Chavis Park (Garner Branch)
Stream Restoration Monitoring Report
EEP Project # 87
Monitoring Year – 04
2007

Submitted to:

Ecosystem Enhancement PROGRAM

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

February 2008

Monitoring Firm

Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609
Phone: (919) 783-9214
Fax: (919) 783-9266

Project Contact: Adam Spiller
Email: aspiller@kci.com

Design Firms

Becky L. Ward Consulting

Ecological Consultants

Natural Areas Ecosystem Management

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX A – VEGETATION DATA

APPENDIX B – GEOMORPHOLOGIC DATA

APPENDIX C – CURRENT CONDITIONS PLAN VIEW

EXECUTIVE SUMMARY

The North Carolina Wetlands Restoration Program identified the Garner Branch of Walnut Creek in Chavis Park as a restoration design project in 1999. The watershed of approximately 0.54-mi^2 is located within the USGS 14-digit HUC 03020201090010 and the NCDWQ Sub-basin 03-04-02 of the Neuse River Basin. The plan proposed to restore approximately 2,000 linear feet of channel. The restoration was designed to correct various problems with the existing stream corridor including unstable channel configuration, poor water quality, no bed diversity, exotic and invasive vegetation, and poor stream and riparian habitat. The restoration plan was completed in 2002 and called for correcting these problems by stabilizing stream banks, installing in-stream structures, adjusting stream planform, and clearing and replanting the riparian areas with native vegetation. Project construction occurred in 2002. Monitoring was completed for the first, second, and third years in 2004, 2005, and 2006, respectively. This report is a description of the findings of the fourth year monitoring that took place in 2007.

The restoration plan called for removal of all existing vegetation along the stream banks and within the riparian buffer. The original planting of native vegetation was found to be unsuccessful during the first year monitoring. A remedial vegetation plan was designed in 2004 and implemented the same year. Vegetation was planted at a density of 680 and 890 stems per acre in the streamside and terrace slope communities, respectively. The wooden stakes marking the first year vegetation monitoring plot corners were not located during the second year. Four new plots were surveyed and the corners marked with metal conduit for the remaining monitoring years. The fourth year monitoring counted an average of 650 stems per acre for all plots. Vegetative cover is extensive for the length of the project with minimal bare banks and slopes. There is a strong presence of exotic/invasive plants throughout the site. The most notable species are microstegium (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), and white mulberry (*Morus alba*). Other invasive vegetation has been noted within this report. Excepting the site's invasive species, the project is on track to meet the vegetation success criteria.

The stream assessment completed during the fourth year monitoring found the stream to be functioning and holding grade for the majority of the project. Channel dimensions have not changed drastically from the designed conditions with the exceptions of local areas of bank erosion. The stream profile does not have well defined features, but some are discernible along the profile length. Many of the in-stream structures are functioning, though several are experiencing stress as evidenced by localized erosion on cross vane arms. The most apparent stream problem during third year monitoring, the hydraulic path cut around the left side of a cross vane, has corrected itself. The path has filled in with sand deposition and the stream has moved back into the designed thalweg. However, the issue of bank erosion at the same location is still an issue. Other bank erosion issues of moderate concern are detailed in the report and should be monitored, but do not call for immediate action. Due to the nature of Chavis Park as an urban stream setting, trash and urban debris exist throughout the project site. Monitoring observed large amounts of trash in the riparian area and stream channel. The level of trash and debris should continue to be monitored to prevent debris from causing damaging blockages to flow or other problems.

1.0 PROJECT BACKGROUND

1.1 Project Objectives

- Reduce bank erosion by adjustment of the existing channel pattern or by bioengineered methods.
- Improve water quality by reducing erosion and by increasing the connectivity between the channel and floodplain.
- Stabilize the bankfull elevation along the reach.
- Enhance instream habitat by placing structures, overhanging vegetation and removal of aggressive species.
- Enhance riparian corridor with native vegetative species to improve the function and aesthetic value.
- Slope and vegetate the stream banks so that they are more resistant to flooding.
- Plant native trees, bushes and ground cover that will stabilize the stream banks, shade the stream, and provide wildlife cover and food.

1.2 Project Structure, Restoration Type, and Approach

Before restoration, the channel of Garner Branch of Walnut Creek through Chavis Recreational Park was deeply incised and entrenched with heavy bank erosion due to urban storm runoff. The creek was restored using channel dimension, pattern, and profile modifications and the establishment of a vegetated riparian zone adjacent to the creek. The new channel profile is maintained through the use of rock cross vanes. Channel pattern is maintained through the use of single vanes and vegetation along the channel banks. Due to multiple urban constraints, pattern modifications were limited throughout the project.

1.3 Location and Setting

Chavis Park is located within the city limits of Raleigh, North Carolina. The 0.54 mi.^{2} watershed is urban and fully developed. The current zoning and planimetric maps from the City of Raleigh show that three-quarters of the watershed consist primarily of residential high density properties. The upper northeastern quarter of the watershed is densely developed, and includes downtown businesses and industrial facilities. The watershed is completely built out with little potential for future development.

1.4 Project History and Background

Table 1. Project Restoration Components
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)

Segment / Reach ID	Existing Linear Feet	Type	Approach	Linear Feet	Stationing	Comment
Garner Branch	N/A	R	P2/3	1,880	10+00 - 28+80	
UT to Garner Branch	N/A	R	P2/3	330	30+00 - 33+30	

DIRECTIONS TO CHAVIS PARK SITE: From I-440 take exit 15 to Poole Road, west toward the City of Raleigh. Poole Road diverges into Martin Luther King Jr. Boulevard; continue on MLK Boulevard until you reach the City of Raleigh's Chavis Park on the north side of MLK Boulevard. Make a right and proceed north on Holmes Street; the site is on the left side (west) before the intersection with E. Lenoir Street.

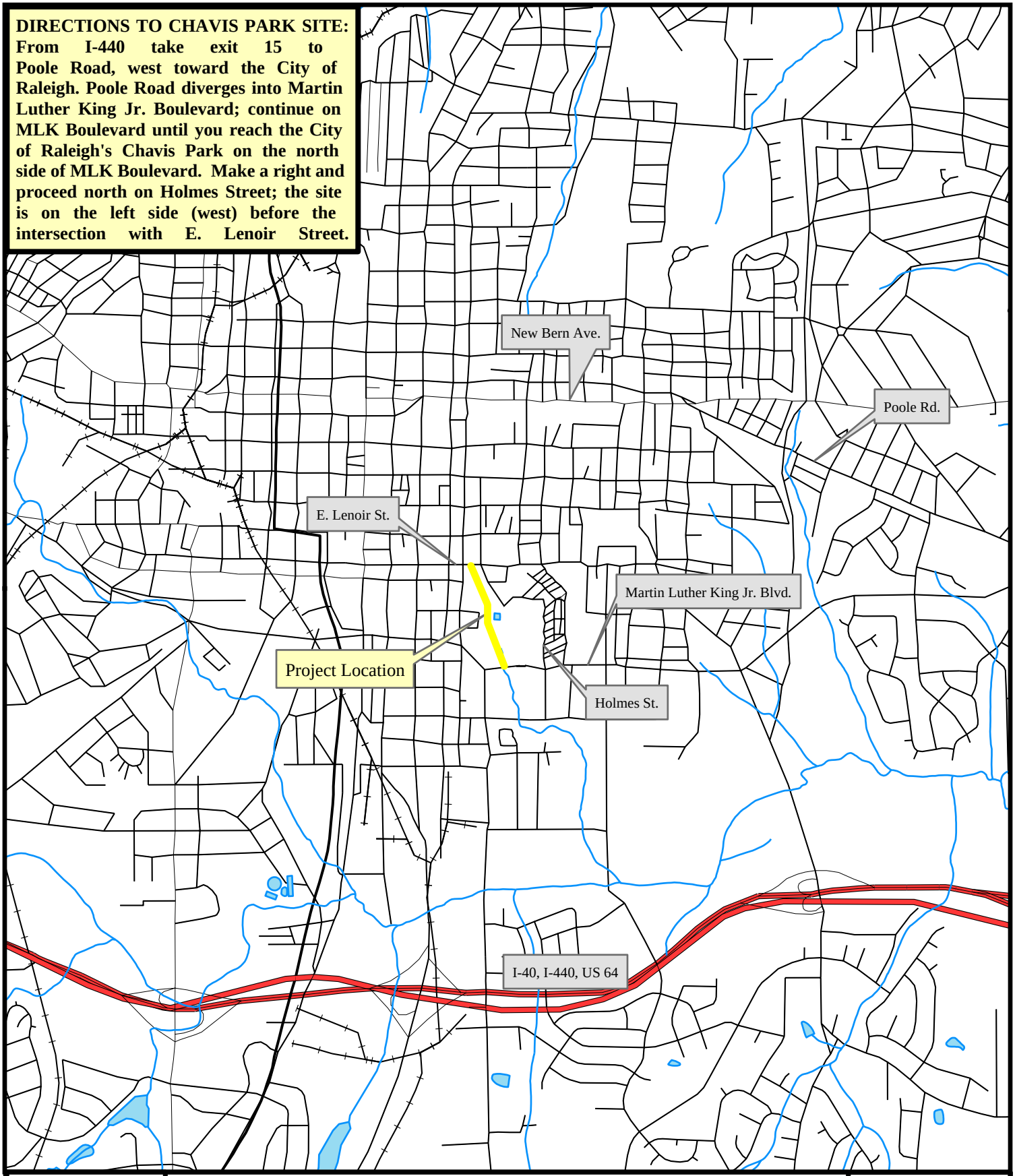


Figure 1. Site Vicinity Map
Chavis Park, Wake County, EEP Project # 87 - MY04

0.25 0.125 0 0.25 0.5 Miles

N

Date: 12/04/07

Ecosystem Enhancement Program

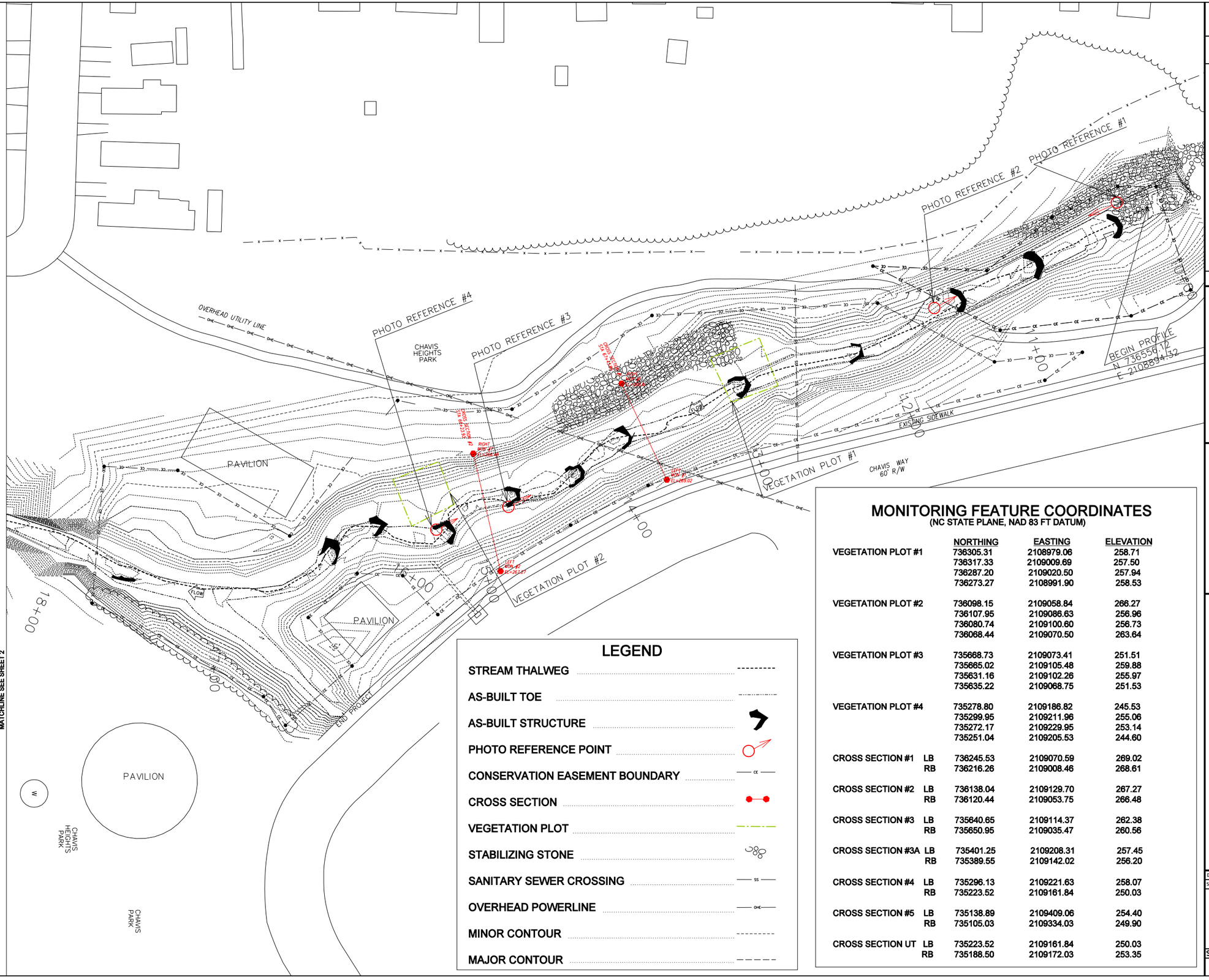
KCI Associates of NC

Table 2. Project Activity and Reporting History Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	2002	Feb 02
Final Design - 90%	N/A	N/A
Construction	2002	2002
As-built Report	Sep 02	2002
Year 1 Monitoring	Jun 04	Feb 05
Vegetative Maintenance Plan	2004	Mar 04
Vegetative Maintenance Planting	2004	Jun 05
Year 2 Monitoring	Aug 05	Jan 06
Year 3 Monitoring	Oct 06	Jan 07
Year 4 Monitoring	Sep 07	Jan 08

Table 3. Project Contact Table Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)	
Design Firms	Becky L. Ward Consulting 1512 Eglantyne Ct. Raleigh, NC 27613
	Ecological Consultants 4216 Hope Valley Drive Raleigh, NC 27278
	Natural Areas Ecosystem Management 10015 Wright Road Harvard, Illinois 60033 Contact: Mr. Randy Stowe Phone: (815) 648-2253 Fax: (815) 648-2403
Construction Contractor	White Oak Construction Corporation 4020 Pea Ridge Road New Hill, North Carolina 27562 Contact: Mr. Bruce Hollis Phone: (919) 545-0442 Fax: (919) 545-2034
Planting and Vegetation Contractor	Tower Engineering Professionals 3703 Junction Boulevard Raleigh, North Carolina 27603-5263 Contact: Mr. George T. Swearingen Phone: (919) 661-6351 Fax: (919) 661-6350

Table 3 cont. Project Contact Table	
Maintenance Planting and Plan Designer	EcoScience 1101 Haynes Street, Suite 101 Raleigh, North Carolina 27604 Phone: (919) 828-3433
Monitoring Performers	
MY-01	Biological & Agricultural Engineering Water Resources Research Institute North Carolina State University Campus Box 7625 Raleigh, NC 27695 Contact: Mr. Dan Clinton Phone: (919) 515-3723
MY-02 - MY-04	KCI Associates of NC 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 Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)**	
Project County	Wake County
Drainage Area	0.54 sq. mi. (Garner Branch)
	0.20 sq. mi. (UT)
Drainage Impervious Cover Estimate (%)	65% (Garner Branch)
	70% (UT)
Stream Order	First/Second Order (Garner Branch)
	First Order (UT)
Physiographic Region	Piedmont
Ecoregion	Northern Outer Piedmont
Rosgen Classification of As-built	C4
Dominant Soil Types	Wehadkee and Bibb Soils and
	Cecil Sandy Loam (Garner Branch)
	Cecil Sandy Loam (UT)
Reference Site ID	Brookhaven Park
USGS HUC for Project and Reference	03020201090010 (Garner Branch)
	03020201080020 (Brookhaven Park)
NCDWQ Sub-basin for Project and Reference	03-04-02 (Garner Branch)
	03-04-02 (Brookhaven Park)
NCDWQ Classification for Project and Reference	C - NSW (Garner Branch)
	Not listed (Brookhaven Park)
Any portion of the project segment 303d listed?	No - not rated
Any portion of the project segment upstream of a 303d listed segment?	N/A
Reasons for 303d Listing or Stressor	N/A
% of Project Easement Fenced	0%
% of Project Easement Demarcated with Plastic Lath Signs	90%



LEGEND

- STREAM THALWEG
- AS-BUILT TOE
- AS-BUILT STRUCTURE
- PHOTO REFERENCE POINT
- CONSERVATION EASEMENT BOUNDARY
- CROSS SECTION
- VEGETATION PLOT
- STABILIZING STONE
- SANITARY SEWER CROSSING
- OVERHEAD POWERLINE
- MINOR CONTOUR
- MAJOR CONTOUR

–60 –30 0 30 60

GRAPHIC SCALE

MONITORING FEATURE COORDINATES
(NC STATE PLANE, NAD 83 FT DATUM)

		NORTHING	EASTING	ELEVATION
VEGETATION PLOT #1		736305.31	2108979.06	258.71
		736317.33	2109009.69	257.50
		736287.20	2109020.50	257.94
		736273.27	2108991.90	258.53
VEGETATION PLOT #2		736098.15	2109058.84	266.27
		736107.95	2109086.63	256.96
		736080.74	2109100.60	256.73
		736068.44	2109070.50	263.64
VEGETATION PLOT #3		735668.73	2109073.41	251.51
		735665.02	2109105.48	259.88
		735631.16	2109102.26	255.97
		735635.22	2109068.75	251.53
VEGETATION PLOT #4		735278.80	2109186.82	245.53
		735299.95	2109211.96	255.06
		735272.17	2109229.95	253.14
		735251.04	2109205.53	244.60
CROSS SECTION #1	LB	736245.53	2109070.59	269.02
	RB	736216.26	2109008.46	268.61
CROSS SECTION #2	LB	736138.04	2109129.70	267.27
	RB	736120.44	2109053.75	266.48
CROSS SECTION #3	LB	735640.65	2109114.37	262.38
	RB	735650.95	2109035.47	260.56
CROSS SECTION #3A	LB	735401.25	2109208.31	257.45
	RB	735389.55	2109142.02	256.20
CROSS SECTION #4	LB	735296.13	2109221.63	258.07
	RB	735223.52	2109161.84	250.03
CROSS SECTION #5	LB	735138.89	2109409.06	254.40
	RB	735105.03	2109334.03	249.90
CROSS SECTION UT	LB	735223.52	2109161.84	250.03
	RB	735188.50	2109172.03	253.35

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

CHAVIS PARK (GARNER BRANCH)
WAKE COUNTY
EEP PROJECT NUMBER 87 - MY04
STATION 10+00 TO STATION 18+40

DATE: NOVEMBER 2007
SCALE: SEE SHEET

MONITORING PLAN VIEW

SHEET 1 OF 2

CAPE AVENUE

274.1

PAVILION

PHOTO REFERENCE #5

CROSS SECTION #3
STA 16+85.59
RIGHT
MON #8
EL=260.56

RT. MONUMENT FOR MAIN CHANNEL
LEFT MONUMENT FOR TRIBUTARY

PAVILION

BEDROCK OUTCROP

GARNER BRANCH

23+00

22+00

21+00

20+00

19+00

VEGETATION PLOT #3

CHAVIS HEIGHTS PARK

RW

RIGHT
MON #3A
EL=256.20

MON #3 & #4

RIGHT
MON #5
EL=253.76
CROSS SECTION #1
STA. 0+67.51

LEFT
MON #4
EL=258.07

CROSS SECTION #2
STA. 24+49.97

MON #3A
EL=257.45

BEDROCK OUTCROP

24+00

25+00

26+00

VEGETATION PLOT #4

PHOTO REFERENCE #6

END PROFILE
N 735043.64
E 2109394.99

TWIN BOX
CULVERTS

CROSS SECTION #4
STA 27+49.27

RIGHT
MON #6
EL=254.90

LEFT
MON #5
EL=254.40

27+00

28+00

PHOTO REFERENCE #7

276.15

POOL

CHAVIS HEIGHTS PARK

RW

RW

LEGEND

- STREAM THALWEG
- AS-BUILT TOE
- AS-BUILT STRUCTURE
- PHOTO REFERENCE POINT
- CONSERVATION EASEMENT BOUNDARY — CE —
- CROSS SECTION
- VEGETATION PLOT
- STABILIZING STONE
- SANITARY SEWER CROSSING — SS —
- OVERHEAD POWERLINE — OHE —
- MINOR CONTOUR
- MAJOR CONTOUR

–60 –30 0 30 60

GRAPHIC SCALE

MATCHLINE SEE SHEET 1

REVISIONS			
STAL	DESCRIPTION	DATE	APPROVED

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

CHAVIS PARK (GARNER BRANCH)
WAKE COUNTY
EEP PROJECT NUMBER 87 - MY04

STATION 18+40 TO STATION 28+06

DATE: NOVEMBER 2007
SCALE: SEE SHEET

MONITORING PLAN VIEW

SHEET 2 OF 2

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 Event and Stability Assessment

Table 5. Verification of Bankfull Events
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)

Date of Data Collection	Date of Occurence	Method	Photo Number
6/15/2006	6/14/2006	Site visit to evaluate stage indicators after storm event	N/A
8/20/2007	Unknown	Crest Gauge	N/A
11/12/2007	Unknown	Crest Gauge	N/A

Table 6. BEHI and Sediment Export Estimates
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)

Time Point	Segment/ Reach	Linear Footage	Extreme		Very High		High		Moderate		Low		Very Low		Sediment Export
			ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	ton/yr
BEHI will be completed during MY05															

2.2.2 Stability Assessment Table

Table 7a. Categorical Stream Feature Visual Stability Assessment
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment/Reach: Garner Branch (1,750 ft.)

Feature	Initial	MY - 01	MY - 02	MY - 03	MY - 04	MY - 05
A. Riffles	100%	N/A	83%	65%	68%	
B. Pools	100%	N/A	83%	58%	75%	
C. Thalweg	100%	N/A	88%	69%	75%	
D. Meanders	100%	N/A	69%	78%	84%	
E. Bed General	100%	N/A	97%	97%	99%	
F. Bank Condition	100%	N/A	97%	93%	93%	
G. Vanes / J Hooks etc.	100%	N/A	83%	83%	82%	

Table 7b. Categorical Stream Feature Visual Stability Assessment
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment/Reach: UT to Garner Branch (250 ft.)

Feature	Initial	MY - 01	MY - 02	MY - 03	MY - 04	MY - 05
A. Riffles	100%	N/A	95%	90%	90%	
B. Pools	100%	N/A	100%	100%	100%	
C. Thalweg	100%	N/A	100%	100%	100%	

2.2.3 Quantitative Measures Summary Tables

Table 8a. Baseline Morphology and Hydraulic Summary
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment Reach: Garner Branch (1,750 ft.)

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Bankfull Width (ft)				12.0	24.0	16.0	10.0	15.6	12.8	21.0	25.0	23.0	16.4	44.8	35.8
Floodprone Width (ft)				52	57		19	33	27	40	63	52	36	74	49
Bankfull Cross Sectional Area (ft^2)						18.6	5.5	11.8	8.6			25.0	19.9	41.0	23.8
Bankfull Mean Depth (ft)				1.4	2.0	1.6	0.6	0.8	0.7	1.1	1.3	1.2	0.5	1.4	1.0
Bankfull Maximum Depth (ft)				3.0	3.8		1.0	1.2	1.1	1.7	2.0	1.8	1.5	3.1	2.0
Width/Depth Ratio						7.7	18.2	20.6	19.4	18.0	21.0	19.0	11.7	84.5	31.4
Entrenchment Ratio						4.5	1.9	3.3	2.6	1.9	2.5	2.2	1.5	3.1	1.9
Bank Height Ratio						1.2	0.9	1.1	1.0	0.9	1.1	1.0	1.0	1.0	1.0
Wetted Perimeter (ft)															
Hydraulic Radius (ft)															
Pattern															
Channel Beltwidth (ft)				19	50	37	28	41	35	35	50	43			
Radius of Curvature (ft)				8	31	20	12	35	24	23	40	32			
Meander Wavelength (ft)						96			47	70	108	80			
Meander Width Ratio						3.0	2.2	3.2	2.7	1.5	2.2	1.9			
Profile															
Riffle Length (ft)															
Riffle Slope (ft/ft)															
Pool Length (ft)															
Pool Spacing (ft)				44	95	69	40	50	45	50	78	64			
Substrate															
d50 (mm)						3			16			3	1.04	19	9
d84 (mm)						11.5			70			11.5			
Additional Reach Parameters															
Valley Length (ft)															
Channel Length (ft)															
Sinuosity					1.05			1.7			1.1				
Water Surface Slope (ft/ft)															
BF Slope (ft/ft)															
Rosgen Classification					E4			C4			C4			C4	

Table 8b. Baseline Morphology and Hydraulic Summary
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment Reach: UT to Garner Branch (250 ft.)

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Bankfull Width (ft)															17.1
Floodprone Width (ft)															24
Bankfull Cross Sectional Area (ft^2)															27
Bankfull Mean Depth (ft)															1.57
Bankfull Maximum Depth (ft)															2.57
Width/Depth Ratio															
Entrenchment Ratio															1.4
Bank Height Ratio															
Wetted Perimeter (ft)															
Hydraulic Radius (ft)															
Pattern															
Channel Beltwidth (ft)															
Radius of Curvature (ft)															
Meander Wavelength (ft)															
Meander Width Ratio															
Profile															
Riffle Length (ft)															
Riffle Slope (ft/ft)															
Pool Length (ft)															
Pool Spacing (ft)															
Substrate															
d50 (mm)															17
d84 (mm)															
Additional Reach Parameters															
Valley Length (ft)															
Channel Length (ft)															
Sinuosity															
Water Surface Slope (ft/ft)															
Bankfull Slope (ft/ft)															
Rosgen Classification															

Table 9. Morphology and Hydraulic Monitoring Summary
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment / Reach: Garner Branch (1,750 ft.)

Parameter	Cross Section 1 Riffle						Cross Section 2 Pool						Cross Section 3 Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	15.2	13.0	14.5	10.7			14.7	13.0	14.2	13.7			15.1	16.0	15.0	14.0		
Floodprone Width (ft)		33	36	34				42	44	41				51	50	51		
Bankfull Cross Sectional Area (ft^2)	12.8	15.2	12.8	11.2			22.1	18.3	19.4	20.6			15.8	18.3	17.0	17.6		
Bankfull Mean Depth (ft)	0.8	1.2	0.9	1.0			1.5	1.4	1.4	1.5			1.0	1.1	1.1	1.3		
Bankfull Maximum Depth (ft)	1.7	1.9	1.7	1.7			2.1	1.9	2.0	2.2			1.7	1.9	1.8	1.8		
Width/Depth Ratio	18.1	11.1	16.4	10.3			9.8	9.2	10.4	9.2			15.1	14.0	13.2	11.2		
Entrenchment Ratio		2.5	2.4	3.1				3.2	3.1	3.0				3.2	3.4	3.7		
Bank Height Ratio	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0		
Wetted Perimeter (ft)		14.1	15.1	11.9				14.1	15.2	14.9				16.8	15.9	15.2		
Hydraulic Radius (ft)		1.1	0.9	0.9				1.3	1.3	1.4				1.1	1.1	1.2		
Substrate																		
d50 (mm)	0.6	12.5	15.5	17.0			0.7	0.9	1.0	1.1			0.7	8.8	16.0	15.0		
d84 (mm)	9.5	28.0	36.0	29.0			10.5	39.0	27.0	3.8			10.5	20.0	39.0	45.0		

Table 9 cont. Morphology and Hydraulic Monitoring Summary
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment / Reach: Garner Branch (1,750 ft.)

Parameter	Cross Section 3A Riffle						Cross Section 4 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)			12.0	12.0			19.2	20.5	20.0	22.3		
Floodprone Width (ft)			30	30				77	75	74		
Bankfull Cross Sectional Area (ft^2)			20.5	20.9			25.0	37.2	36.9	36.2		
Bankfull Mean Depth (ft)			1.7	1.7			1.3	1.8	1.8	1.6		
Bankfull Maximum Depth (ft)			2.3	2.5			2.3	3.3	3.6	3.4		
Width/Depth Ratio			7.0	6.9			14.8	11.3	10.8	13.8		
Entrenchment Ratio			2.5	2.5				3.8	3.7	3.3		
Bank Height Ratio			1.0	1.0			1.0	1.0	1.0	1.0		
Wetted Perimeter (ft)			13.6	14.3				22.2	22.7	25.9		
Hydraulic Radius (ft)			1.5	1.5				1.7	1.6	1.4		
Substrate												
d50 (mm)			15.3	19.0			0.9	2.1	0.7	5.5		
d84 (mm)			38.0	58.0			5.8	10.0	6.0	28.0		

Table 9 cont. Morphology and Hydraulic Monitoring Summary
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment / Reach: Garner Branch (1,750 ft.) and UT to Garner Branch (250 ft.)

Parameter	Cross Section 5						Cross Section UT					
	Pool						Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	25.5	21.2	20.3	20.6			14.6	12.0	9.6	8.9		
Floodprone Width (ft)		46	46	41				20	17	16		
Bankfull Cross Sectional Area (ft^2)	22.4	23.3	23.3	20.6			12.0	13.9	10.3	8.3		
Bankfull Mean Depth (ft)	0.9	1.1	1.1	1.1			0.8	1.2	1.1	0.9		
Bankfull Maximum Depth (ft)	1.6	1.8	1.9	1.6			1.3	1.7	1.4	1.2		
Width/Depth Ratio	28.3	19.3	17.7	17.2			18.3	10.4	8.9	9.5		
Entrenchment Ratio		2.2	2.3	2.2				1.7	1.8	1.8		
Bank Height Ratio	1.0	1.0	1.0	0.8			1.0	1.0	1.0	1.1		
Wetted Perimeter (ft)		22	21.2	19.4				13.4	10.7	9.9		
Hydraulic Radius (ft)		1.1	1.1	1.1				1.0	1.0	0.8		
Substrate												
d50 (mm)	1.0	0.9	1.6	3.1			1.3	17.0	13.0	5.2		
d84 (mm)	6.8	18.0	22.0	19.0			19.2	33.0	31.0	45.0		

Table 9 cont. Morphology and Hydraulic Monitoring Summary continued
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment Reach: Garner Branch (1,750 ft.)

Parameter	MY - 01 (2004)			MY - 02 (2005)			MY - 03 (2006)			MY - 04 (2007)			MY - 05 (2008)		
Pattern*	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	24	56	33	13	44	29	20	45	26	21	44	26			
Radius of Curvature (ft)	28	87	66	15	80	50	20	75	50	27	75	53			
Meander Wavelength (ft)	83	104	100	72	113	84	77	118	96	83	119	92			
Meander Width Ratio***	1.6	3.7	2.2	1.6	4.1	2.6	1.4	3.2	1.8	1.7	3.6	2.1			
Profile															
Riffle Length (ft)	22	71	31	4	52	20	8	86	22	7	85	17			
Riffle Slope (ft/ft)	0.62%	4.53%	1.49%	1.06%	12.50%**	2.60%	0.10%	3.54%	1.66%	0.20%	5.24%	1.90%			
Pool Length (ft)	9	51	18	6	57	22	11	90	22	4	52	16			
Pool Spacing (ft)	19	402	61	9	404	44	34	673	61	32	189	55			
Additional Reach Parameters															
Valley Length (ft)					1,550			1,550			1,550				
Channel Length (ft)					1,773			1,780			1,780				
Sinuosity					1.15			1.15			1.18				
Water Surface Slope (ft/ft)															
Bankfull Slope (ft/ft)															
Rosgen Classification					C4			C4			C4				

*Pattern measurements for MY – 02, 03, & 04 calculated from approximately station 11+00 to 16+50, where the stream was re-meandered.

**Max riffle slope from bedrock riffle, omitted from riffle calculations for MY02

***Meander Width Ratios calculated using average bankfull width from riffle cross sections

Appendix A
Vegetation Data

A1 - Vegetation Data Tables

Table A1. Stem counts for each species arranged by plot
Project Number and Name: 87 - Chavis Park (Garner Branch of Walnut Creek)

Species	Plots				Initial Totals	Year 2 Totals	Year 3 Totals	Year 4 Totals	Survival %
	1	2	3	4					
Shrubs									
Viburnum nudum	1	2	2	2	N/A	10	9	9	80%
Cornus amomum	6	4	5	1	N/A	17	18	16	94%
Ilex verticillata	2	1			N/A	4	4	3	75%
Ilex glabra		1			N/A	1	1	1	100%
Myrica cerifera	2				N/A	2	2	2	100%
Callicarpa americana		4		1	N/A	5	6	5	100%
Alnus serrulata	1	1	4		N/A	6	6	6	100%
Trees									
Platanus occidentalis	4	3	6	1	N/A	14	14	14	100%
Hamamelis virginiana	1	5			N/A	6	6	6	100%
Fraxinus pennsylvanica		2	2		N/A	6	4	4	67%
Liriodendron tulipifera		1			N/A	3	3	1	33%
Betula nigra					N/A	1	0	0	0%

Monitoring Year 01 revealed poor survival of planted species within the vegetation plots. The first year monitoring report recommended that the project area be replanted with larger containerized trees. Maintenance planting throughout the entire site was completed in 2004. The vegetation plot corners established during Monitoring Year 01 could not be found and new plots were established and permanently marked during Monitoring Year 02.

Explanation of Probable Causes of Vegetation Mortality
The planted vegetation has experienced a moderate amount of mortality over the past year. Mortality of six planted stems can most likely be attributed to competition with herbaceous vegetation. This should be closely monitored to determine if herbicide should be sprayed around the planted stems to promote and uphold vegetative success.

Invasives Species Within the Site and Implications
Invasive species are abundant throughout the site, consisting of English ivy (*Hedera helix*), microstegium (*Microstegium vimineum*), mimosa (*Albizia julibrissin*), white malberry (*Morus alba*), and Japanese honeysuckle (*Lonicera japonica*). Species that were observed include Japanese privet (*Ligustrum japonicum*), Chinese privet (*Ligustrum sinense*), Bradford pear (*Pyrus calleryana*), Japanese hops (*Humulus japonicus)*, princess tree (*Paulownia tomentosa*), oriental bittersweet (*Celastrus orbiculatus*), osage orange (*Maclura pomifera*), multiflora rose (*Rosa multiflora*), lespedeza (*Lespedeza cuneata*), porcelainberry (*Ampelopsis brevipedunculata*), and morning glory (*Ipomoea jaegeri*).

Due to the urban location of Chavis Park there are many sources of invasive species close to the project and complete eradication of these plants is not possible. Controlling the invasive species by spraying and manual removal could help reduce the closest seed sources and decrease competition with the planted native species. The removal of the large white mulberry trees in the easement is recommended.

Table A2. Stem Density By Plot
Project Number and Name: 87 - Chavis Park (Garner Branch) Stream Restoration
Date : 5/29/07
Crew : A. Spiller, B. Roberts

Plot #	Winterberry *Ilex verticillata*	Silky Dogwood *Cornus amomum*	Green Ash *Fraxinus pennsylvanica*	Tag Alder *Alnus serrulata*	Witch Hazel *Hamamelis virginiana*	Possum Haw *Viburnum nudum*	River Birch *Betula nigra*	Sycamore *Platanus occidentalis*	Tulip Poplar *Liriodendron tulipifera*	American Beautyberry *Callicarpa americana*	Wax Myrtle *Myrica cerifera*	Inkberry *Ilex glabra*	Total (Year 4)	**Density (Trees/Acre)**
1	2	6		1	1	1		4			2		17	680
2	1	4	2	1	5	2		3	1	4		1	24	960
3		5	2	4		2		6					19	760
4		1				2		1		1			5	200
											Average Density			650

A2 – Representative Vegetation Problem Area Photos

VP1 – English ivy (*Hedera helix*) on stream bank. Photo taken near Station 10+50. 11/12/07 - MY 04

VP2 – Japanese hops (*Humulus japonicus*) on stream bank and terrace. Photo taken near Station 24+50. 11/12/07 - MY 04

VP3 – Unconsolidated dirt dumped on stream bank. Photo taken near Station 10+50. 11/12/07 - MY 04

A3 - Vegetation Monitoring Plot Photos

Plot 1 Photo – Taken looking at center of plot on right bank from top of left bank. 5/29/07 - MY 04.

Plot 2 Photo – Taken looking at center of plot from top of right bank. 5/29/07 - MY 04.

Plot 3 Photo – Taken looking at center of plot from top of left bank. 5/29/07 - MY 04.

Plot 4 Photo – Taken looking at center of plot from top of left bank. 5/29/07 - MY 04.

Appendix B
Geomorphologic Data

B1 – Representative Stream Problem Area Photos

SP1 – Mid-channel bar forming. Photo taken on tributary. 11/12/07 - MY 04

SP2 – Bank erosion/slumping. Photo taken near Station 11+60. 11/12/07 - MY 04

SP3 – Bank erosion/slumping. Photo taken near Station 13+70. 11/12/07 - MY 04

SP4 – Bank erosion/slumping. Photo taken near Station 14+95. 11/12/07 - MY 04

SP5 – Bank erosion/slumping. Photo taken near Station 24+25. 11/12/07 - MY 04

SP6 – Bank erosion/slumping. Photo taken near Station 24+60. 11/12/07 - MY 04

SP7 – Back arm scour on cross vane. Photo taken near Station 14+00. 11/12/07 - MY 04

B2 –Stream Photo Station Photos

Photo Point 1 – 11/12/07 - MY 04

Photo Point 2 – 11/12/07 - MY 04

Photo Point 3 – 11/12/07 - MY 04

Photo Point 4 – 11/12/07 - MY 04

Photo Point 5 – 11/12/07 - MY 04

Photo Point 6 (Garner Branch) – 11/12/07 - MY 04

Photo Point 6 (UT) – 11/12/07 - MY 04

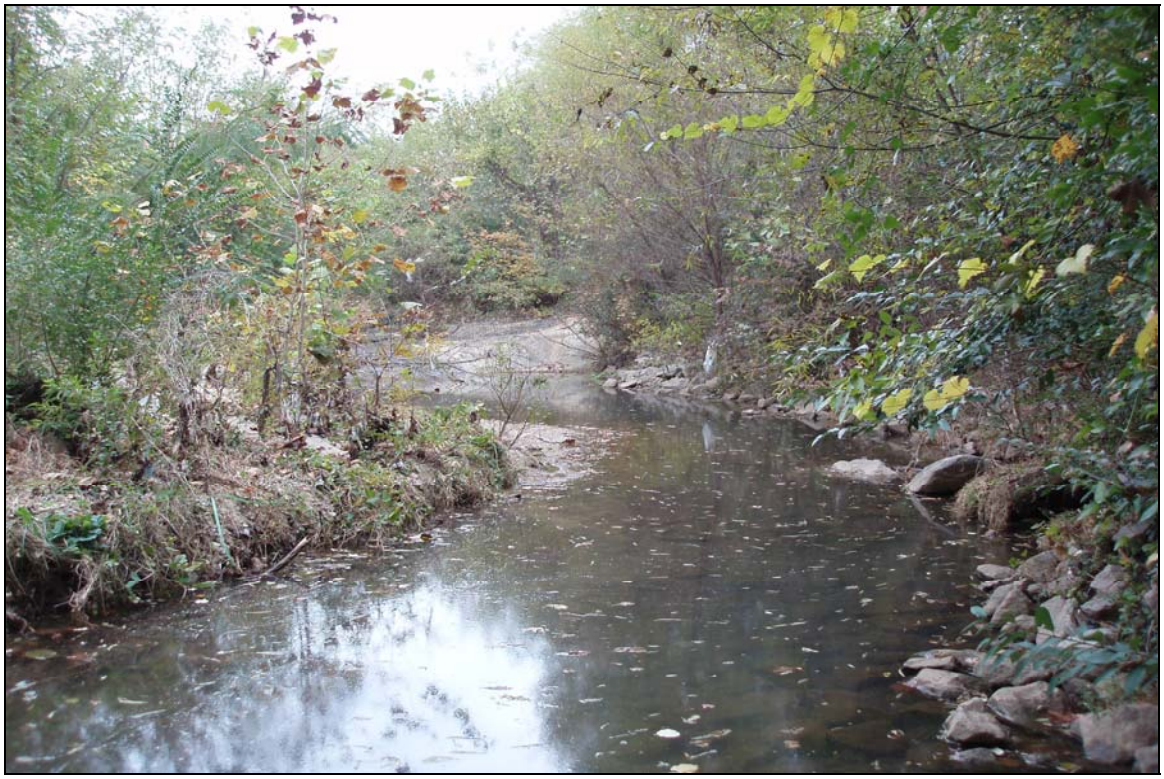


Photo Point 7 – 11/12/07 - MY 04

B3 – Qualitative Visual Stability Assessment

Table B2. Qualitative Visual Stability Assessment
Project Number 87 - Chavis Park (Garner Branch of Walnut Creek)
Segment/Reach: Garner Branch (1,750 ft.)

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?	12	18	N/A	72	
	2. Armor stable (e.g. no displacement)?	12	18	N/A	67	
	3. Facet grade appears stable?	12	18	N/A	67	
	4. Minimal evidence of embedding/fining?	12	18	N/A	67	
	5. Length appropriate?	12	18	N/A	67	**68%**
B. Pools	1. Present? (e.g. no severe aggradation or migration)	22	28	N/A	79	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	22	28	N/A	79	
	3. Length appropriate?	19	28	N/A	68	**75%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	13	16	N/A	81	
	2. Downstream of meander (glide/inflection) centering?	11	16	N/A	69	**75%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	13	16	N/A	69	
	2. Of those eroding, # w/ concomitant point bar formation?	3	3	N/A	100	
	3. Apparent Rc within spec?	11	16	N/A	69	
	4. Sufficient floodplain access and relief?	16	16	N/A	100	**84%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	15-Jan	99	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0/0	100	**99%**
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	7/225	93	**93%**
G. Vanes	1. Free of back or arm scour?	12	19	N/A	63	
	2. Height appropriate?	16	19	N/A	84	
	3. Angle and geometry appear appropriate?	18	19	N/A	95	
	4. Free of piping or other structural failures?	16	19	N/A	84	**82%**

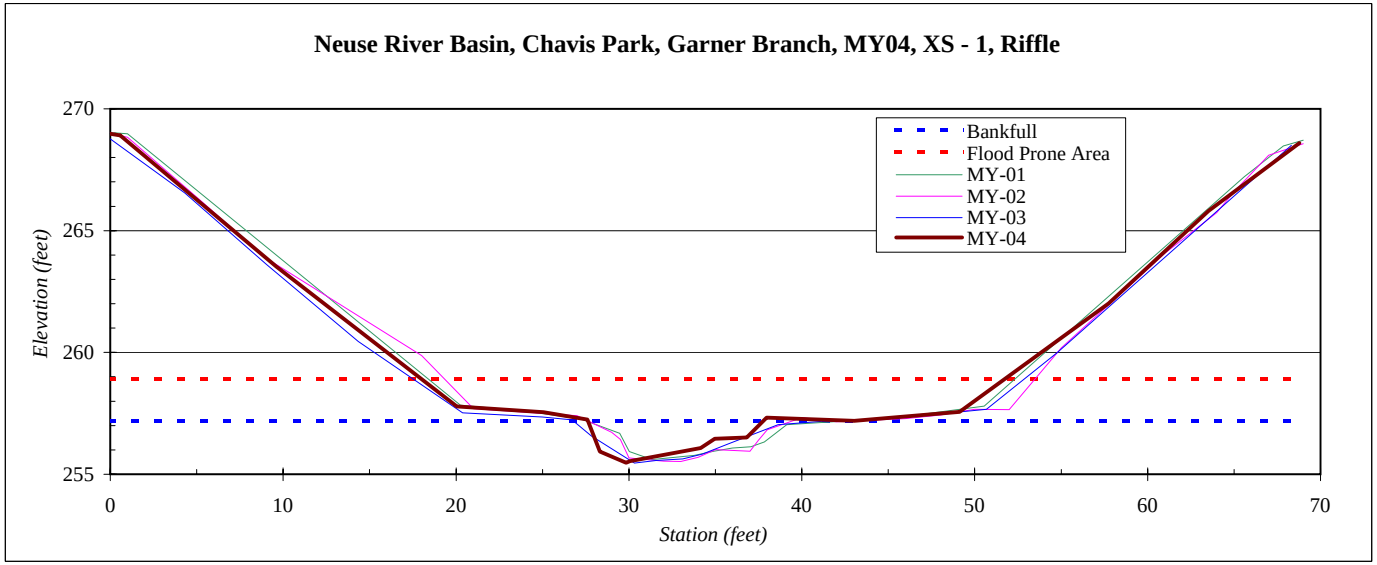
* Total number of features per as-built estimated from as-built profile and planview shee

B4 - Cross Section Plots

River Basin:	Neuse
Watershed:	Chavis Park, Garner Branch, MY04
XS ID	XS - 1, Riffle
Drainage Area (sq mi):	0.54
Date:	8/16/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	268.97
0.6	268.92
9.6	263.53
20.0	257.78
25.1	257.55
27.6	257.25
28.3	255.94
29.8	255.47
30.1	255.54
34.2	256.08
35.0	256.46
36.8	256.51
38.0	257.32
43.0	257.19
49.1	257.57
57.7	262.01
63.5	265.81
68.8	268.60

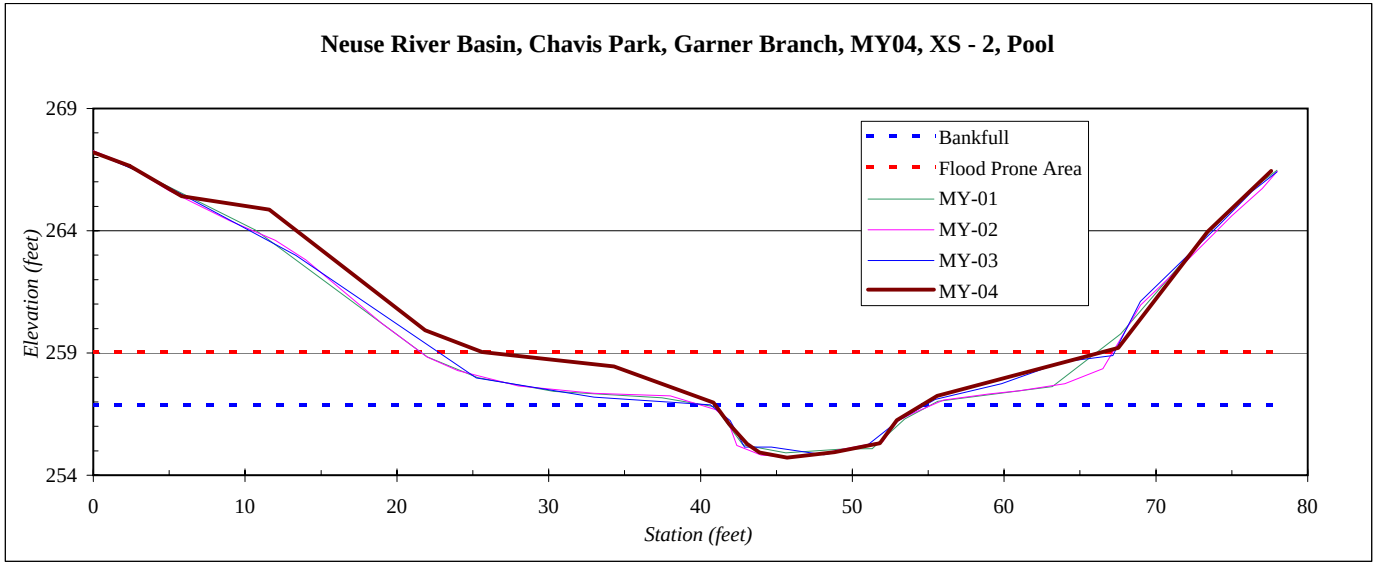
SUMMARY DATA	
Bankfull Elevation:	257.2
Bankfull Cross-Sectional Area:	11.2
Bankfull Width:	10.7
Flood Prone Area Elevation:	258.9
Flood Prone Width:	33.8
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	1.0
W / D Ratio:	10.3
Entrenchment Ratio:	3.1
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	Chavis Park, Garner Branch, MY04
XS ID	XS - 2, Pool
Drainage Area (sq mi):	0.54
Date:	8/17/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	267.21
2.4	266.66
5.8	265.41
11.6	264.86
21.9	259.92
25.6	259.04
34.3	258.45
40.9	256.97
41.9	256.09
43.1	255.28
43.9	254.93
45.7	254.72
48.8	254.95
51.8	255.30
52.9	256.25
55.6	257.24
67.5	259.21
73.4	263.96
77.6	266.45

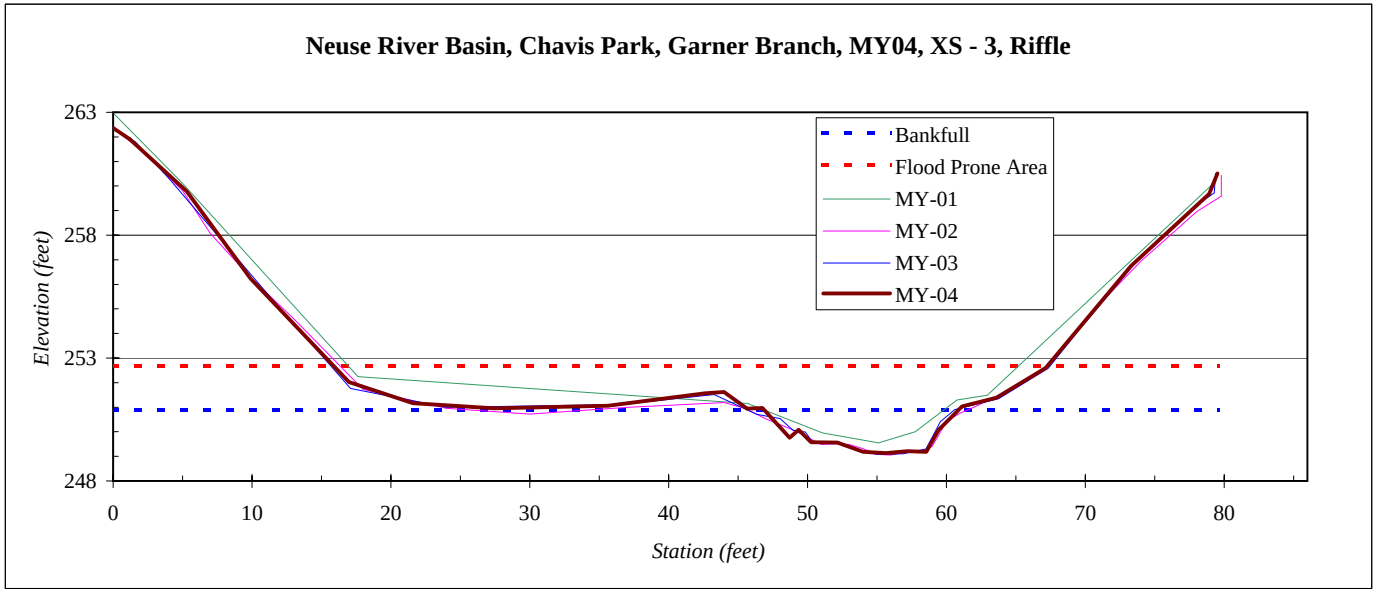
SUMMARY DATA	
Bankfull Elevation:	256.9
Bankfull Cross-Sectional Area:	20.6
Bankfull Width:	13.7
Flood Prone Area Elevation:	259.0
Flood Prone Width:	41.3
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.5
W / D Ratio:	9.2
Entrenchment Ratio:	3.0
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	Chavis Park, Garner Branch, MY04
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	0.54
Date:	8/18/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	262.36
1.2	261.90
5.3	259.78
9.9	256.24
17.0	252.03
21.6	251.16
27.4	250.96
35.6	251.07
42.6	251.56
44.0	251.62
45.6	250.95
46.8	250.97
48.7	249.75
49.3	250.09
50.3	249.57
52.1	249.56
54.0	249.19
55.6	249.13
57.2	249.22
58.6	249.18
59.4	250.07
61.1	251.03
63.6	251.39
67.1	252.59
73.3	256.75
78.9	259.68
79.5	260.52

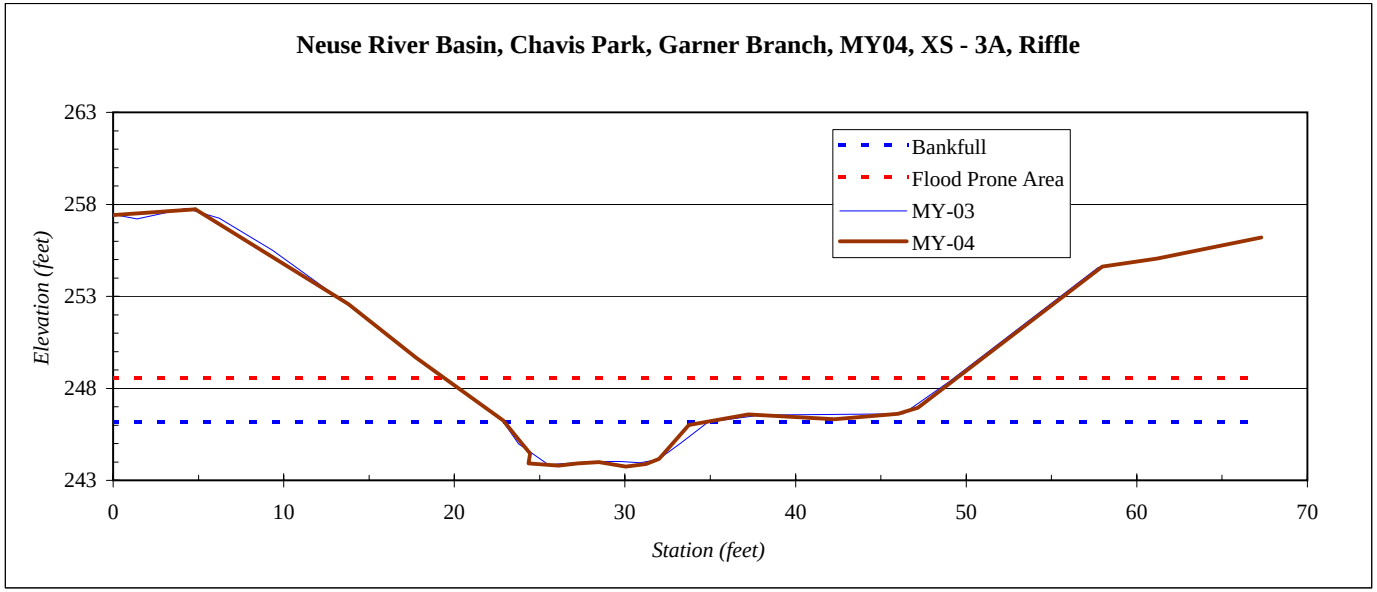
SUMMARY DATA	
Bankfull Elevation:	250.9
Bankfull Cross-Sectional Area:	17.6
Bankfull Width:	14.0
Flood Prone Area Elevation:	252.7
Flood Prone Width:	51.4
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.3
W / D Ratio:	11.1
Entrenchment Ratio:	3.7
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	Chavis Park, Garner Branch, MY04
XS ID	XS - 3A, Riffle
Drainage Area (sq mi):	0.54
Date:	8/18/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	257.42
4.8	257.73
13.8	252.58
17.8	249.66
22.9	246.25
23.7	245.34
24.4	244.47
24.3	243.92
26.1	243.79
27.2	243.92
28.5	243.99
30.0	243.75
31.2	243.89
32.0	244.16
33.7	246.01
37.2	246.58
42.3	246.32
46.0	246.62
47.2	246.95
58.0	254.62
61.2	255.05
67.3	256.20

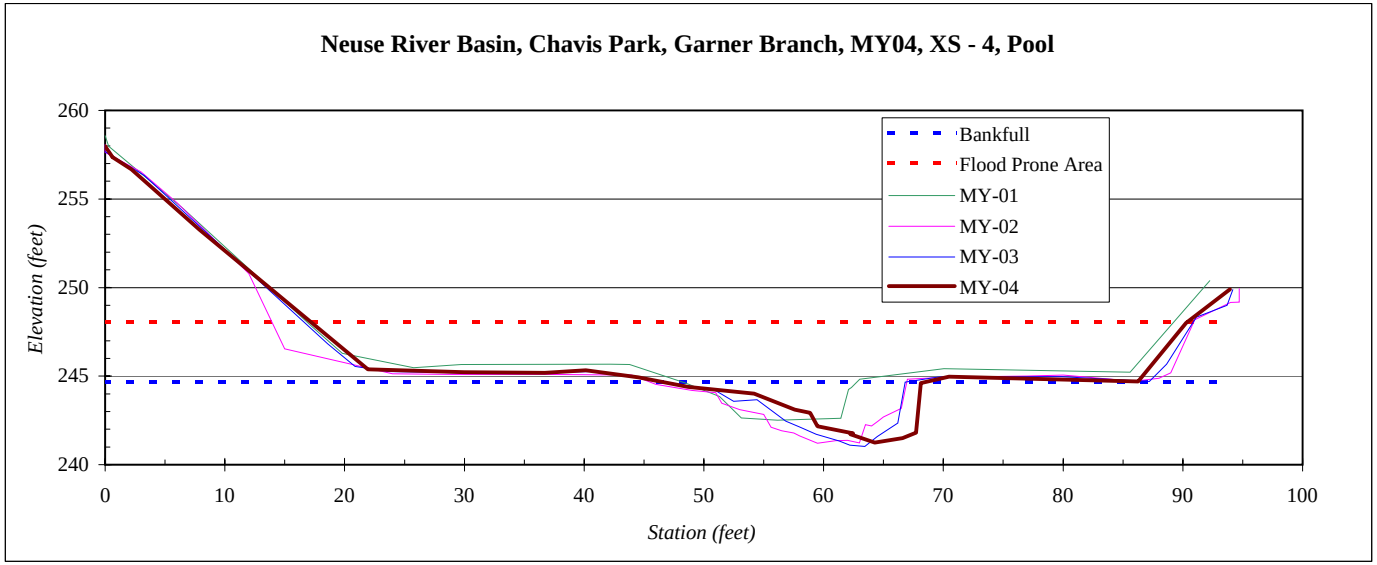
SUMMARY DATA	
Bankfull Elevation:	246.2
Bankfull Cross-Sectional Area:	20.5
Bankfull Width:	12.0
Flood Prone Area Elevation:	248.6
Flood Prone Width:	29.7
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	1.7
W / D Ratio:	7.0
Entrenchment Ratio:	2.5
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	Chavis Park, Garner Branch, MY04
XS ID	XS - 4, Pool
Drainage Area (sq mi):	0.54
Date:	8/22/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	257.97
0.6	257.36
2.2	256.68
7.9	253.29
21.9	245.39
30.0	245.23
36.7	245.18
40.1	245.32
44.5	244.94
48.7	244.39
54.2	244.02
57.6	243.11
58.9	242.92
59.5	242.16
62.5	241.76
62.2	241.72
64.3	241.26
66.6	241.49
67.7	241.81
68.1	244.61
70.5	244.96
86.3	244.70
90.3	248.01
93.9	249.89

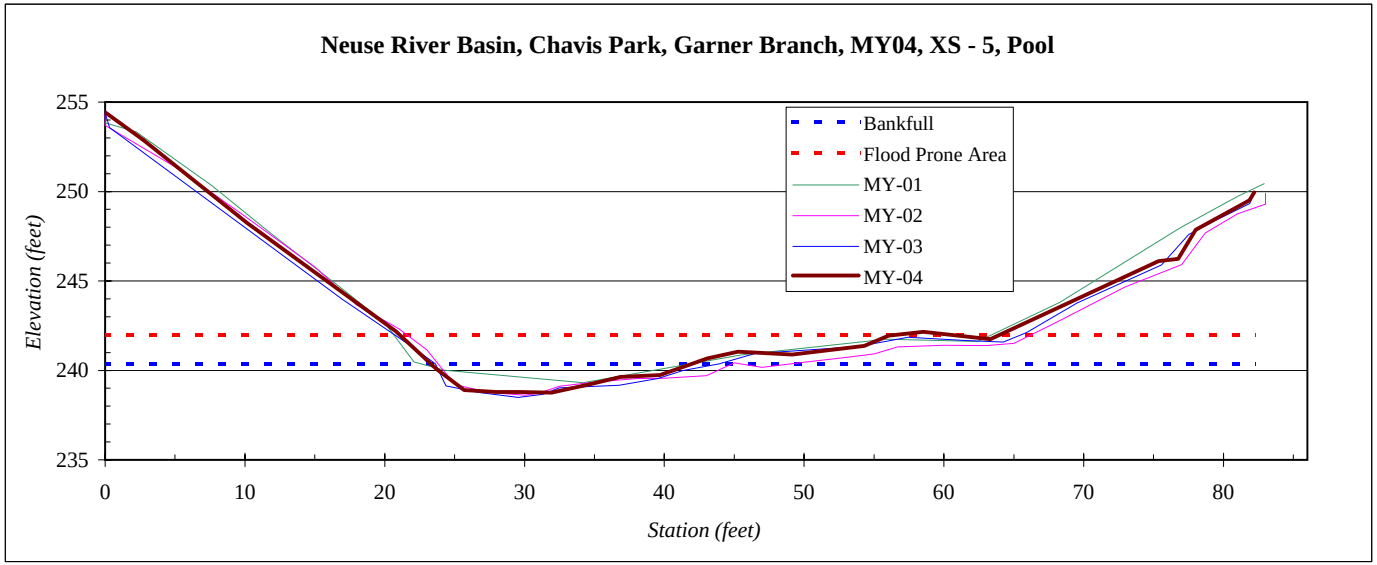
SUMMARY DATA	
Bankfull Elevation:	244.7
Bankfull Cross-Sectional Area:	36.2
Bankfull Width:	22.3
Flood Prone Area Elevation:	248.1
Flood Prone Width:	73.5
Max Depth at Bankfull:	3.4
Mean Depth at Bankfull:	1.6
W / D Ratio:	13.7
Entrenchment Ratio:	3.3
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	Chavis Park, Garner Branch, MY04
XS ID	XS - 5, Pool
Drainage Area (sq mi):	0.54
Date:	9/6/2007
Field Crew:	B. Roberts, J. Costante

Station	Elevation
0.0	254.43
2.7	252.88
10.2	248.24
20.8	242.19
23.7	240.09
25.7	238.90
28.0	238.79
29.6	238.79
31.9	238.75
34.7	239.23
36.8	239.63
39.7	239.74
43.1	240.67
45.3	241.05
49.2	240.88
54.3	241.36
56.0	241.94
58.5	242.15
63.3	241.74
75.3	246.12
76.8	246.24
78.0	247.86
81.9	249.51
82.2	249.96

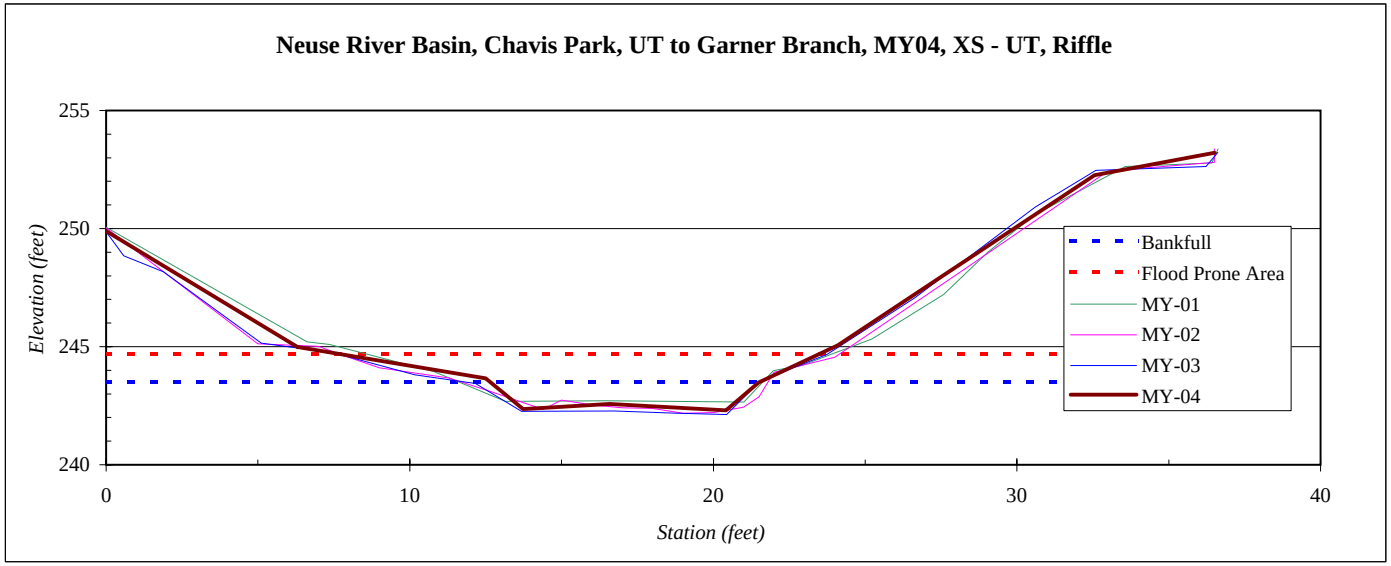
SUMMARY DATA	
Bankfull Elevation:	240.4
Bankfull Cross-Sectional Area:	20.6
Bankfull Width:	18.8
Flood Prone Area Elevation:	242.0
Flood Prone Width:	40.6
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.1
W / D Ratio:	17.2
Entrenchment Ratio:	2.2
Bank Height Ratio:	0.8



River Basin:	Neuse
Watershed:	Chavis Park, UT to Garner Branch, MY04
XS ID	XS - UT, Riffle
Drainage Area (sq mi):	0.2
Date:	8/22/2007
Field Crew:	B. Roberts, J. Costante

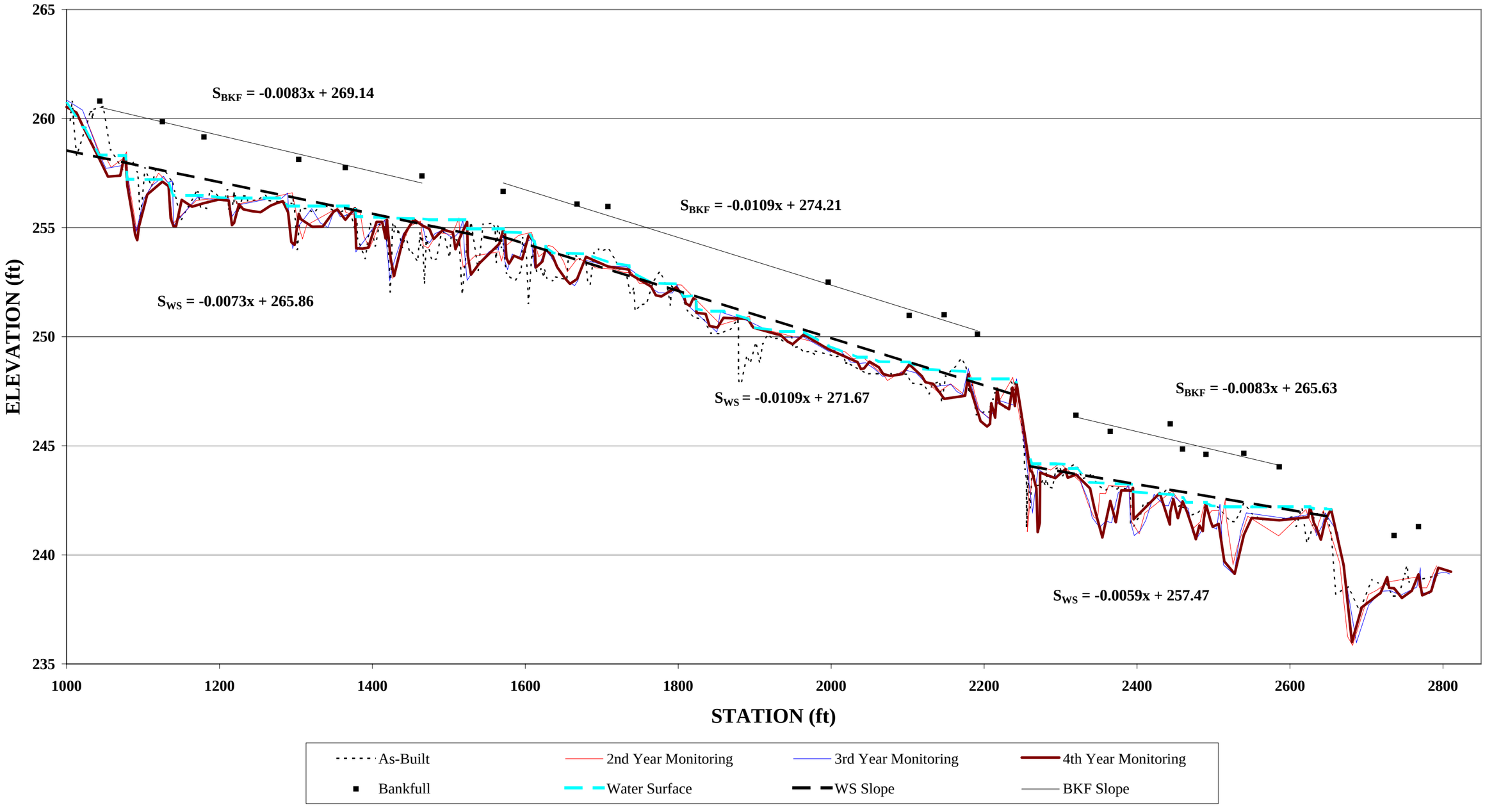
Station	Elevation
0.0	249.89
6.3	244.99
12.5	243.65
13.7	242.35
16.6	242.57
20.4	242.31
21.5	243.49
24.1	245.05
32.6	252.26
36.5	253.21

SUMMARY DATA	
Bankfull Elevation:	243.5
Bankfull Cross-Sectional Area:	8.3
Bankfull Width:	8.9
Flood Prone Area Elevation:	244.7
Flood Prone Width:	15.8
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.9
W / D Ratio:	9.5
Entrenchment Ratio:	1.8
Bank Height Ratio:	1.1



B5 - Longitudinal Plot

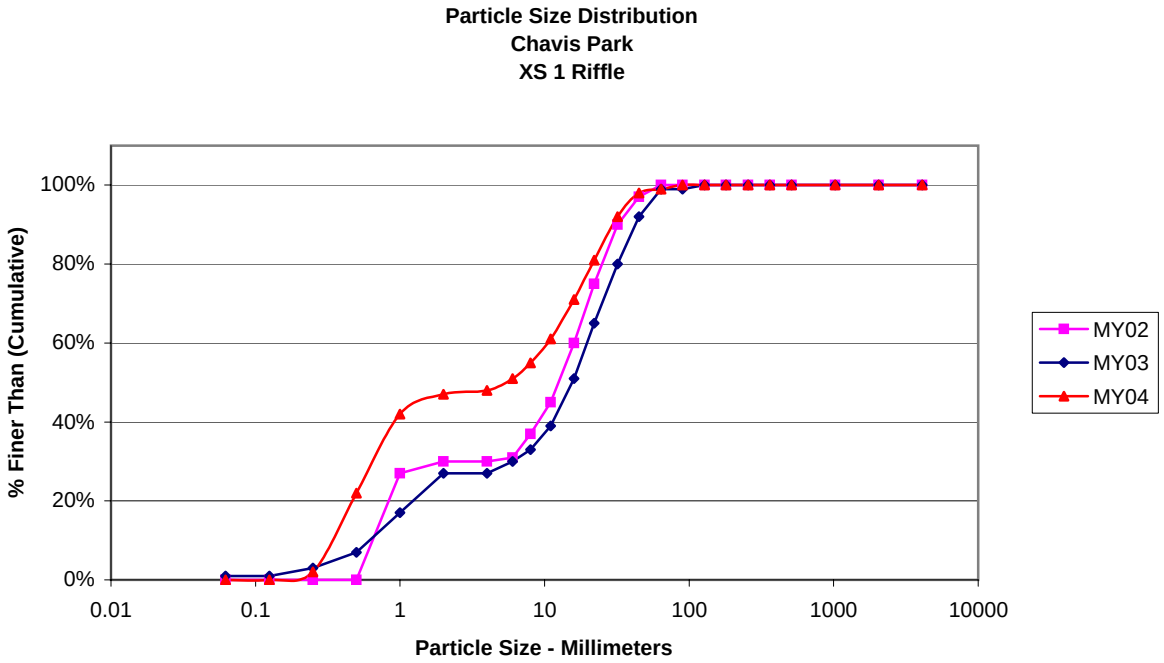
Longitudinal Profile
Chavis Park (Garner Branch), Wake County
EEP Project Number 87 - MY04



B6 - Pebble Count Plots

Cross Section 1 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	2
Medium	.25 - .50	N	20
Coarse	.50 - 1	D	20
Very Coarse	1 - 2	S	5
Very Fine	2 - 4		1
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	10
Coarse	16 - 22.6	E	10
Coarse	22.6 - 32	L	11
Very Coarse	32 - 45	S	6
Very Coarse	45 - 64		1
Small	64 - 90	C	1
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



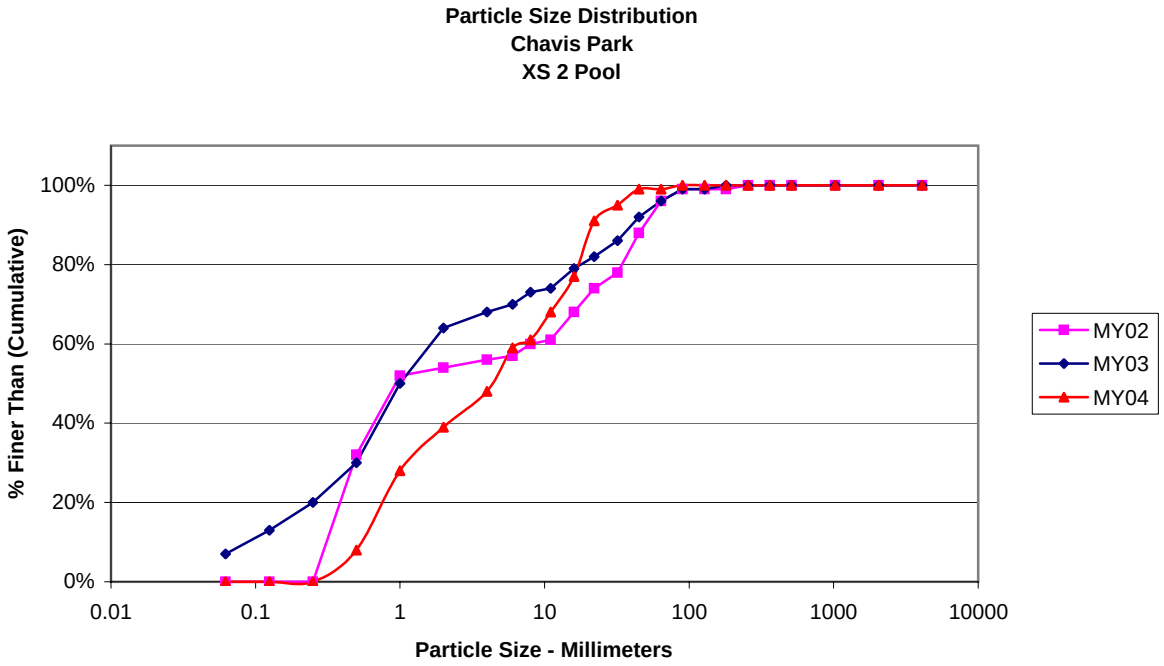
Size (mm)	
D16	0.41
D35	0.78
D50	5.2
D65	13
D84	24
D95	38

Size Distribution	
mean	3.1
dispersion	8.6
skewness	-0.17

Type	
silt/clay	0%
sand	47%
gravel	52%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 2 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	8
Coarse	.50 - 1	D	20
Very Coarse	1 - 2	S	11
Very Fine	2 - 4		9
Fine	4 - 5.7	G	11
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	7
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	14
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	4
Very Coarse	45 - 64		
Small	64 - 90	C	1
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



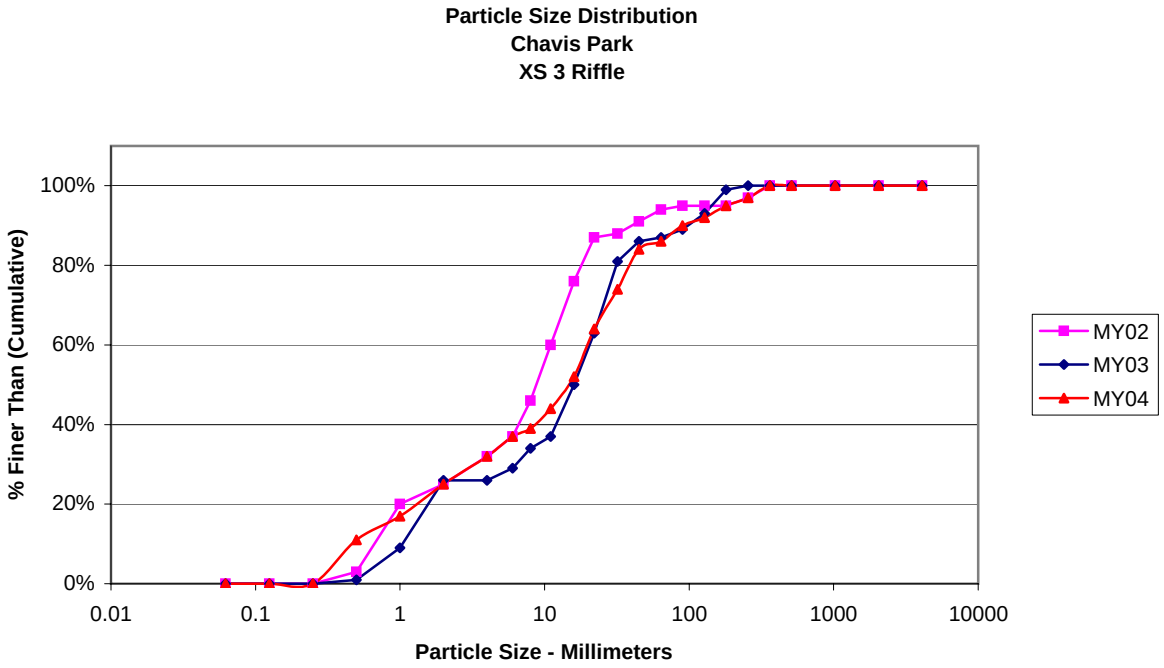
Size (mm)	
D16	0.66
D35	1.6
D50	4.3
D65	9.6
D84	19
D95	32

Size Distribution	
mean	3.5
dispersion	5.5
skewness	-0.07

Type	
silt/clay	0%
sand	39%
gravel	60%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 3 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	11
Coarse	.50 - 1	D	6
Very Coarse	1 - 2	S	8
Very Fine	2 - 4		7
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	8
Coarse	16 - 22.6	E	12
Coarse	22.6 - 32	L	10
Very Coarse	32 - 45	S	10
Very Coarse	45 - 64		2
Small	64 - 90	C	4
Small	90 - 128	O	2
Large	128 - 180	B	3
Large	180 - 256	L	2
Small	256 - 362	B	3
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



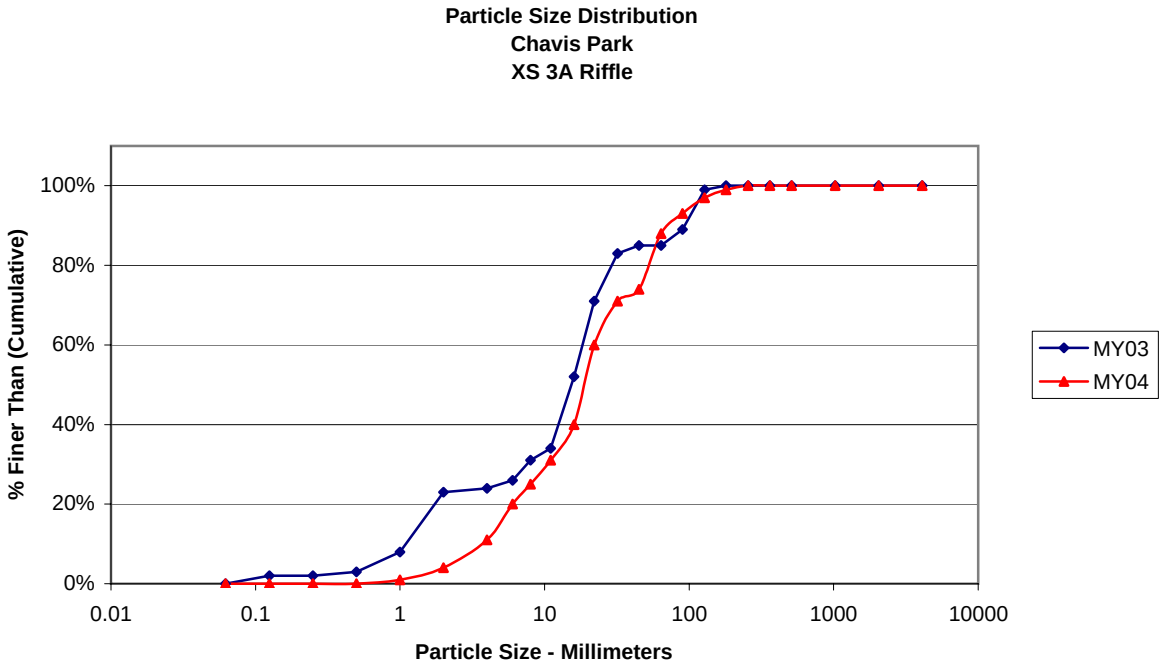
Size (mm)	
D16	0.89
D35	5.1
D50	15
D65	23
D84	45
D95	180

Size Distribution	
mean	6.3
dispersion	9.9
skewness	-0.29

Type	
silt/clay	0%
sand	25%
gravel	61%
cobble	11%
boulder	3%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 3A Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	3
Very Fine	2 - 4		7
Fine	4 - 5.7	G	9
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	20
Coarse	22.6 - 32	L	11
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		14
Small	64 - 90	C	5
Small	90 - 128	O	4
Large	128 - 180	B	2
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



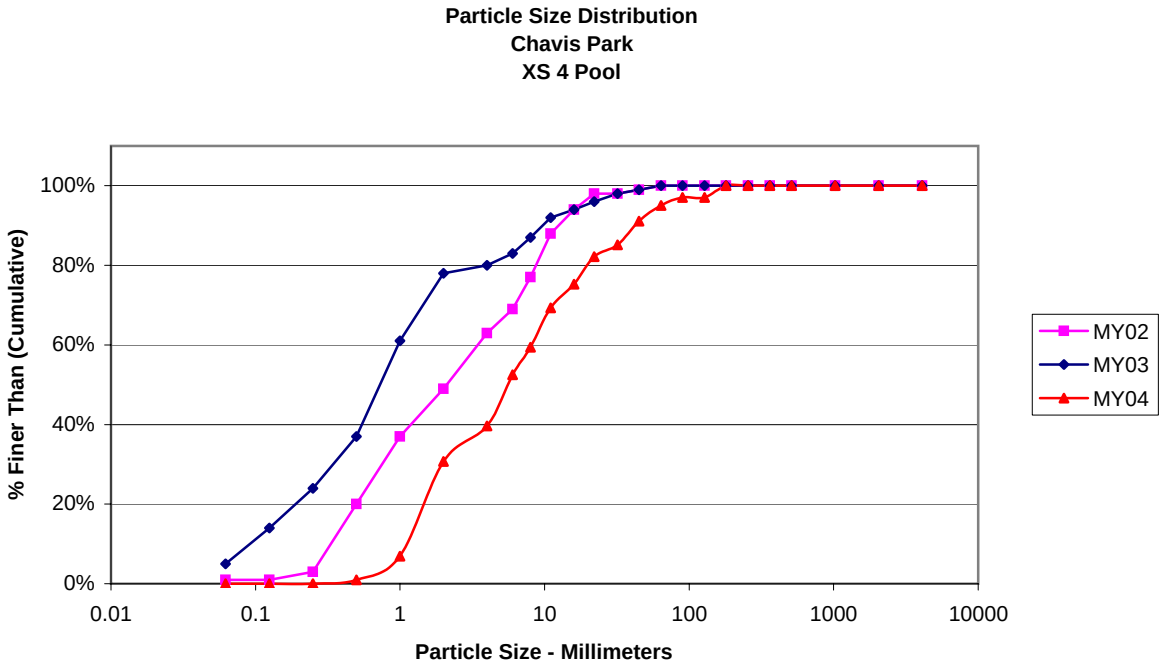
Size (mm)	
D16	5
D35	13
D50	19
D65	26
D84	58
D95	110

Size Distribution	
mean	17.0
dispersion	3.4
skewness	-0.05

Type	
silt/clay	0%
sand	4%
gravel	84%
cobble	12%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 4 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	6
Very Coarse	1 - 2	S	24
Very Fine	2 - 4		9
Fine	4 - 5.7	G	13
Fine	5.7 - 8	R	7
Medium	8 - 11.3	A	10
Medium	11.3 - 16	V	6
Coarse	16 - 22.6	E	7
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	6
Very Coarse	45 - 64		4
Small	64 - 90	C	2
Small	90 - 128	O	
Large	128 - 180	B	3
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



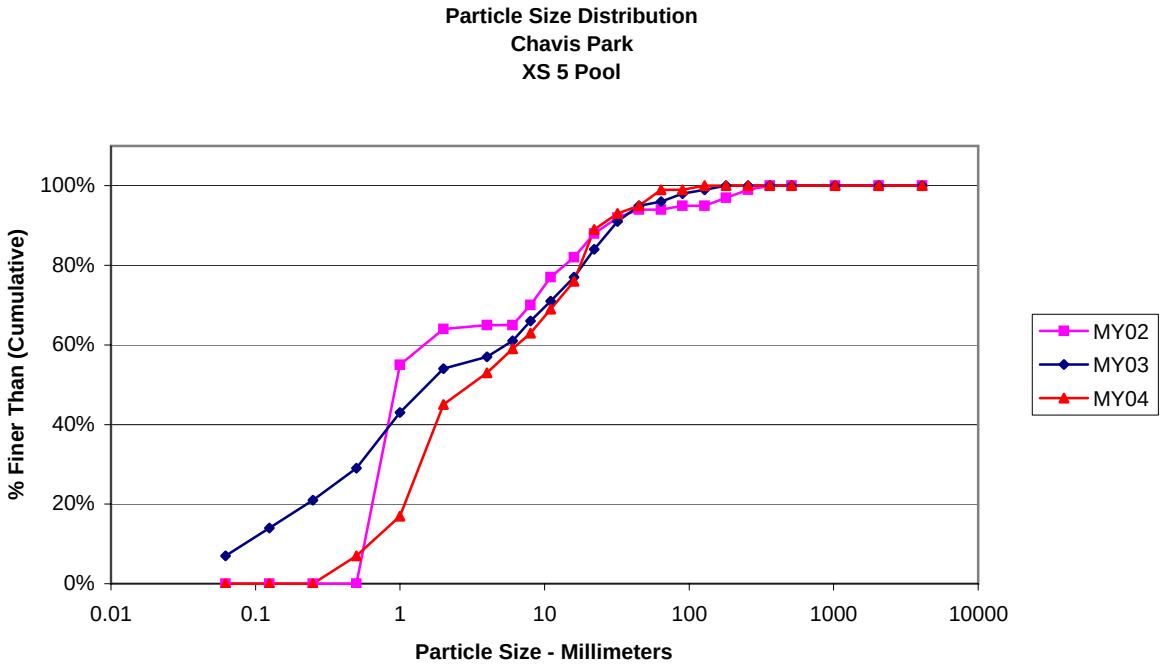
Size (mm)	
D16	1.3
D35	2.8
D50	5.5
D65	9.6
D84	28
D95	64

Size Distribution	
mean	6.0
dispersion	4.7
skewness	0.03

Type	
silt/clay	0%
sand	31%
gravel	64%
cobble	5%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section 5 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	10
Very Coarse	1 - 2	S	28
Very Fine	2 - 4		8
Fine	4 - 5.7	G	6
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	7
Coarse	16 - 22.6	E	13
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	2
Very Coarse	45 - 64		4
Small	64 - 90	C	
Small	90 - 128	O	1
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



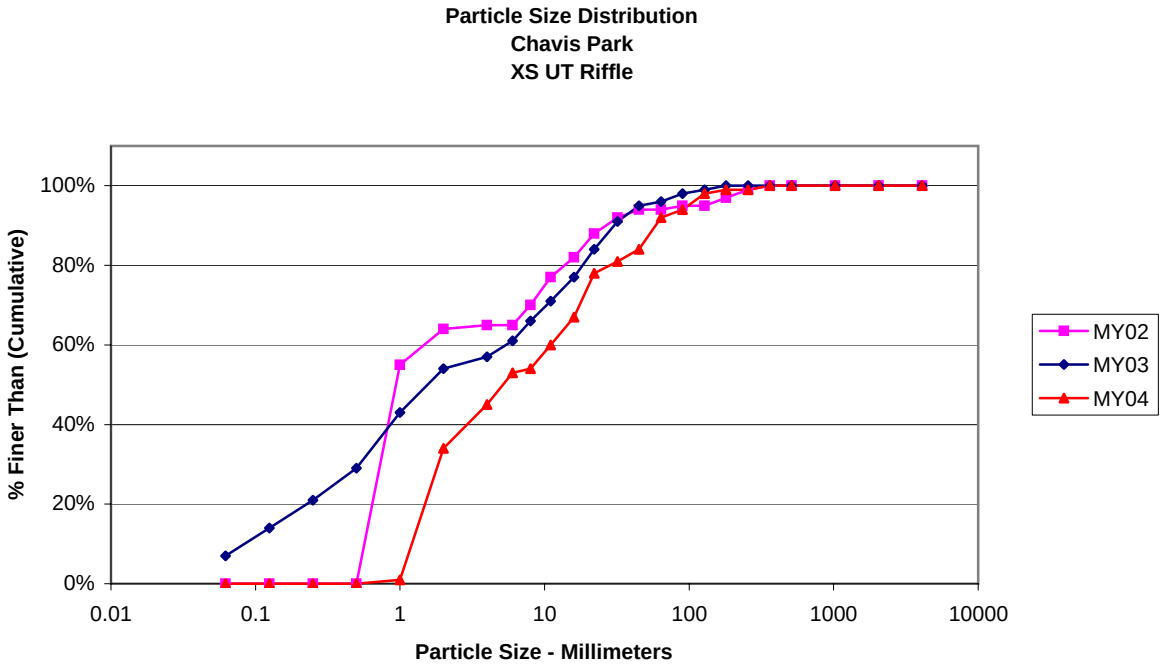
Size (mm)	
D16	0.93
D35	1.6
D50	3.1
D65	8.9
D84	19
D95	45

Size Distribution	
mean	4.2
dispersion	4.7
skewness	0.12

Type	
silt/clay	0%
sand	45%
gravel	54%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross Section UT Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	33
Very Fine	2 - 4		11
Fine	4 - 5.7	G	8
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	7
Coarse	16 - 22.6	E	11
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		8
Small	64 - 90	C	2
Small	90 - 128	O	4
Large	128 - 180	B	1
Large	180 - 256	L	
Small	256 - 362	B	1
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:

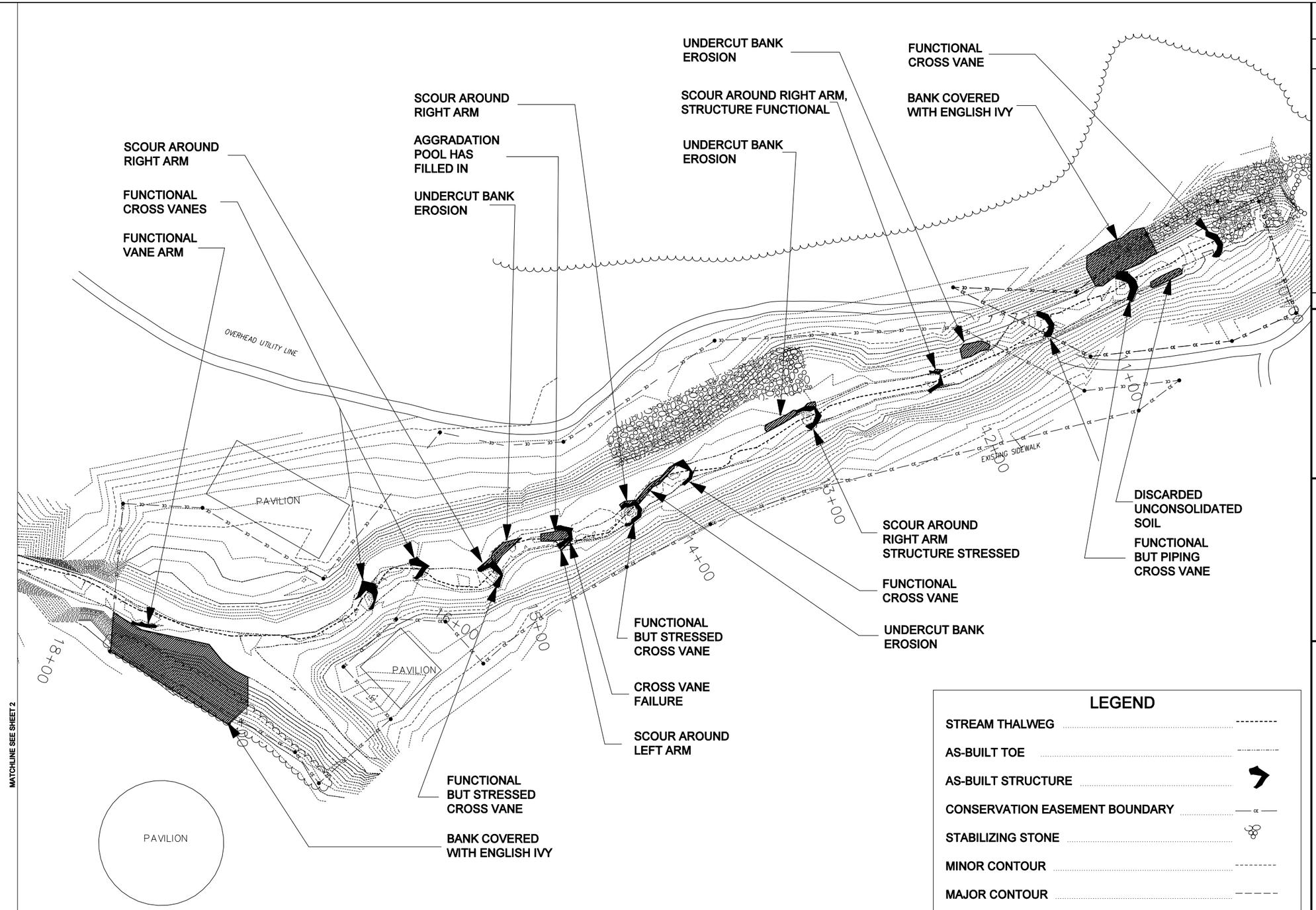


Size (mm)	
D16	1.4
D35	2.1
D50	5.2
D65	14
D84	45
D95	98

Size Distribution	
mean	7.9
dispersion	6.2
skewness	0.15

Type	
silt/clay	0%
sand	34%
gravel	58%
cobble	7%
boulder	1%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Appendix C
Current Conditions Plan View



LEGEND

- STREAM THALWEG
- AS-BUILT TOE
- AS-BUILT STRUCTURE
- CONSERVATION EASEMENT BOUNDARY — CE —
- STABILIZING STONE
- MINOR CONTOUR
- MAJOR CONTOUR

–60 –30 0 30 60

GRAPHIC SCALE

REVISIONS

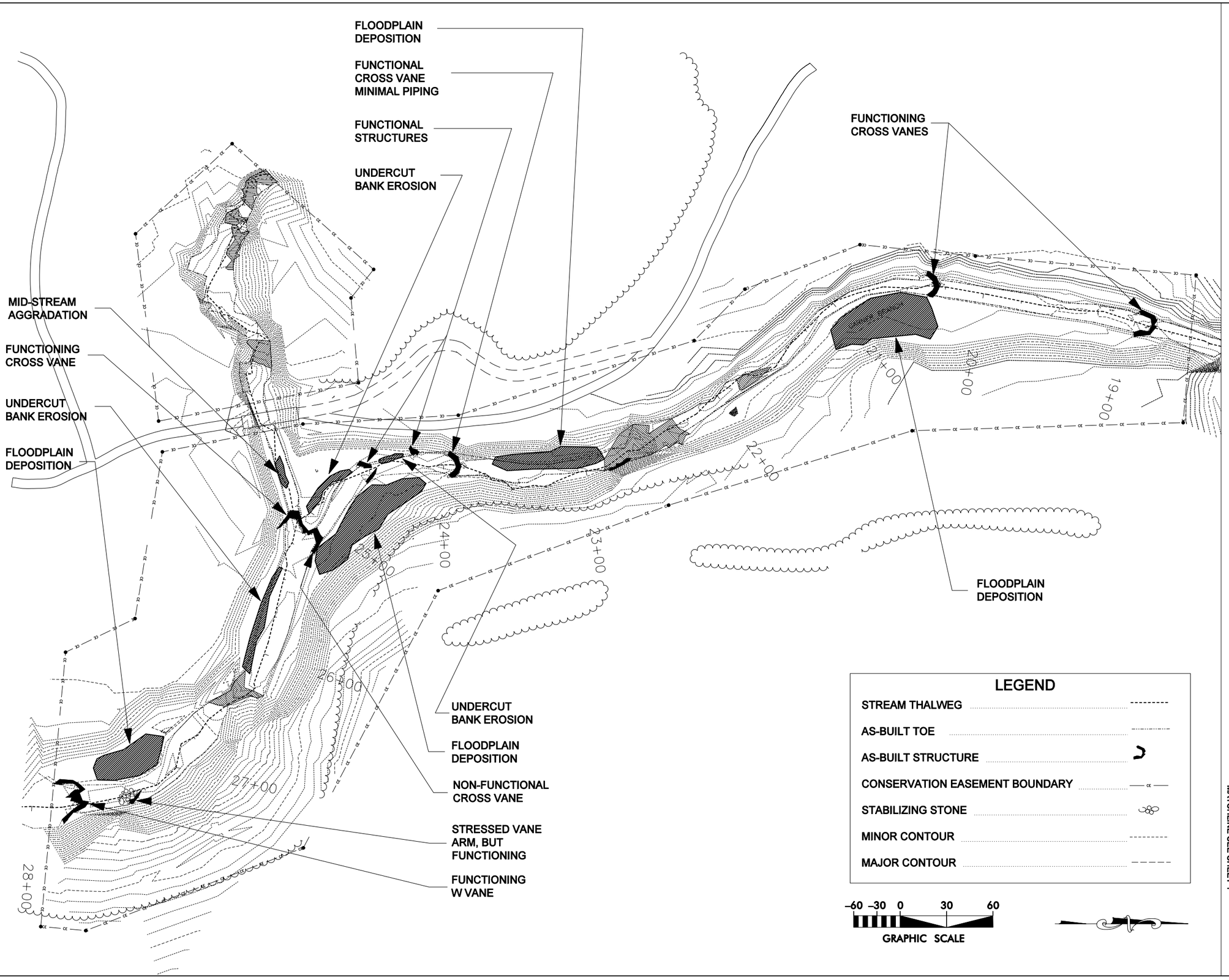
NO.	DESCRIPTION	DATE	APPROVED

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

CHAVIS PARK (GARNER BRANCH)
WAKE COUNTY
EEP PROJECT NUMBER 87 - MY04
STATION 10+00 TO STATION 18+40

DATE: NOVEMBER 2007
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW



MATCHLINE SEE SHEET 1

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

CHAVIS PARK (GARNER BRANCH)
WAKE COUNTY
EEP PROJECT NUMBER 87 - MY04

STATION 18+40 TO STATION 28+06

DATE: NOVEMBER 2007
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW

SHEET 2 OF 2