEET 3

SEE SHEET 5

LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE 620
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE P
- FENCE X

SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

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GLEN RAVEN - UT TO HAW RIVER STREAM RESTORATION PROJECT

BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA

STATION 19+62 TO STATION 28+75

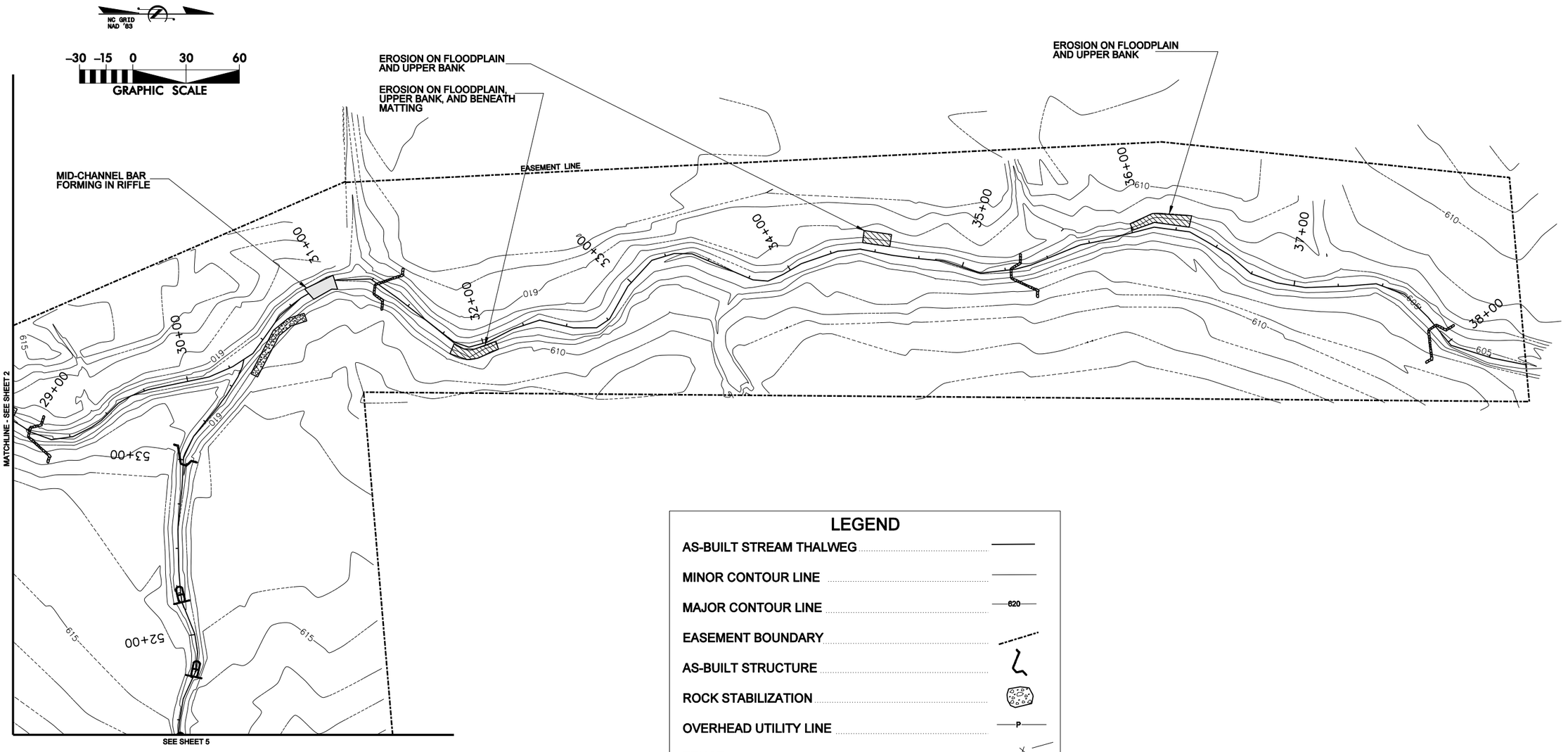
DATE: NOVEMBER 2007

SCALE: 1"=30'

CURRENT CONDITIONS PLAN VIEW

NC GRID
NAD '83

–30 –15 0 30 60
GRAPHIC SCALE



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE — 620
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE — P
- FENCE — X

REVISIONS

NO.	DESCRIPTION	DATE	APPROVED

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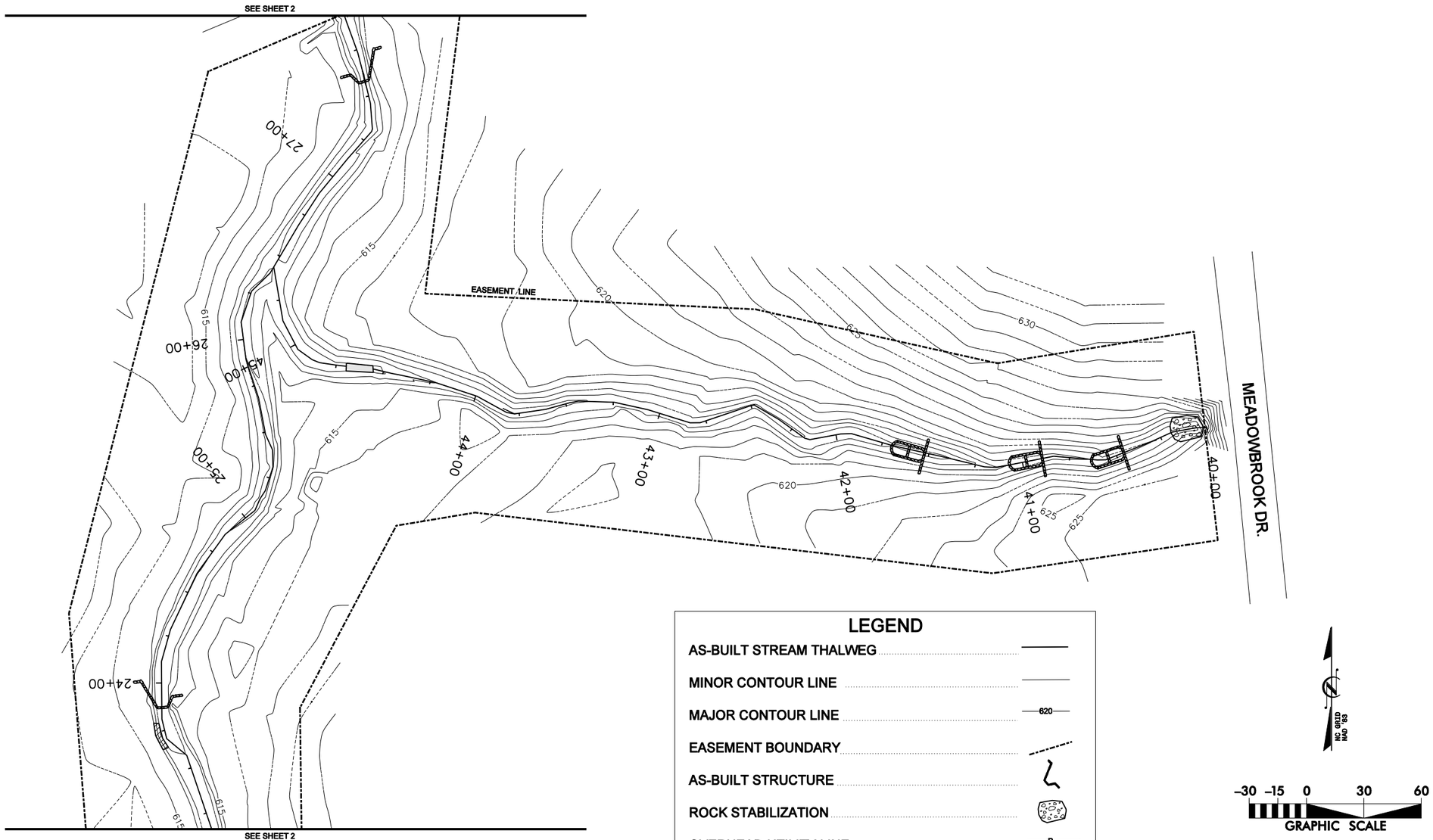
STREAM RESTORATION PROJECT
BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA
STATION 28+75 TO STATION 38+52

DATE: NOVEMBER 2007
SCALE: 1"=30'

CURRENT CONDITIONS PLAN VIEW

SHEET 3 OF 5



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE — 620
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE — P
- FENCE — X

NC GRID NAD '83

–30 –15 0 30 60

GRAPHIC SCALE

STAL	DESCRIPTION	DATE	APPROVED
	REVISIONS		

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GLEN RAVEN - UT TO HAW RIVER STREAM RESTORATION PROJECT

BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA

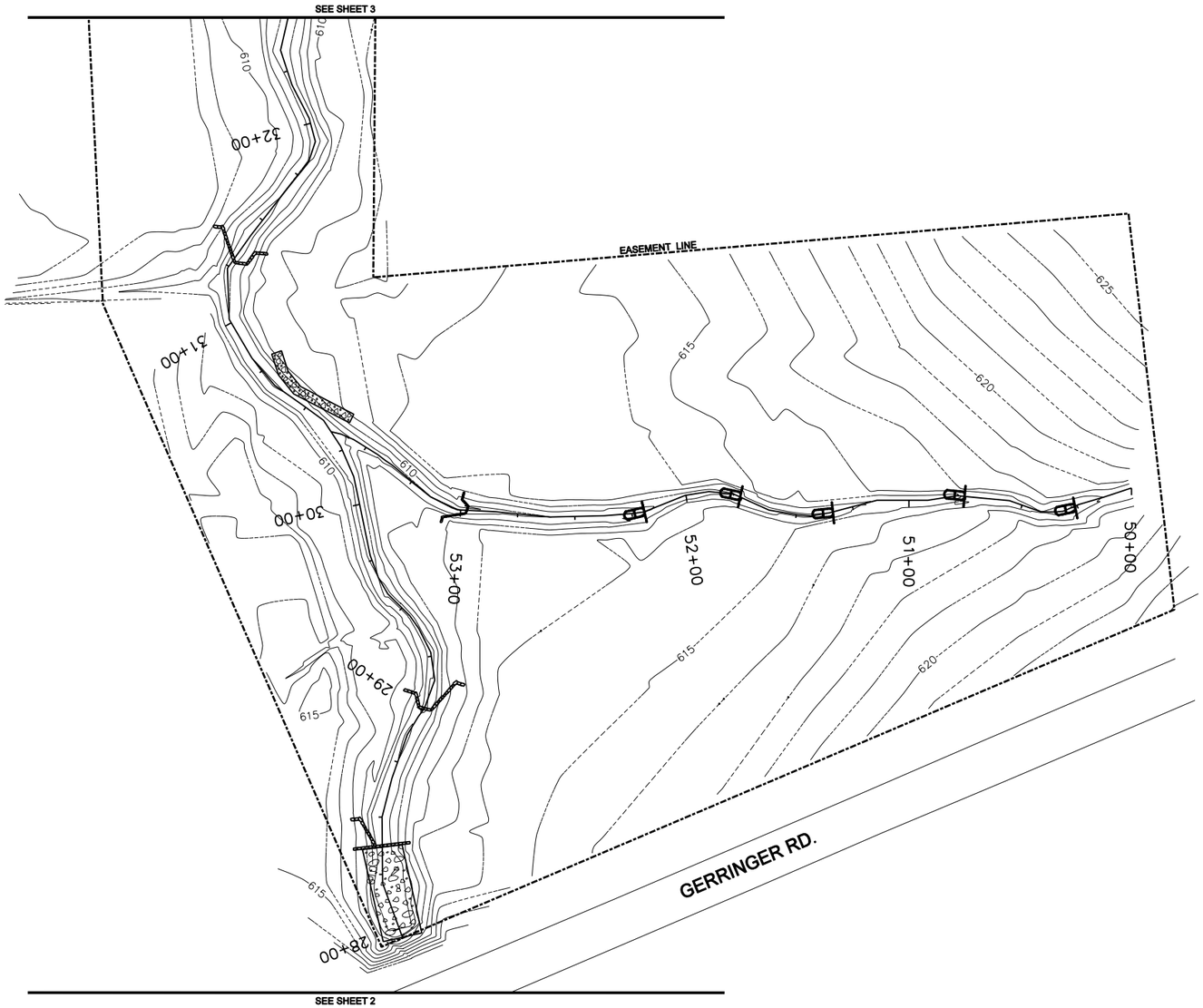
STATION 40+00 TO STATION 45+56

DATE: NOVEMBER 2007

SCALE: 1"=30'

CURRENT CONDITIONS PLAN VIEW

SHEET 4 OF 5



LEGEND

- AS-BUILT STREAM THALWEG
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE (620)
- EASEMENT BOUNDARY
- AS-BUILT STRUCTURE
- ROCK STABILIZATION
- OVERHEAD UTILITY LINE (P)
- FENCE

NC GRID NAD '83

–30 –15 0 30 60

GRAPHIC SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

Ecosystem Enhancement

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GLEN RAVEN - UT TO HAW RIVER STREAM RESTORATION PROJECT

BURLINGTON, ALAMANCE COUNTY, NORTH CAROLINA

STATION 50+00 TO STATION 53+70

DATE: NOVEMBER 2007

SCALE: 1"=30'

CURRENT CONDITIONS PLAN VIEW

SHEET 5 OF 5