Prestonwood Golf Course
(Hatchet's Grove)
Stream Restoration Monitoring Report
EEP Project # 289
Monitoring Year – 06

Submitted to:

Ecosystem Enhancement PROGRAM

NCDENR-EEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

Data Collection: 2010
Construction Completed: May 2004
Submitted: December 2010

Monitoring Firm

Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609
Phone: (919) 278-2514
Fax: (919) 783-9266

Project Contact: Adam Spiller
Email: adam.spiller@kci.com
KCI Project No: 12071067B_PG10

Design Firm

Soil & Environmental Consultants, PA
11010 Raven Ridge Road
Raleigh, NC 27614
Phone: (919) 846-5900
Fax: (919) 846-9467

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

In 2004, the North Carolina Ecosystem Enhancement Program (EEP) conducted restoration of Hatchet's Grove Tributary and a tributary to Hatchet's Grove (Meadow Creek) through one of Prestonwood Country Club's golf courses in Cary, North Carolina. The 3.7 mi^2 watershed is located within the USGS 14-digit HUC 03020201080010 and the NCDWQ Sub-basin 03-04-02 of the Neuse River Basin. The project restored approximately 4,123 linear feet of channel, 3,828 feet on Hatchet's Grove and 295 feet on Meadow Creek. Due to golf cart crossings and overlapping utility easements that reduce the total number of credits, the site is projected to generate 3,699 stream mitigation units. Project construction occurred in 2004. The project goals and objectives are listed below.

- Develop a channel with the appropriate dimension, pattern, and longitudinal profile utilizing the existing channel condition survey and collected reference reach data as a guide.
- Improve and create bed form diversity (riffles, runs, pools, and glides).
- Construct a floodplain (bankfull bench) that is accessible at the proposed bankfull channel elevation (Priority 2 restoration).
- Ensure channel and stream bank stabilization by integrating grade control structures, root wads, and native vegetation in conjunction with the eradication or modification of current grounds maintenance practices.
- Establish a 30-foot native riparian plant community, when possible, from the edge of the restored reach.
- Integrate existing golf course uses with the proposed restoration plan providing aesthetic and educational values.

The riparian buffer was planted with sixteen different species of bare root trees and shrubs, and three different species of live stakes. Six vegetation monitoring plots were established during the as-built survey, three buffer plots and three stream bank plots. These plots were monitored during the first year of monitoring. Starting in 2006, the EEP requested that the site be monitored using the Carolina Vegetation Survey (CVS) vegetation monitoring protocol. Three new plots were established for the second monitoring year, and the stream bank monitoring plots were discontinued. The sixth year of monitoring counted an average of 647 planted stems/acre. Overall, the site is well vegetated, with varying degrees of density and coverage. There is exotic vegetation sparsely scattered throughout but it does not dominate in any areas. Sections of the buffer are play-over areas that include sanctioned pruning or cutting. These include the areas immediately downstream of each bridge and the sewer easement that borders Meadow Creek. The areas directly below the upper and lower bridge allow cutting to an elevation of two feet above the fairway/terrace elevation. The area below the bridge at the middle of the project allows pruning to a six foot height. In the past the groundskeeper at the golf course has pruned these areas to two feet, following the terrain as opposed to a set elevation. KCI was informed by EEP that the agreed upon easement maintenance requirements were reiterated through on-site meetings to a new groundskeeper and management staff. Additional mapping was provided to course maintenance personnel in March 2010 and boundary marking was improved in summer 2010 using steel posts in cement, painted to demarcate the beginning and end of sanctioned maintenance zones. There have been beaver at the site, which have impacted the vegetation in the past in certain areas with multiple treatment/removal efforts in response. The beginnings of a few small beaver dams were noted again in December of 2010 and as per EEP, the control contractor has been notified. Although the mean for woody stems exceeds the success criteria and the projects vegetation is on track for long term success, several locations had lesser amounts of trees in part due to the beaver and as mentioned there were some areas of encroachment. In response EEP installed approximately 300 woody stems comprised of 3-5 gallon containerized specimens of Sycamore, Ash, River Birch, three species of Oaks, Elderberry, and Button Bush. Another 350 specimens will be installed in the 2010/2011 dormant season with additional live staking in bank areas that will benefit.

Stream observations in the sixth year of monitoring found many of the same conditions present as in past years. Overall, the total amount of active bank erosion has decreased as vegetation has begun to stabilize previously bare banks. Although some of the structure placement and construction were not ideal in terms of more recent practice and understanding, all of the structures within the reach are maintaining grade

control. However, the structure placement has led to bed degradation and reduced riffle habitat directly downstream of the structures, increasing the number of pools throughout the site. Monitoring Year 6 has found that the stream is generally functioning, but the previous years of bank erosion indicate that the stream is susceptible to change and should be closely monitored following additional bankfull events to determine if the increased bank vegetation and the lowering rates of erosion continue to progress.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on the EEPs website. All raw data supporting the tables and figures in the appendices are available upon request.

2.0 METHODOLOGY

The CVS-EEP protocol (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data from the Prestonwood Site this year, the sixth year of monitoring. This methodology was incorporated during the second year of monitoring. The method used before that time was the EEP 2004 Stem Counting Protocol.

The profile was stationed by thalweg length and then adjusted to match grade control structures between monitoring years.

3.0 REFERENCES

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

Weakley, A. S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas. (http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf)

Appendix A

Project Vicinity Map and Background Tables

DIRECTIONS TO PRESTONWOOD GOLF COURSE SITE:
From I-40, take exit 285 Aviation Parkway. Proceed South on Aviation Parkway. Turn left onto Chapel Hill Road (NC 54). Turn right onto Morrisville Pkwy. Turn right on Double Eagle Ct. or into the Legends Apartment Complex. Park in remnant cul-de-sac after passing Stony Ct. on the right. Follow gravel road to golf course.

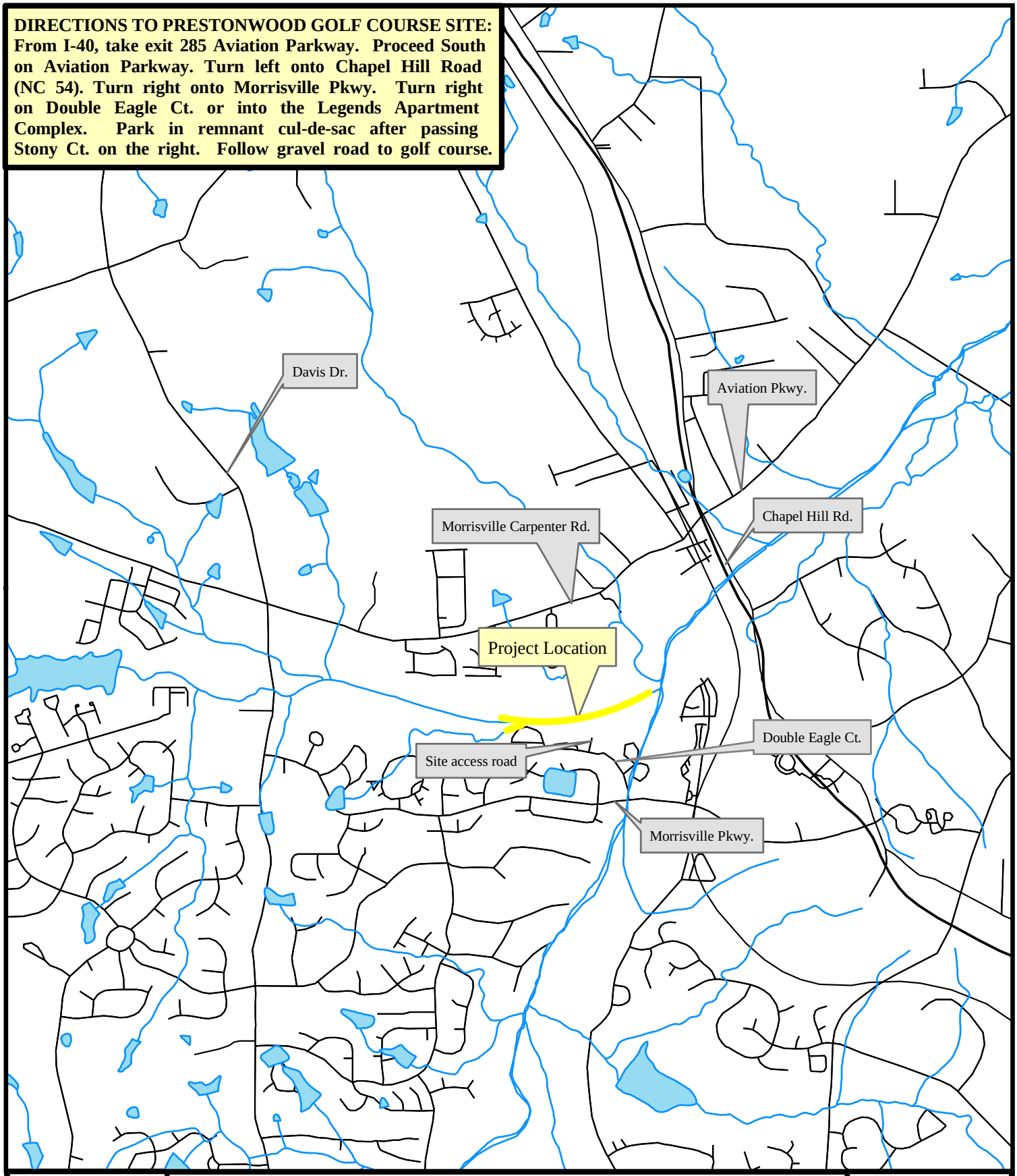


Figure 1. Site Vicinity Map
Prestonwood Golf Course, Wake County, EEP Project # 289

0.25 0.125 0 0.25 0.5
Miles

Ecosystem Enhancement PROGRAM

KCI ASSOCIATES OF NC

Table 1a. Project Restoration Components
Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)

Segment/ Reach ID	Existing Linear Feet	Restoration Level	Approach	Linear Feet / Square Feet	Creditable Linear Feet / Square Feet	Stationing	Mitigation Units	BMP Elements	Comment
Hatchet's Grove*	3,200	R	P2	3,828	3,783	10+00 - 48+28	3,441		Reach was regraded to create a bankfull channel with a new profile and a bankfull bench, and instream structures were installed along the new planform. One tributary enters Hatchet's Grove.
Meadow Creek**		R	P2	295	258	0+00 - 2+95	258		Reach was regraded to create a bankfull channel with a new profile and a bankfull bench, and instream structures were installed along a new planform.
Stream Buffer		R		50,530			50,530		Buffer is the required width and was planted with native trees. Some of these areas were supplementally planted in the winter of 2009/2010.

R = Restoration P2 = Priority 2

* The creditable footage number is the total footage minus 45 feet to account for the three golf cart bridge cossings. The SMU total of 3,441 was arrived at to account for credit reductions associated with the utility and playover crossings.

** The SMU total of 258 was arrived at to account for a credit reduction of 50% related to a sewer utility crossing.

Table 1b. Project Component Summations
Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	3,699						
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation							
HQ Preservation							
		0	0				
Totals (Feet/Acres)	**3,699**	**0**		**0**	**0**	**1.16**	**0**
MU Totals	**3,699**	**0**		**0**	**0**	**1.16**	

Non-Applicable

Table 2. Project Activity and Reporting History Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)		
Elapsed Time Since Grading Complete: 6 yr 7 months **Elapsed Time Since Planting Complete: 6 yr 7 months** **Number of Reporting Years: 6**		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Concept Plan		Aug-02
Restoration Plan		Nov-02
Final Design - 90%		
Construction		May-04
Live Stake Planting		May-04
Riparian Buffer Planting		May-04
As-Built Survey		Sep-04
Mitigation Plan and As-Built Report		Sep-04
Year 1 Stream Monitoring	Oct-05	Apr-06
Year 2 Stream Monitoring	Sep-06	Jan-07
Year 3 Stream Monitoring	Jul-07	Jan-08
Year 4 Stream Monitoring	Oct-08	Jan-09
Year 5 Stream Monitoring	Nov-09	Dec-09
Supplemental Planting	Winter 2009/2010	Winter 2009/2010
Year 6 Stream Monitoring	Nov-10	Dec-10

Table 3. Project Contacts Table Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)	
Design Firm	S&EC, PA 11010 Raven Ridge Rd. Raleigh, North Carolina 27614 Phone: (919) 846-5900 Fax: (919) 846-9467
Construction Contractor	McQueen Construction Co. 619 Patrick Rd. Bahama, North Carolina 27503
Planting Contractor	Carolina Silvics, Inc. 908 Indian Trail Rd. Edenton, North Carolina 27932
Monitoring Performers	
MY-00-01	S&EC, PA 11010 Raven Ridge Rd. Raleigh, North Carolina 27614 Contact: Ms. Rebecca Wargo and Ms. Jessica Regan Phone: (919) 846-5900 Fax: (919) 846-9467
MY-02-06	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)				
Project County	Wake County			
Physiographic Region	Piedmont			
Ecoregion	Triassic Basin			
Project River Basin	Neuse			
USGS HUC for Project (14 digit)	03020201080010			
NCDWQ Sub-basin for Project	03-04-02			
Within extent of EEP Watershed Plan?	No			
WRC Class (Warm, Cool, Cold)	Warm			
% of project easement demarcated	100%			
Beaver activity observed during design phase?	No			
Restoration Component Attribute Table				
	Hatchet's Grove		Meadow Creek	
Drainage Area	3.7 sq.mi.		0.23 sq.mi.	
Stream Order	Third		First	
Restored length (feet)	3,828		295	
Perennial or Intermittent	Perennial		Intermittent	
Watershed Type (Rural, Urban, Developing, etc.)	Urban			
Watershed LULC Distribution				
Urban	-			
Ag-Row Crop	-			
Ag-Livestock	-			
Forested	-			
Water/Wetlands	-			
Watershed impervious cover (%)	30%			
NCDWQ AU/Index Number	27-31-(1)			
NCDWQ Classification	C -NSW			
303d listed?	No			
Upstream of a 303d listed segment?	Yes			
Reasons for 303d Listing or Stressor	Impaired Biological Integrity, Turbidity, Low O_2			
Total acreage of easement	8.6 Acres			
Total vegetated acreage within the easement	N/A			
Total planted acreage as part of the restoration	5.3 Acres			
Rosgen Classification of pre-existing	E5/F5		-	
Rosgen Classification of As-built	E5/F5		-	
Valley Type	VIII		U	
Valley Slope	0.0022		U	
Valley side slope range (e.g. 2-3%)	U		U	
Valley toe slope range (e.g. 2-3%)	U		U	
Trout waters designation	No			
Species of concern, endangered etc.? (Y/N)	No			
Dominant soil series and characteristics				
Series	Chewacla and Wehadkee			
Depth Clay%	-	-		-
K	-	-		-
T	-	-		-

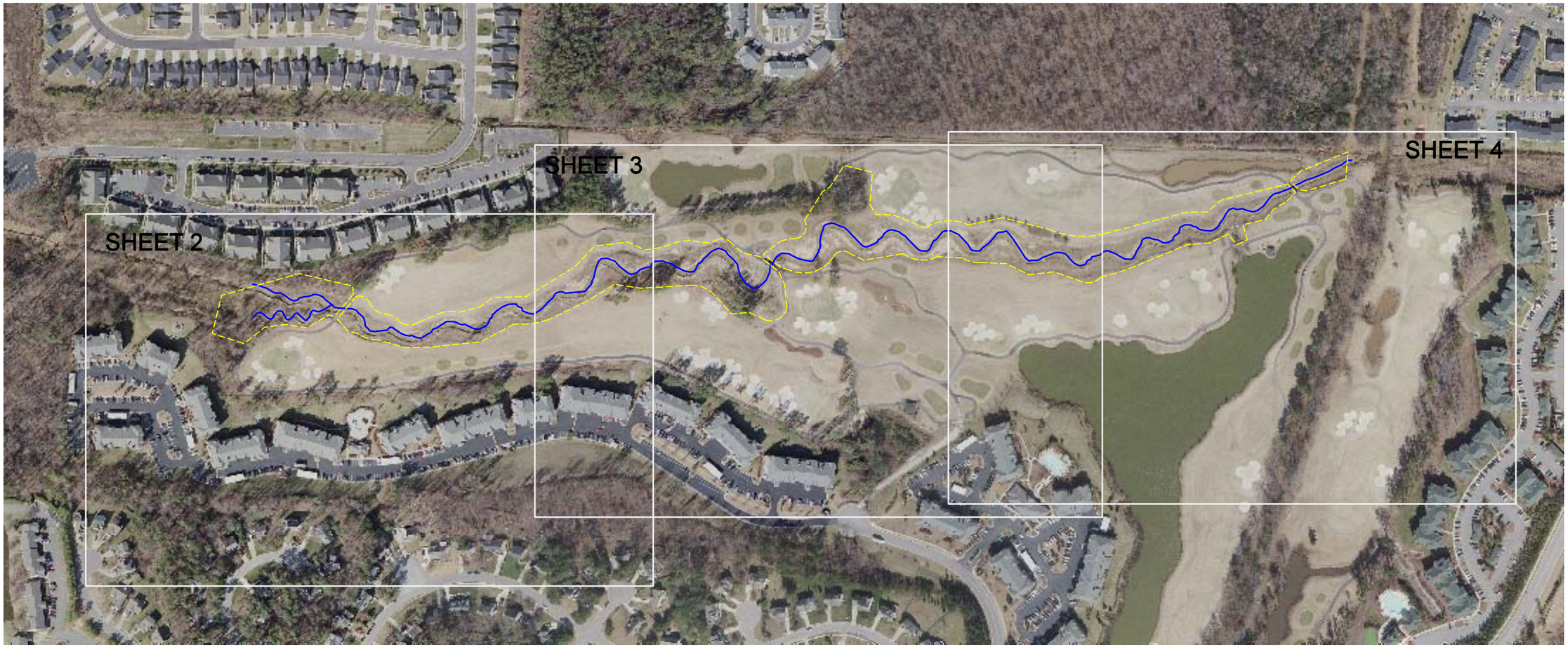
"N/A" is for items that do not apply.

"-" is for items that are unavailable.

"U" is for items that are unknown.

Appendix B

Visual Assessment Data



LEGEND

EASEMENT BOUNDARY .....

AS-BUILT CENTERLINE.....

–150 –75 0 150 300

GRAPHIC SCALE

REVISIONS			
BY	DESCRIPTION	DATE	APPROVED

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

Ecosystem Enhancement Program

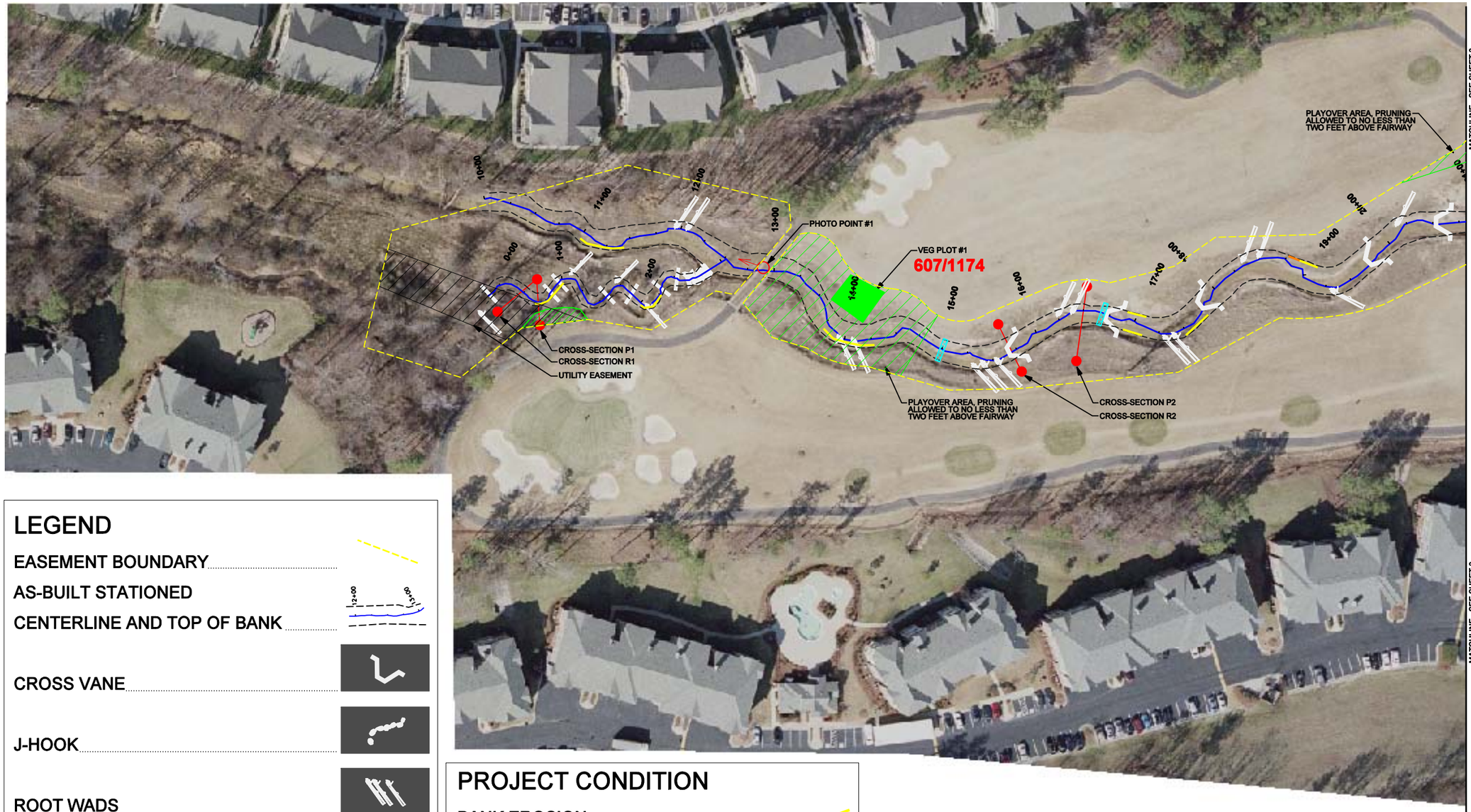
PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY06

SITE OVERVIEW

DATE: DECEMBER 2010
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW

SHEET 1 OF 4



LEGEND

- EASEMENT BOUNDARY
- AS-BUILT STATIONED
- CENTERLINE AND TOP OF BANK
- CROSS VANE
- J-HOOK
- ROOT WADS
- STEP POOL STRUCTURE
- LOG/ROCK SILL
- PHOTO POINT
- CROSS-SECTION

PROJECT CONDITION

- BANK EROSION
- UNDERCUT BANK
- MASS WASTING OF BANK
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- EASEMENT ENCROACHMENT
- BEAVER DAM

PROJECT CONDITION DETAILS

VEG PLOT TOTAL / PLANTED STEM DENSITY **890/423**

–50 –25 0 50 100

GRAPHIC SCALE

REVISIONS

BY	DESCRIPTION	DATE	APPROVED

Ecosystem Enhancement Program

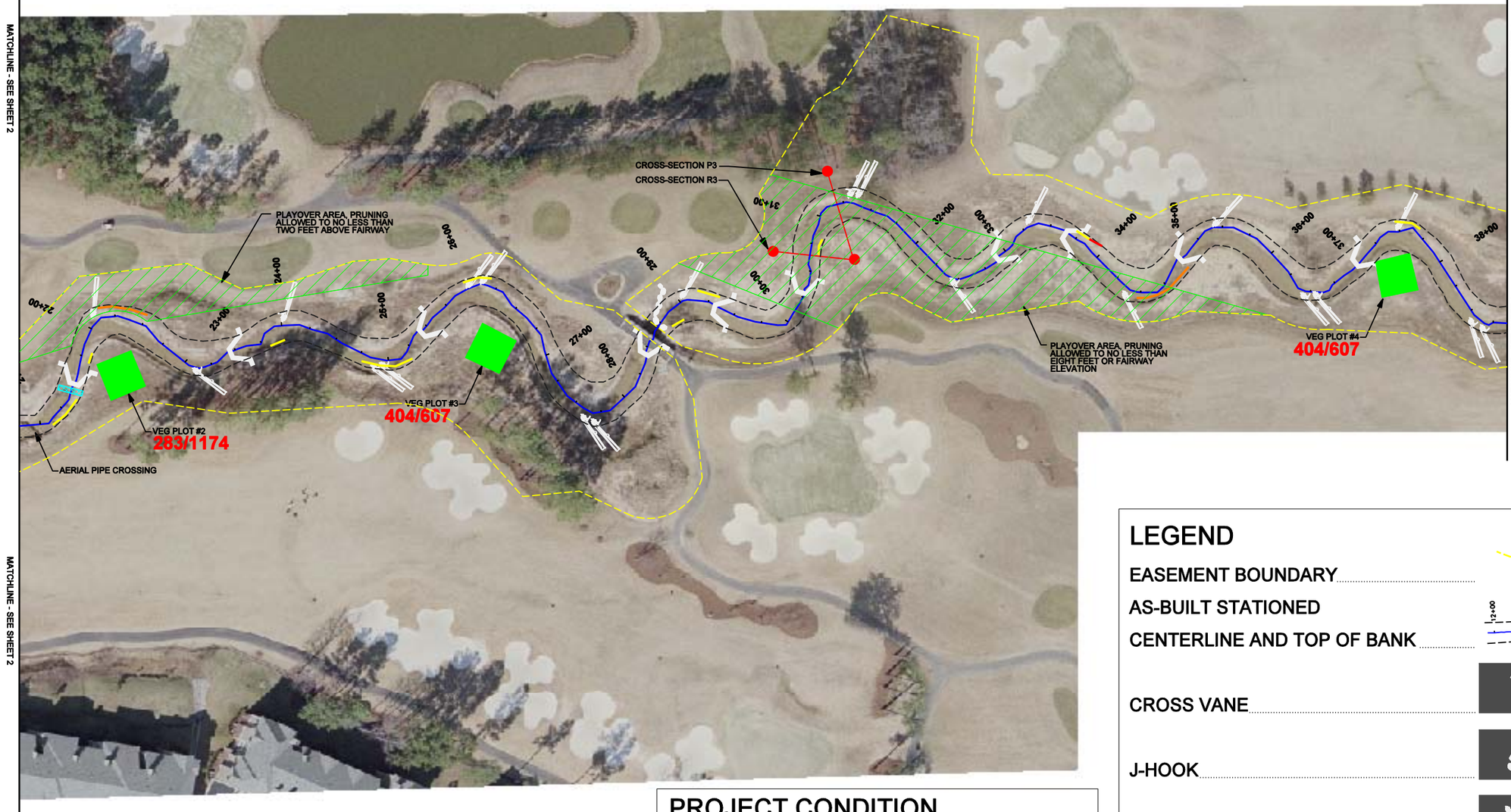
KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY06

STATION 10+00 TO STATION 20+80

DATE: DECEMBER 2010
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW



PROJECT CONDITION DETAILS

VEG PLOT TOTAL / PLANTED STEM DENSITY	890/423

PROJECT CONDITION

- BANK EROSION
- UNDERCUT BANK
- MASS WASTING OF BANK
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- EASEMENT ENCROACHMENT
- BEAVER DAM

LEGEND

- EASEMENT BOUNDARY
- AS-BUILT STATIONED
- CENTERLINE AND TOP OF BANK
- CROSS VANE
- J-HOOK
- ROOT WADS
- STEP POOL STRUCTURE
- LOG/ROCK SILL
- PHOTO POINT
- CROSS-SECTION

–50 –25 0 50 100

GRAPHIC SCALE

REVISIONS

NO.	DESCRIPTION	DATE	APPROVED

Ecosystem Enhancement Program

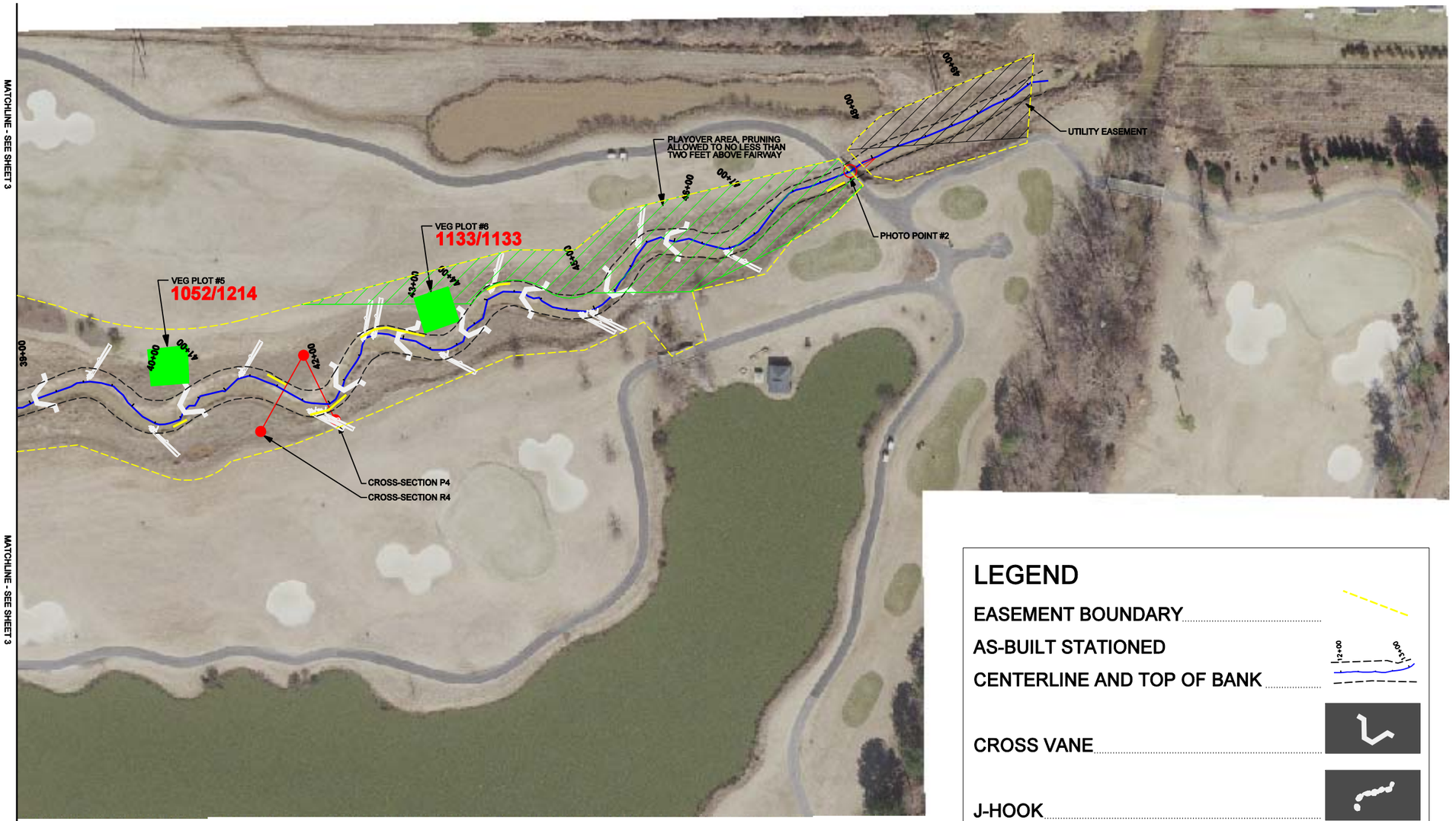
KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY06

STATION 20+80 TO STATION 38+90

DATE: DECEMBER 2010
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW



LEGEND

- EASEMENT BOUNDARY
- AS-BUILT STATIONED
- CENTERLINE AND TOP OF BANK
- CROSS VANE
- J-HOOK
- ROOT WADS
- STEP POOL STRUCTURE
- LOG/ROCK SILL
- PHOTO POINT
- CROSS-SECTION

PROJECT CONDITION

- BANK EROSION
- UNDERCUT BANK
- MASS WASTING OF BANK
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- EASEMENT ENCROACHMENT
- BEAVER DAM

PROJECT CONDITION DETAILS

VEG PLOT TOTAL / PLANTED STEM DENSITY 890/423

–50 –25 0 50 100

GRAPHIC SCALE

REVISIONS			
BY	DESCRIPTION	DATE	APPROVED

Ecosystem Enhancement

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RALEIGH, NORTH CAROLINA 27609

PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY06
STATION 38+90 TO STATION 49+68

DATE: DECEMBER 2010
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW

Table 5. Visual Stream Morphology Stability Assessment
Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)
Hatchet's Grove Assessed Length 3,828

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built*	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	30	99%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition+	1. Texture/Substrate - Riffle maintains coarser substrate	19	44			43%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	49	42			117%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	49	42			117%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	26	44			59%			
		2. Thalweg centering at downstream of meander (Glide)	26	44			59%			
2. Bank	**1. Scoured/ Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			22	558	93%	7	145	95%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			3	112	99%	0	0	99%
	3. Mass Wasting	Bank slumping, calving, or collapse			1	13	100%	0	0	100%
				Totals	26	683	91%	7	145	93%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	25	25			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	25	25			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	25	25			100%			
	3. Bank Protection#	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	N/A	N/A			N/A			
	4. Habitat**	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	25	25			100%			

* The total number of as-built features are estimated from profile and planview sheets.

+ Due to the channel's sand bed, all riffles have fine sediment. Additionally, riffles are poorly defined throughout the system because the slope changes only take place at the grade control structures, not at bed features. This metric counts the number of riffles that were identified during the longitudinal profile survey.

#The cross vanes on this project are evaluated as grade control and stone toe stabilization. They do not provide bank protection as a traditional vane would.

**The rootwads are not included in this assessment; many of them have rotted and washed away or become covered with vegetation so that they are not visible.

Table 6. Vegetation Condition Assessment

Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)

Planted Acreage 5.3 **Easement Acreage 8.6**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	1	0.01	0.1%

Stream Station Photos

Photo Point 1 – Taken looking upstream from golf cart bridge at the upper 300 feet of the Hatchet's Grove. 11/5/06 - MY 02

Photo Point 1 – Taken looking upstream from golf cart bridge at the upper 300 feet of the Hatchet's Grove. 12/7/10 - MY 06

Photo Point 2 – Taken looking downstream from golf cart bridge at the lower 300 feet of the Hatchet's Grove. 11/5/06 - MY 02

Photo Point 2 – Taken looking downstream from golf cart bridge at the lower 300 feet of the Hatchet's Grove. 12/7/10 - MY 06

Vegetation Monitoring Plot Photos

Vegetation Plot 1 – 10/7/10 - MY 06

Vegetation Plot 4 – 10/7/10 - MY 06

Vegetation Plot 2 – 10/7/10 - MY 06

Vegetation Plot 5 – 10/7/10 - MY 06

Vegetation Plot 3 – 10/7/10 - MY 06

Vegetation Plot 6 – 10/7/10 - MY 06

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)	
Vegetation Plot ID	**Vegetation Survival Threshold Met?**
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes

Table 8. CVS Vegetation Plot Metadata Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)	
Report Prepared By	Adam Spiller
Date Prepared	12/14/2010 9:50
database name	KCI-2010-EC.mdb
database location	M:\2007\12071067_2007 EEP OPEN END\Veg_database
computer name	12-CSPV0M1
file size	55091200
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	289
project Name	Prestonwood Golf Course (Hatchet's Grove)
Description	Stream Restoration
River Basin	Neuse
length(ft)	3800
stream-to-edge width (ft)	25
area (sq m)	17649.79
Required Plots (calculated)	6
Sampled Plots	6

Table 9. Stem Count Total and Planted Stems by Plot and Species
Project Number and Name: 289 - Prestonwood Golf Course (Hatchet's Grove)

			Current Plot Data (MY6 2010)																	Annual Means					
			289-01-0001			289-01-0002			289-01-0003			289-01-0004			289-01-0005			289-01-0006			MY6 (2010)			MY5 (2009)		
Scientific Name	Common Name	Species Type	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
Alnus serrulata	hazel alder	Shrub Tree		1	2														2	2		3	4		3	12
Aronia arbutifolia	Red Chokeberry	Shrub		4	4														3	3		7	7		7	9
Baccharis	baccharis	Shrub Tree																								114
Baccharis halimifolia	eastern baccharis	Shrub Tree			5			21			5			3			4						38			
Betula nigra	river birch	Tree			1		1	1						1		2	2					3	5		3	6
Cephalanthus occidentalis	common buttonbush	Shrub Tree		1	1																	1	1		1	3
Cornus amomum	silky dogwood	Shrub		5	9																	5	9		5	5
Diospyros virginiana	common persimmon	Tree											2	2		10	10		1	1		13	13		13	13
Hamamelis virginiana	American witchhazel	Shrub Tree		3	6														2	2		5	8		5	8
Ligustrum sinense	Chinese privet	Shrub Tree																								1
Liriodendron tulipifera	tuliptree	Tree												1									1			1
Morella cerifera	wax myrtle	Shrub Tree																								32
Nyssa sylvatica	blackgum	Tree														1	1					1	1		1	1
Pinus taeda	loblolly pine	Tree																								4
Quercus laurifolia	laurel oak	Tree					3	3					8	8		6	6		10	10		27	27		29	34
Quercus michauxii	swamp chestnut oak	Tree					1	1		10	10					5	5		6	6		22	22		23	24
Quercus phellos	willow oak	Tree					1	2								2	2		4	4		7	8		7	7
Salix nigra	black willow	Tree		1	1		1	1														2	2		2	7
Sambucus canadensis	Common Elderberry	Shrub Tree																								3
Vaccinium	blueberry	Shrub Vine Tree																								5
		Stem count	0	15	29	0	7	29	0	10	15	0	10	15	0	26	30	0	28	28	0	96	146	0	99	289
		size (ares)	1			1			1			1			1			1			6			6		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.15			0.15		
		Species count	0	6	8	0	5	6	0	1	2	0	2	5	0	6	7	0	7	7	0	12	14	0	12	19
		Stems per ACRE	0	607	1174	0	283	1174	0	405	607	0	405	607	0	1052	1214	0	1133	1133	0	647	985	0	668	1949

P-LS - Planted Live Stake Stems P-all - Planted Stems Total (with Live Stakes) T - Total (Planted Including Live Stakes and Volunteers)

Appendix D

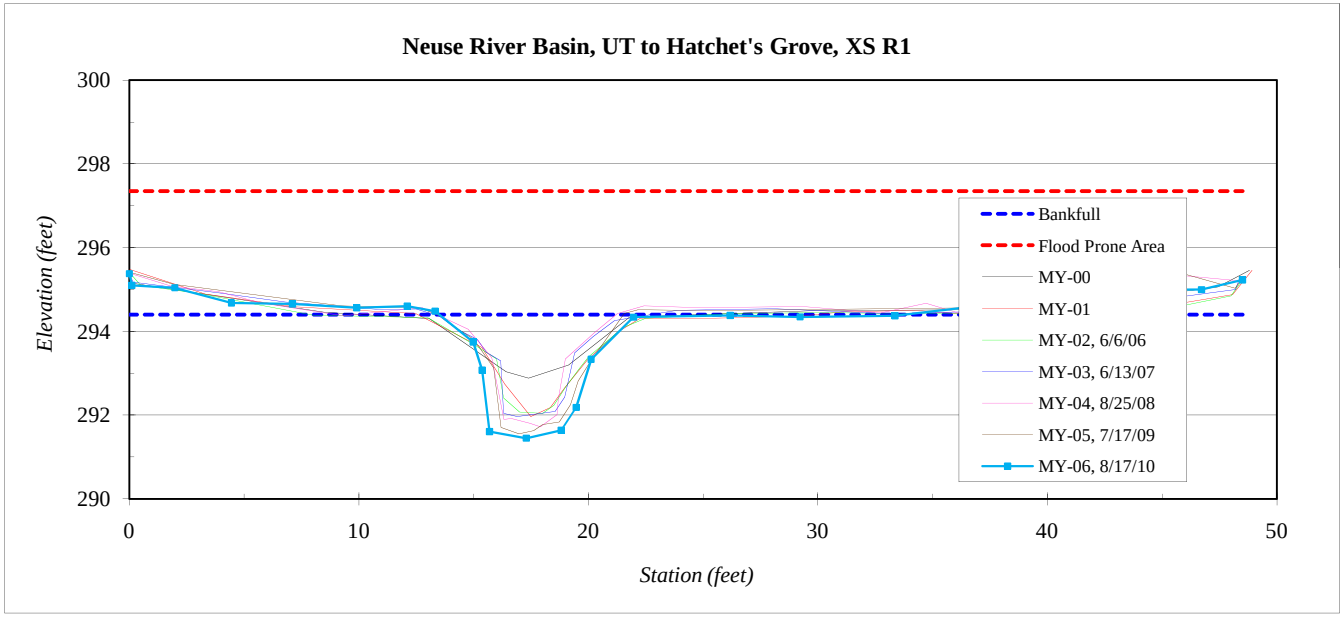
Stream Survey Data

Cross-Section Plots

River Basin:	Neuse
Watershed:	UT to Hatchet's Grove
XS ID	XS R1
Drainage Area (sq mi):	0.23
Date:	8/17/2010
Field Crew:	A. French, B. Roberts

Station	Elevation
0.0	295.38
0.1	295.10
2.0	295.04
4.4	294.68
7.1	294.66
9.9	294.56
12.1	294.60
13.3	294.48
15.0	293.75
15.4	293.07
15.7	291.60
17.3	291.45
18.8	291.64
19.5	292.18
20.1	293.33
22.0	294.34
26.2	294.38
29.2	294.35
33.4	294.37
37.7	294.65
39.8	294.82
41.5	294.67
43.7	294.99
46.7	295.00
48.5	295.23

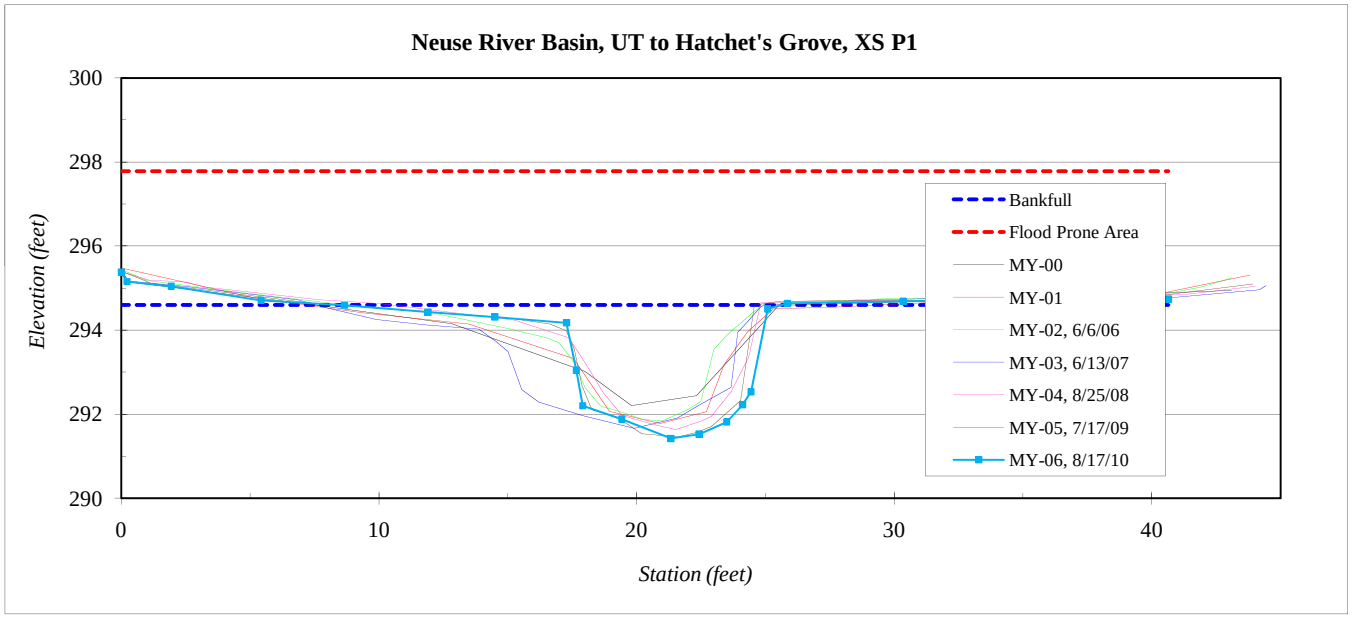
SUMMARY DATA	
Bankfull Elevation:	294.4
Bankfull Cross-Sectional Area:	14.0
Bankfull Width:	8.4
Flood Prone Area Elevation:	297.4
Flood Prone Width:	90
Max Depth at Bankfull:	3.0
Mean Depth at Bankfull:	1.7
W / D Ratio:	5.0
Entrenchment Ratio:	10.7
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	UT to Hatchet's Grove
XS ID	XS P1
Drainage Area (sq mi):	0.23
Date:	8/17/2010
Field Crew:	A. French, B. Roberts

Station	Elevation
0.0	295.38
0.2	295.15
1.9	295.04
5.4	294.71
8.7	294.59
11.9	294.43
14.5	294.31
17.3	294.17
17.7	293.05
17.9	292.20
19.4	291.88
21.3	291.42
22.4	291.53
23.5	291.81
24.1	292.22
24.4	292.53
25.1	294.50
25.9	294.63
30.4	294.69
33.7	294.73
38.7	294.76
40.6	294.74

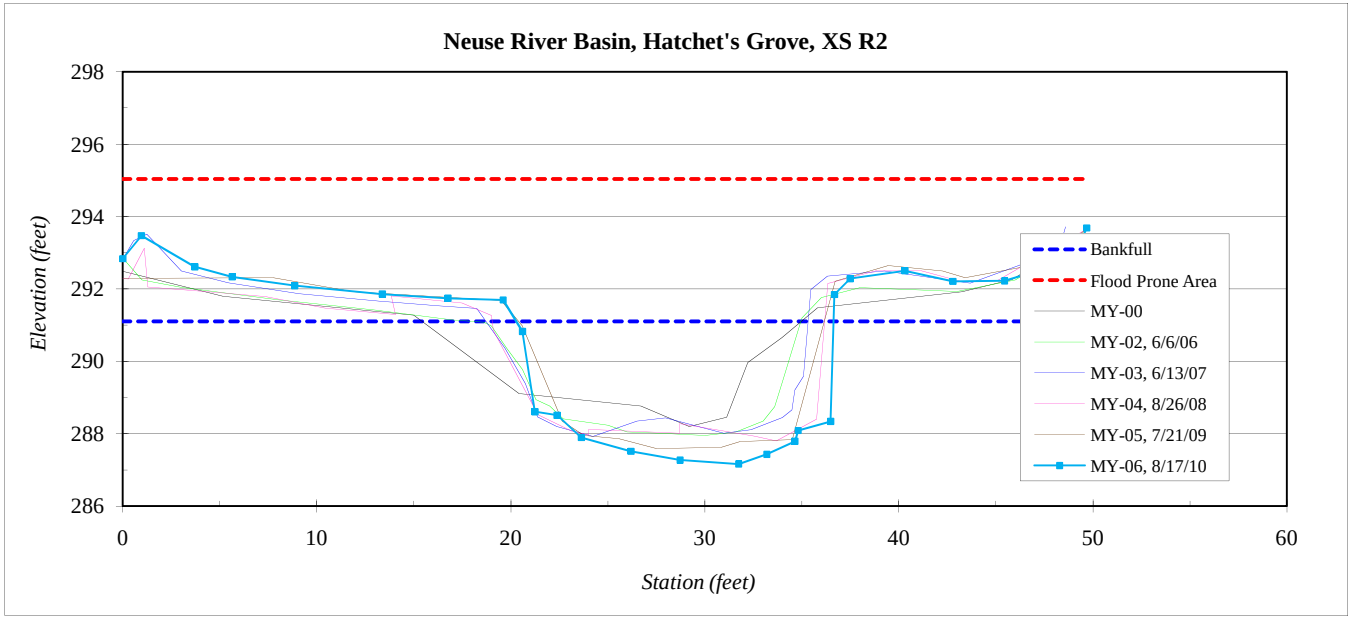
SUMMARY DATA	
Bankfull Elevation:	294.6
Bankfull Cross-Sectional Area:	21.9
Bankfull Width:	17.0
Flood Prone Area Elevation:	297.8
Flood Prone Width:	100
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	1.3
W / D Ratio:	13.2
Entrenchment Ratio:	5.9
Bank Height Ratio:	0.9



River Basin:	Neuse
Watershed:	Hatchet's Grove
XS ID	XS R2
Drainage Area (sq mi):	3.7
Date:	8/17/2010
Field Crew:	A. French, B. Roberts

Station	Elevation
0.0	292.84
1.0	293.47
3.7	292.61
5.6	292.33
8.9	292.09
13.4	291.86
16.8	291.74
19.6	291.70
20.6	290.83
21.2	288.61
22.4	288.51
23.6	287.89
26.2	287.51
28.7	287.27
31.7	287.16
33.2	287.43
34.6	287.79
34.8	288.09
36.5	288.34
36.7	291.84
37.5	292.29
40.3	292.50
42.8	292.21
45.4	292.22
47.1	292.49
49.4	293.36
49.7	293.68

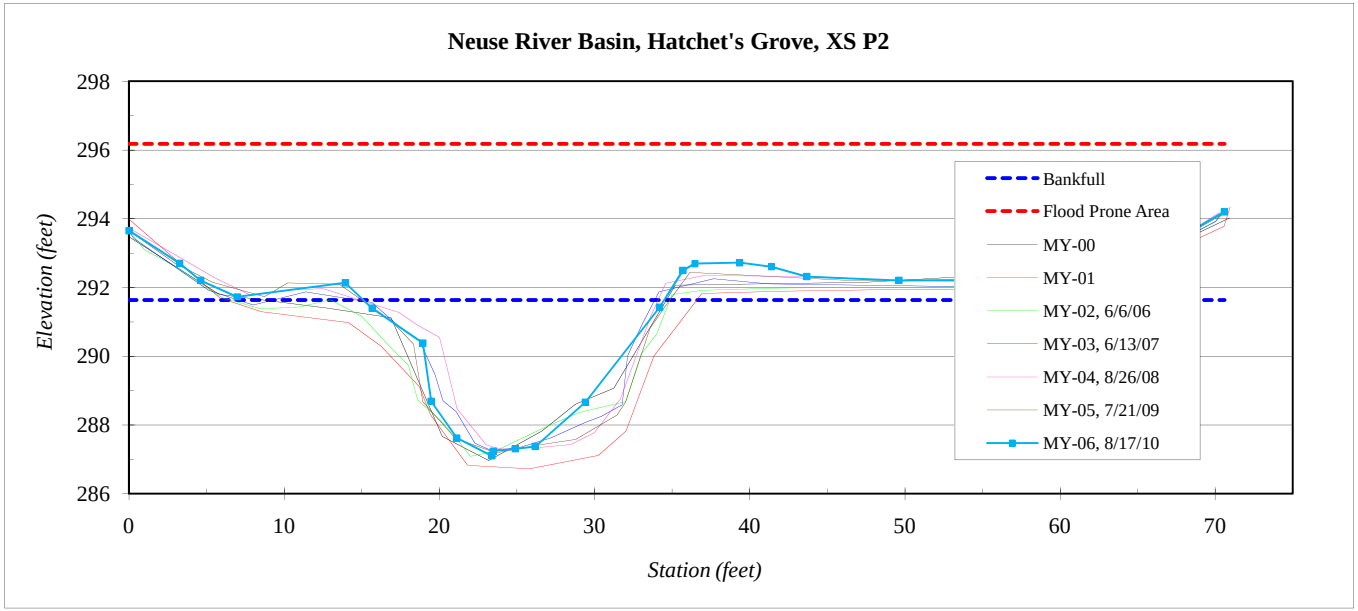
SUMMARY DATA	
Bankfull Elevation:	291.1
Bankfull Cross-Sectional Area:	53.4
Bankfull Width:	16.4
Flood Prone Area Elevation:	295.0
Flood Prone Width:	60
Max Depth at Bankfull:	3.9
Mean Depth at Bankfull:	3.3
W / D Ratio:	5.0
Entrenchment Ratio:	3.7
Bank Height Ratio:	1.1



River Basin:	Neuse
Watershed:	Hatchet's Grove
XS ID	XS P2
Drainage Area (sq mi):	3.7
Date:	8/17/2010
Field Crew:	A. French, B. Roberts

Station	Elevation
0.0	293.65
3.3	292.70
4.6	292.21
7.0	291.73
13.9	292.14
15.7	291.40
18.9	290.38
19.5	288.69
21.1	287.62
23.4	287.11
23.5	287.24
24.9	287.31
26.2	287.38
29.4	288.66
34.2	291.43
35.7	292.49
36.5	292.69
39.4	292.72
41.4	292.61
43.7	292.32
49.6	292.20
54.8	292.21
60.3	292.28
63.6	292.61
67.5	293.38
70.6	294.20

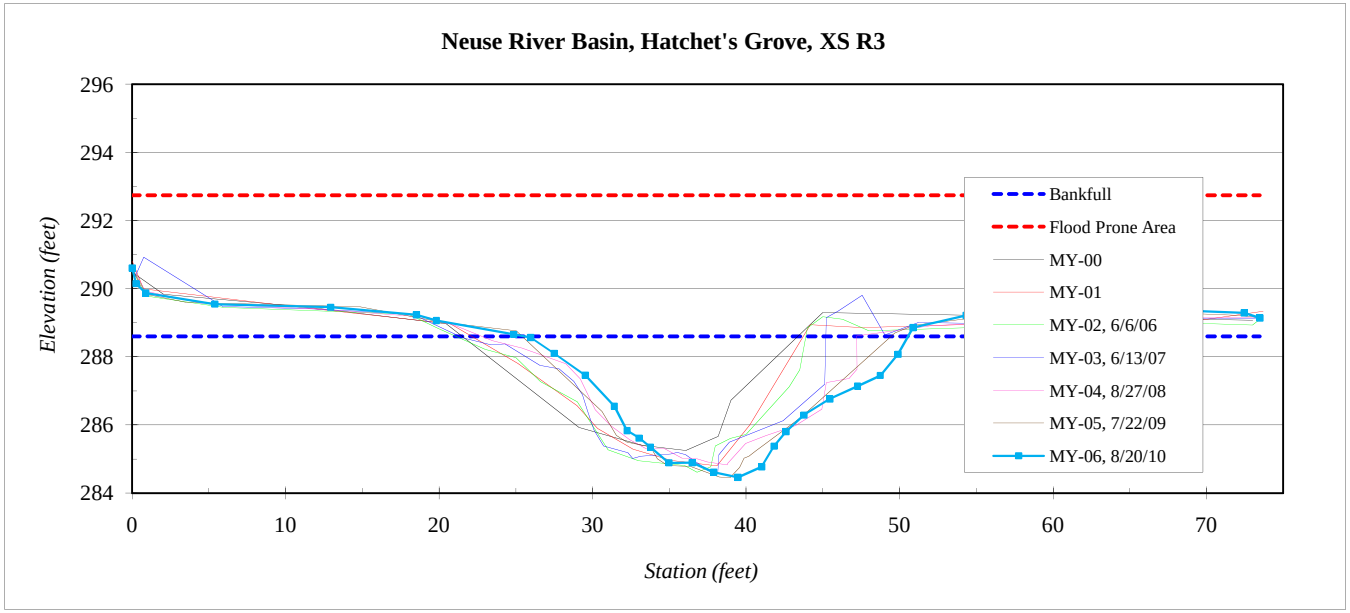
SUMMARY DATA	
Bankfull Elevation:	291.6
Bankfull Cross-Sectional Area:	59.0
Bankfull Width:	19.1
Flood Prone Area Elevation:	296.2
Flood Prone Width:	80
Max Depth at Bankfull:	4.5
Mean Depth at Bankfull:	3.1
W / D Ratio:	6.2
Entrenchment Ratio:	4.2
Bank Height Ratio:	1.1



River Basin:	Neuse
Watershed:	Hatchet's Grove
XS ID	XS R3
Drainage Area (sq mi):	3.7
Date:	8/20/2010
Field Crew:	A. French, B. Roberts

Station	Elevation
0.0	290.60
0.3	290.15
0.9	289.87
5.4	289.55
12.9	289.45
18.5	289.23
19.8	289.07
24.9	288.65
26.0	288.57
27.5	288.10
29.5	287.45
31.4	286.55
32.2	285.83
33.0	285.61
33.8	285.35
35.0	284.89
36.5	284.89
37.9	284.61
39.5	284.46
41.0	284.77
41.8	285.38
42.6	285.81
43.8	286.29
45.5	286.76
47.3	287.14
48.7	287.45
49.9	288.07
50.9	288.86
54.3	289.22
60.6	289.34
67.1	289.38
72.5	289.29
73.5	289.14

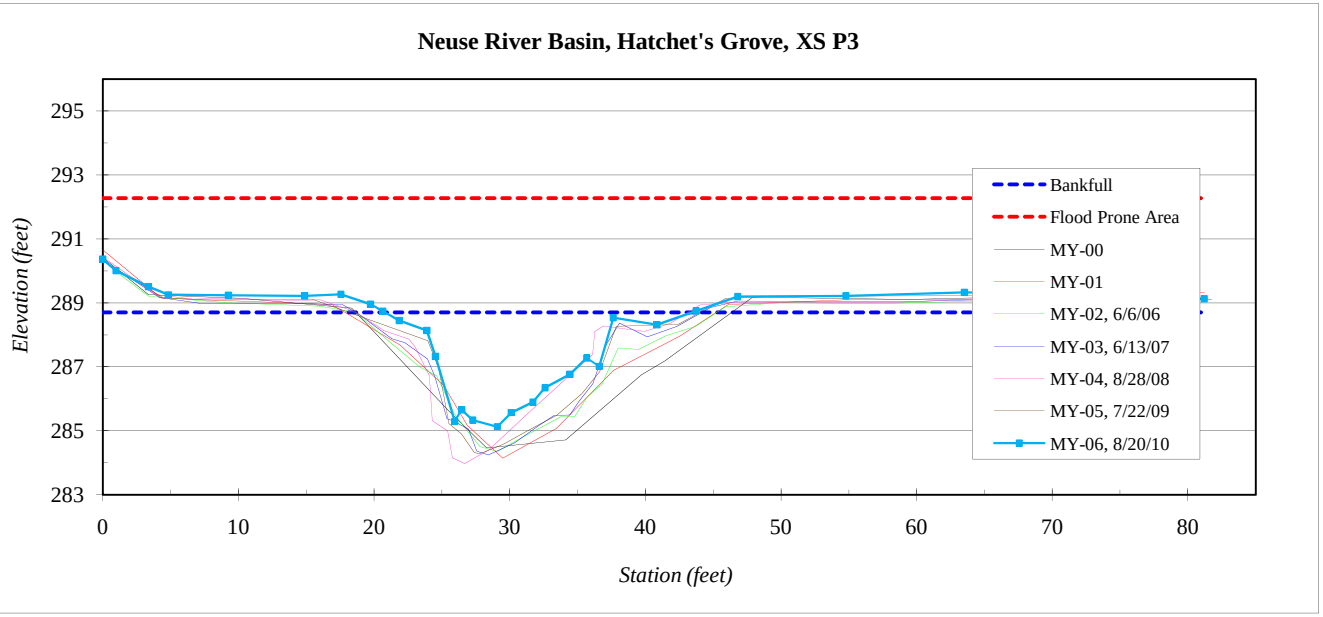
SUMMARY DATA	
Bankfull Elevation:	288.6
Bankfull Cross-Sectional Area:	57.2
Bankfull Width:	25.0
Flood Prone Area Elevation:	292.7
Flood Prone Width:	100
Max Depth at Bankfull:	4.1
Mean Depth at Bankfull:	2.3
W / D Ratio:	10.9
Entrenchment Ratio:	4.0
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	Hatchet's Grove
XS ID	XS P3
Drainage Area (sq mi):	3.7
Date:	8/20/2010
Field Crew:	A. French, B. Roberts

Station	Elevation
0.0	290.37
1.0	290.01
3.4	289.50
4.8	289.25
9.3	289.24
14.9	289.22
17.6	289.27
19.7	288.96
20.6	288.74
21.9	288.44
23.9	288.14
24.5	287.33
25.9	285.29
26.5	285.66
27.3	285.33
29.1	285.13
30.1	285.57
31.7	285.90
32.6	286.34
34.4	286.76
35.7	287.27
36.6	287.01
37.6	288.53
40.9	288.31
43.7	288.74
46.8	289.20
54.8	289.21
63.5	289.33
70.7	289.28
81.2	289.13

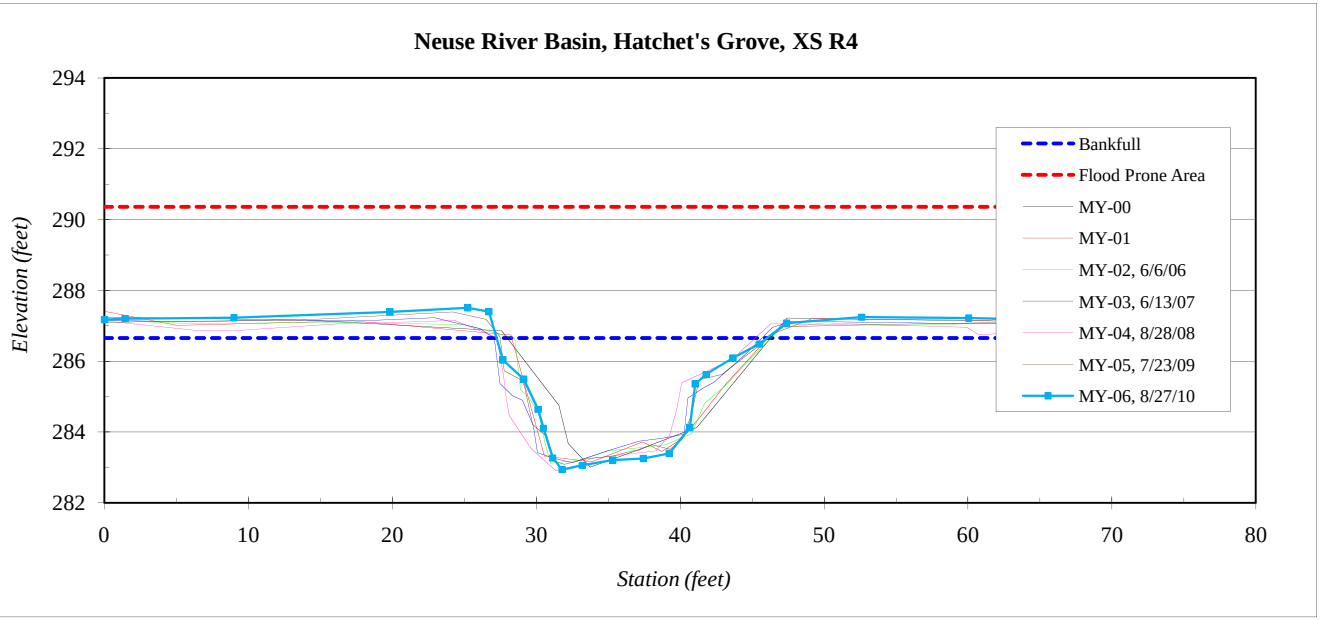
SUMMARY DATA	
Bankfull Elevation:	288.7
Bankfull Cross-Sectional Area:	35.8
Bankfull Width:	22.7
Flood Prone Area Elevation:	292.3
Flood Prone Width:	110
Max Depth at Bankfull:	3.6
Mean Depth at Bankfull:	1.6
W / D Ratio:	14.4
Entrenchment Ratio:	4.8
Bank Height Ratio:	1.0



River Basin:	Neuse
Watershed:	Hatchet's Grove
XS ID	XS R4
Drainage Area (sq mi):	3.7
Date:	8/27/2010
Field Crew:	A. French, A. Helms

Station	Elevation
0.0	287.18
1.4	287.20
9.0	287.23
19.8	287.39
25.2	287.51
26.7	287.40
27.7	286.03
29.1	285.50
30.1	284.64
30.5	284.10
31.1	283.26
31.8	282.94
33.2	283.06
35.3	283.21
37.4	283.25
39.2	283.40
40.7	284.13
41.1	285.36
41.8	285.62
43.7	286.09
45.5	286.48
47.4	287.08
52.6	287.24
60.0	287.22
67.2	287.16
74.2	287.47
75.6	287.69
76.0	287.82

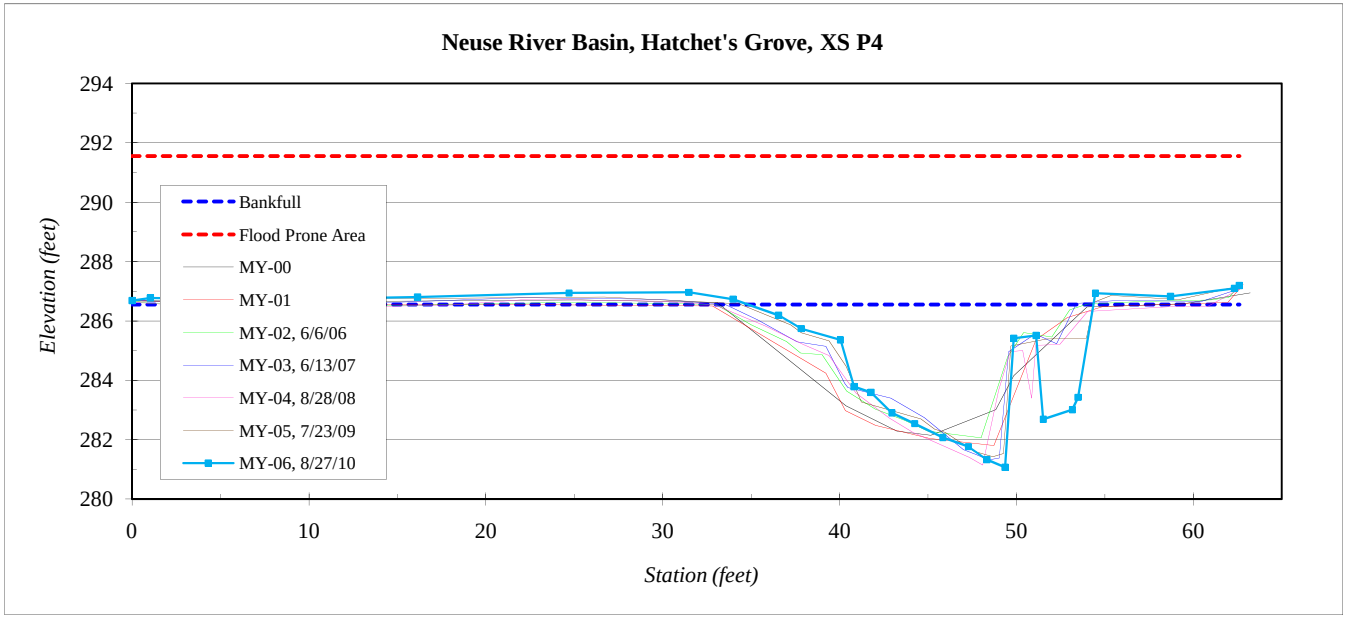
SUMMARY DATA	
Bankfull Elevation:	286.7
Bankfull Cross-Sectional Area:	41.8
Bankfull Width:	18.8
Flood Prone Area Elevation:	290.4
Flood Prone Width:	95
Max Depth at Bankfull:	3.7
Mean Depth at Bankfull:	2.2
W / D Ratio:	8.5
Entrenchment Ratio:	5.1
Bank Height Ratio:	1.1



River Basin:	Neuse
Watershed:	Hatchet's Grove
XS ID	XS P4
Drainage Area (sq mi):	3.7
Date:	8/27/2010
Field Crew:	A. French, A. Helms

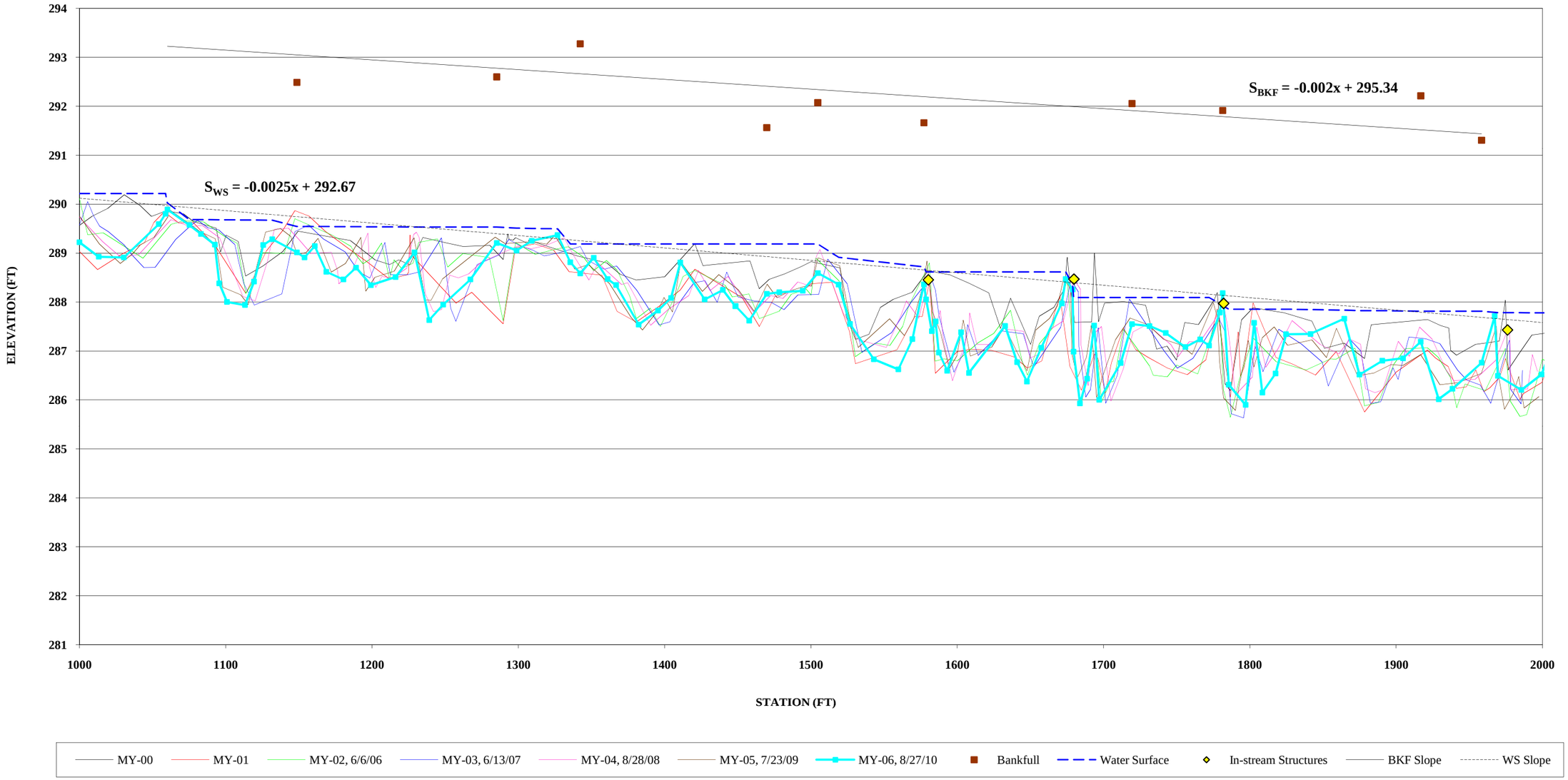
Station	Elevation
0.0	287.16
1.0	287.25
7.9	287.20
16.1	287.28
24.7	287.42
31.5	287.44
34.0	287.21
36.5	286.67
37.8	286.22
40.0	285.84
40.8	284.27
41.8	284.07
43.0	283.38
44.2	283.02
45.8	282.55
47.3	282.25
48.3	281.81
49.3	281.55
49.8	285.90
51.1	285.99
51.5	283.17
53.2	283.49
53.5	283.90
54.5	287.42
58.7	287.31
62.3	287.58
62.6	287.67

SUMMARY DATA	
Bankfull Elevation:	286.6
Bankfull Cross-Sectional Area:	45.1
Bankfull Width:	17.5
Flood Prone Area Elevation:	291.5
Flood Prone Width:	95
Max Depth at Bankfull:	5.0
Mean Depth at Bankfull:	2.6
W / D Ratio:	6.8
Entrenchment Ratio:	5.4
Bank Height Ratio:	1.0

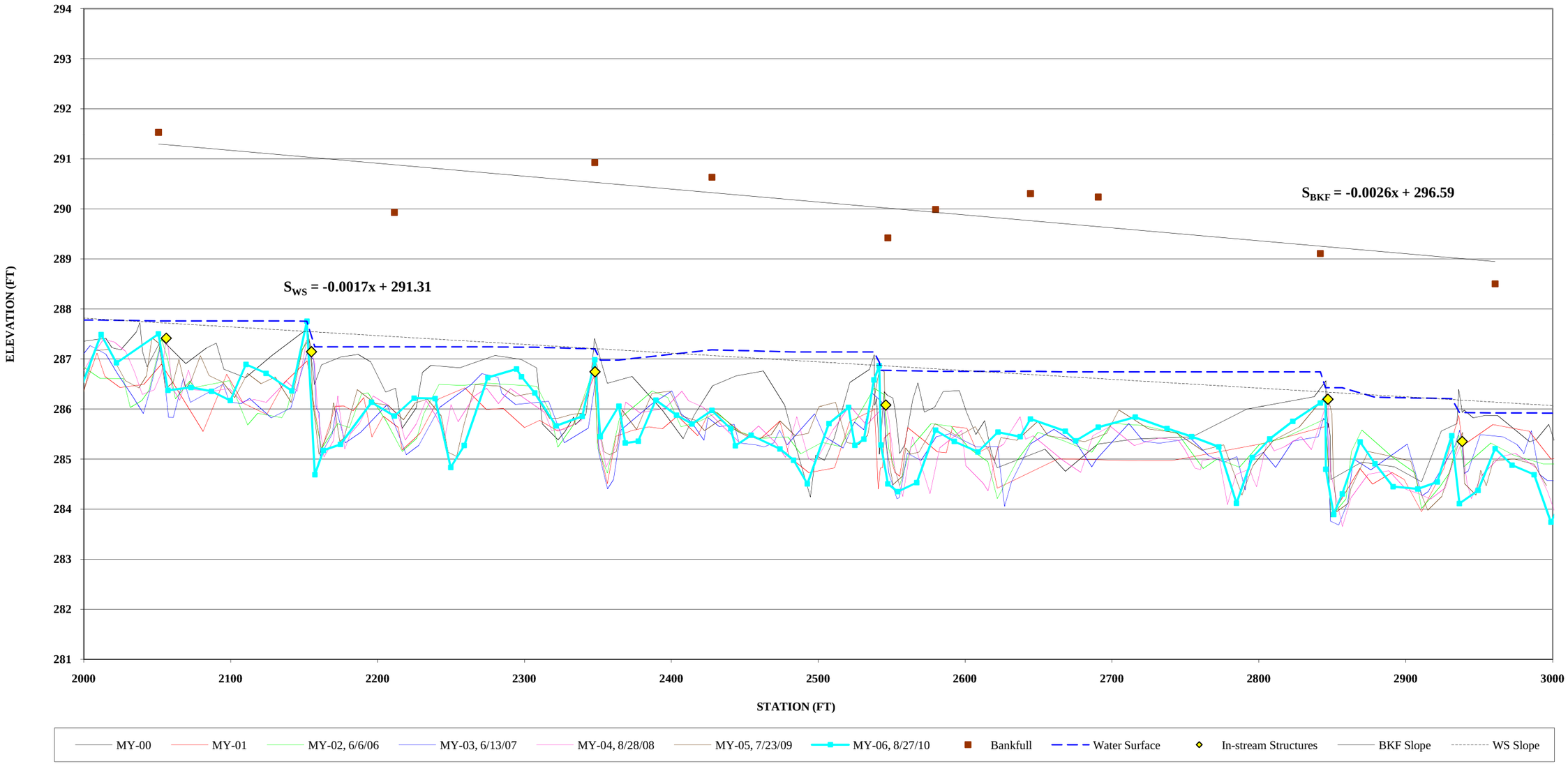


Longitudinal Plots

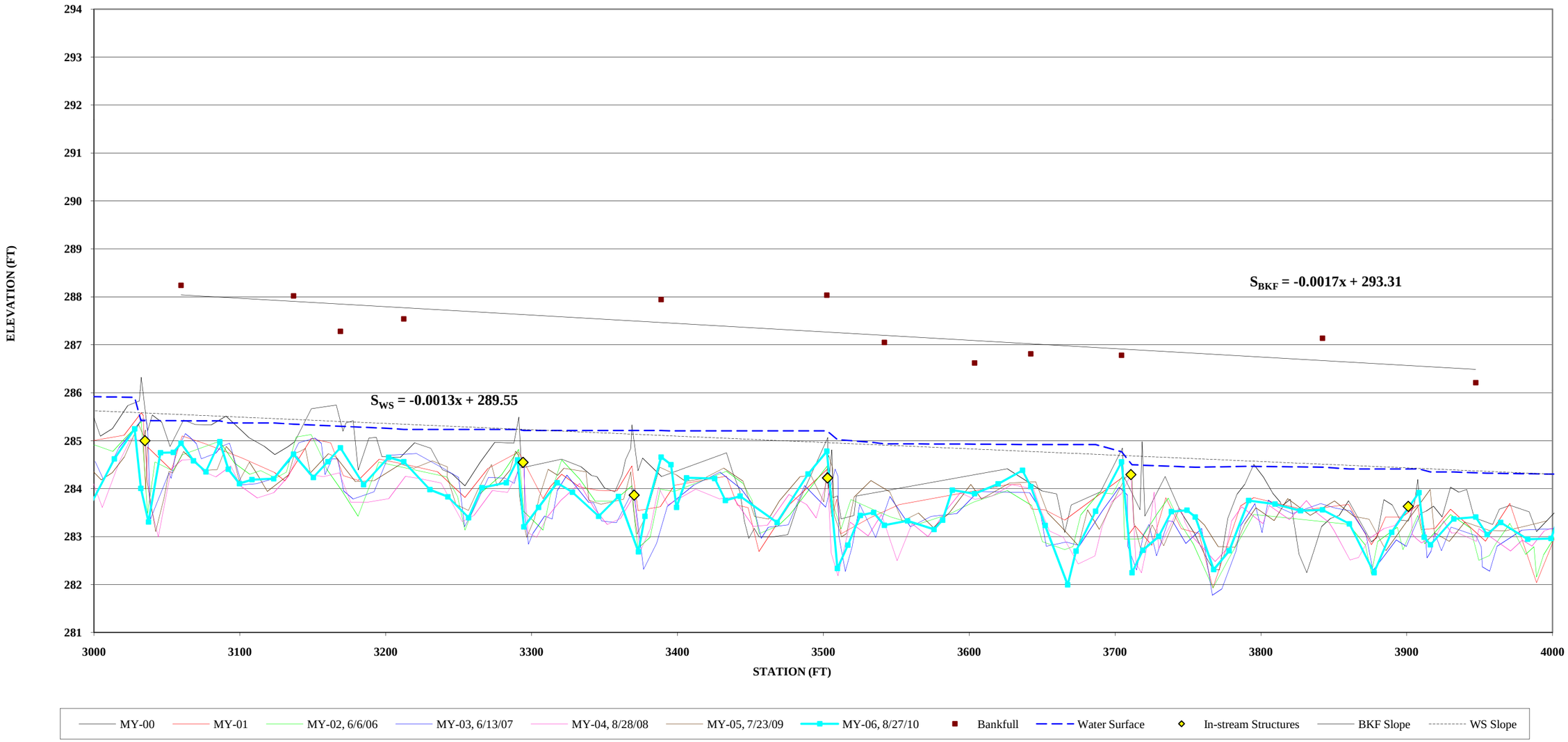
Longitudinal Profile
Prestonwood Golf Course - Hatchet's Grove
EEP Project Number 289 - MY06
Stations 10+00-20+00



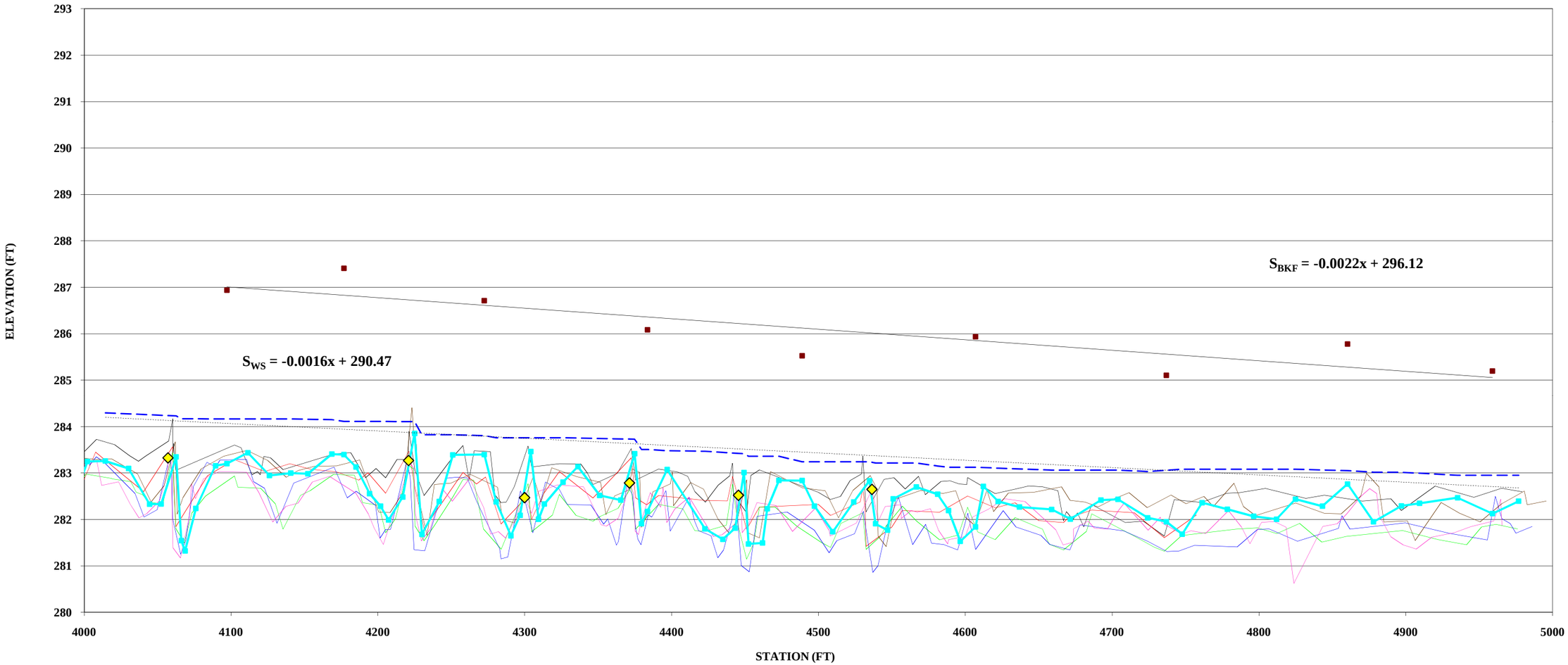
Longitudinal Profile
Prestonwood Golf Course - Hatchet's Grove
EEP Project Number 289 - MY06
Stations 20+00-30+00



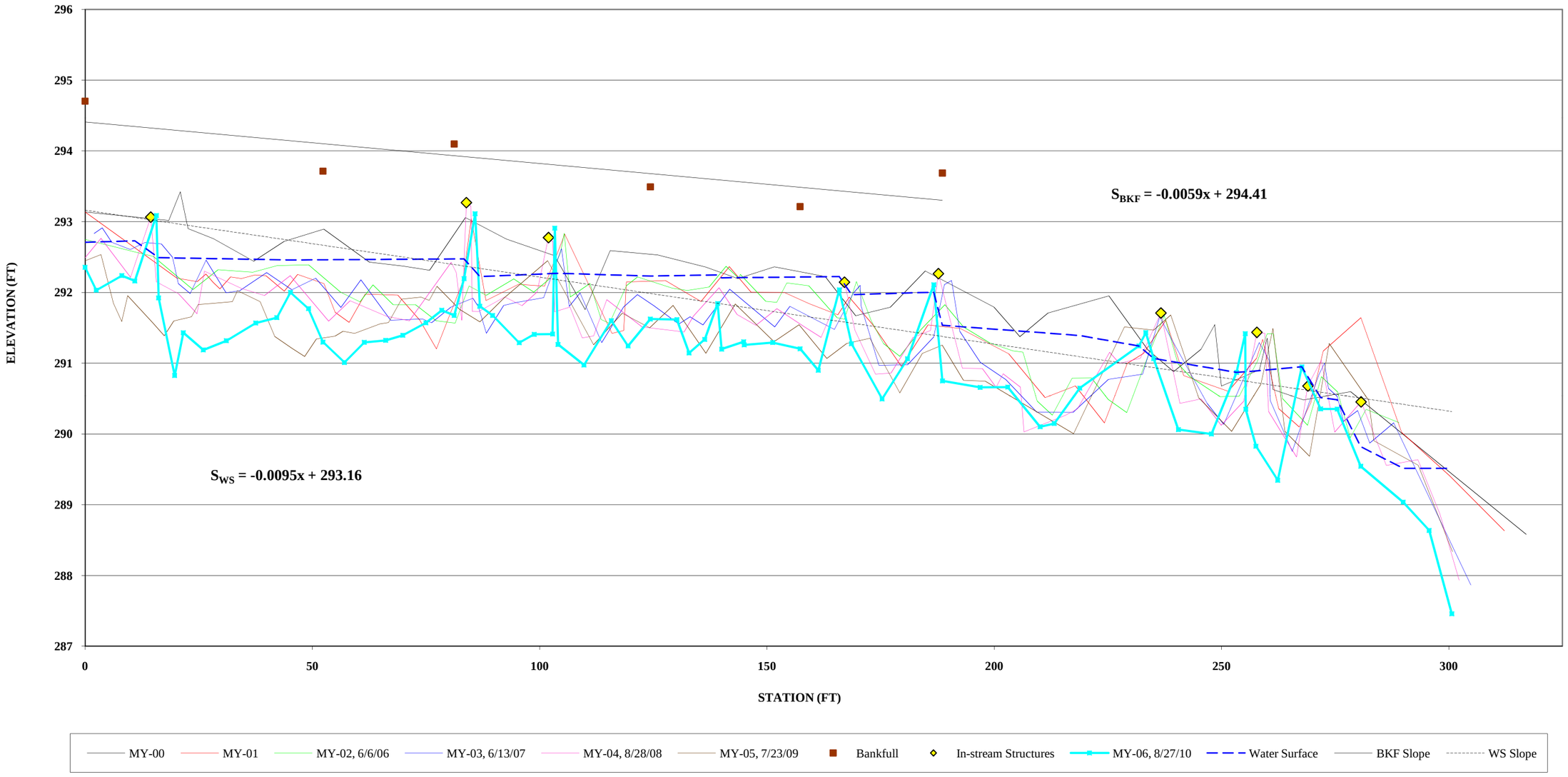
Longitudinal Profile
Prestonwood Golf Course - Hatchet's Grove
EEP Project Number 289 - MY06
Stations 30+00-40+00



Longitudinal Profile
Prestonwood Golf Course - Hatchet's Grove
EEP Project Number 289 - MY06
Stations 40+00-50+00



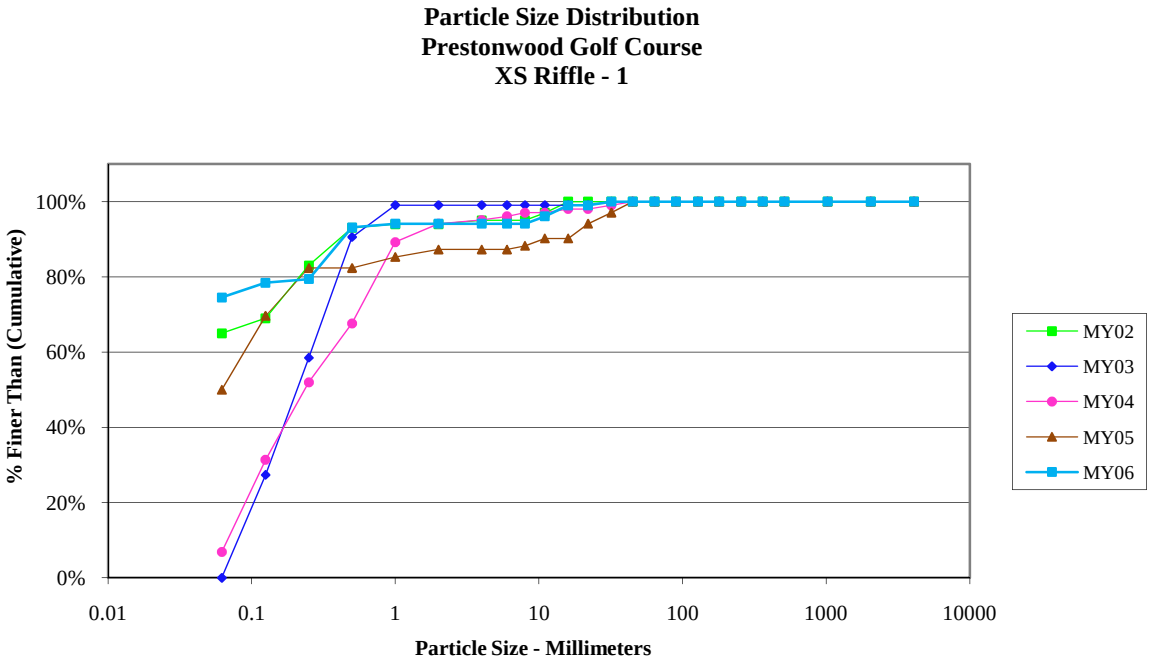
Longitudinal Profile
Prestonwood Golf Course - Meadow Creek
EEP Project Number 289 - MY06
Stations 00+00 - 03+00



Pebble Count Plots

Cross-Section Riffle 1 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	76
Very Fine	.062 - .125	S	4
Fine	.125 - .25	A	1
Medium	.25 - .50	N	14
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	1
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
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	102

Note:



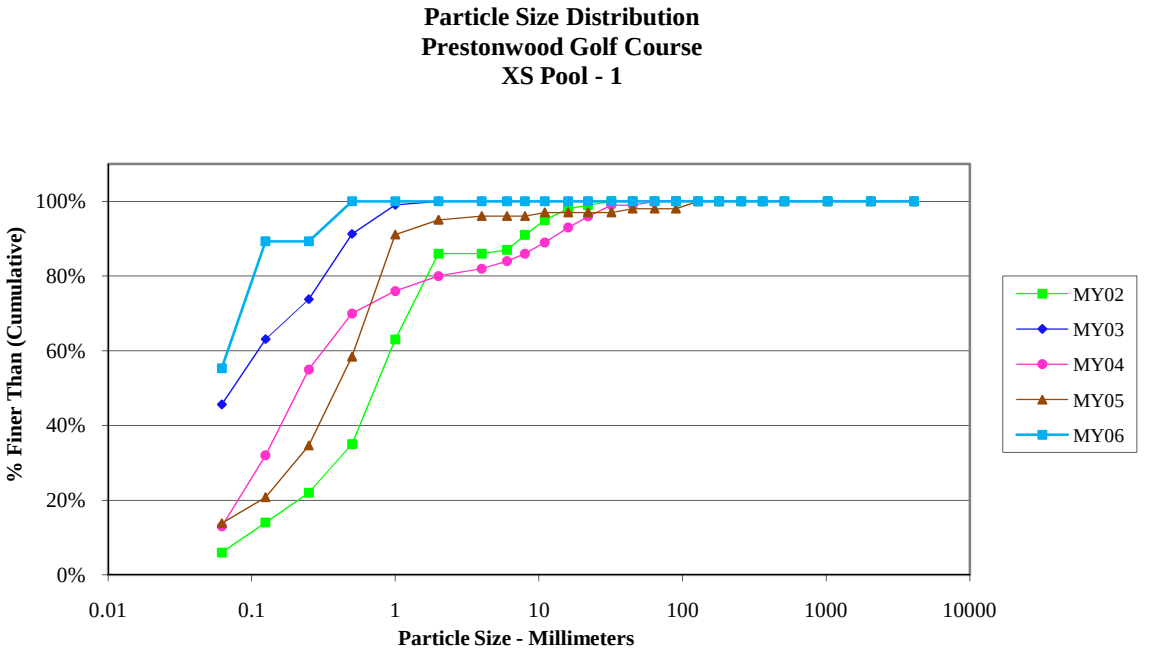
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.32
D95	9.2

Size Distribution	
mean	0.1
dispersion	3.1
skewness	0.42

Type	
silt/clay	75%
sand	20%
gravel	6%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 1 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	57
Very Fine	.062 - .125	S	35
Fine	.125 - .25	A	
Medium	.25 - .50	N	11
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
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	103

Note:



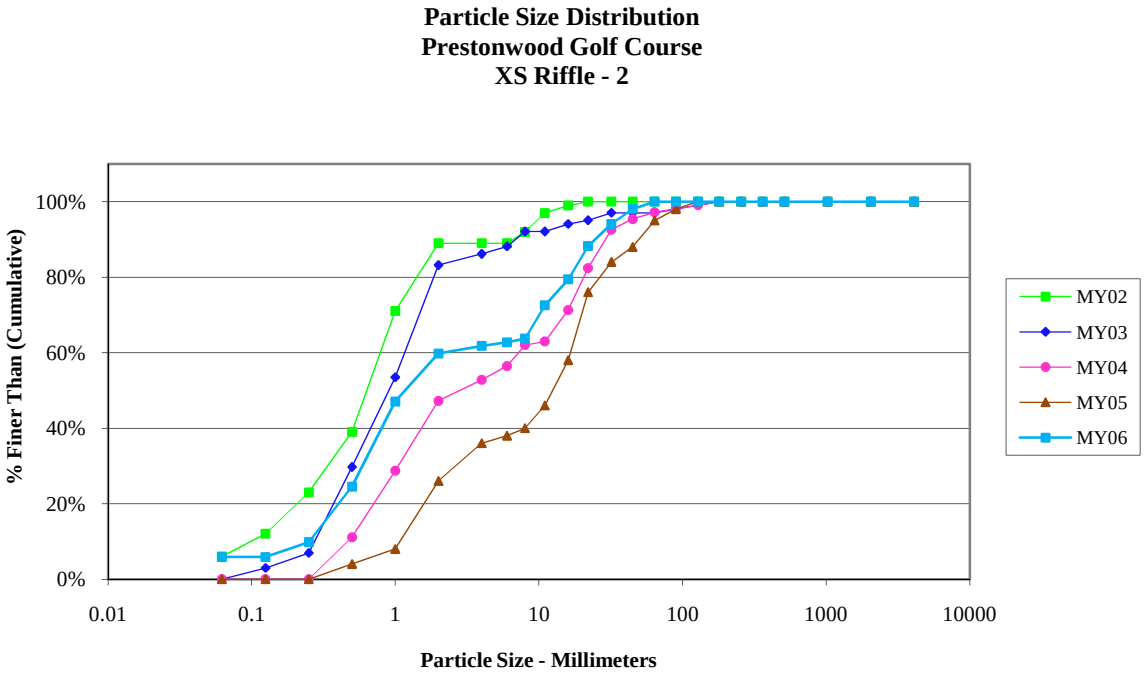
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.076
D84	0.11
D95	0.36

Size Distribution	
mean	0.1
dispersion	1.4
skewness	0.25

Type	
silt/clay	55%
sand	45%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 2 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	6
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	4
Medium	.25 - .50	N	15
Coarse	.50 - 1	D	23
Very Coarse	1 - 2	S	13
Very Fine	2 - 4		2
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	9
Medium	11.3 - 16	V	7
Coarse	16 - 22.6	E	9
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	4
Very Coarse	45 - 64		2
Small	64 - 90	C	
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	102

Note:



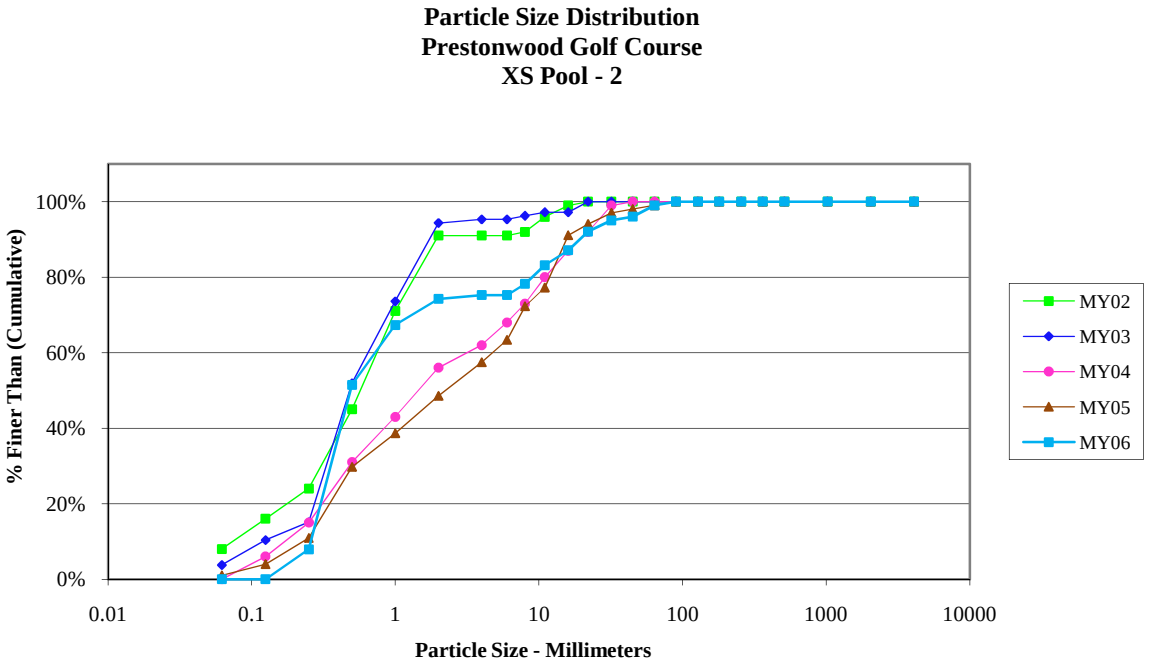
Size (mm)	
D16	0.33
D35	0.69
D50	1.2
D65	8.4
D84	19
D95	35

Size Distribution	
mean	2.5
dispersion	9.7
skewness	0.24

Type	
silt/clay	6%
sand	54%
gravel	40%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 2 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	8
Medium	.25 - .50	N	44
Coarse	.50 - 1	D	16
Very Coarse	1 - 2	S	7
Very Fine	2 - 4		1
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	5
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		3
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	101

Note:



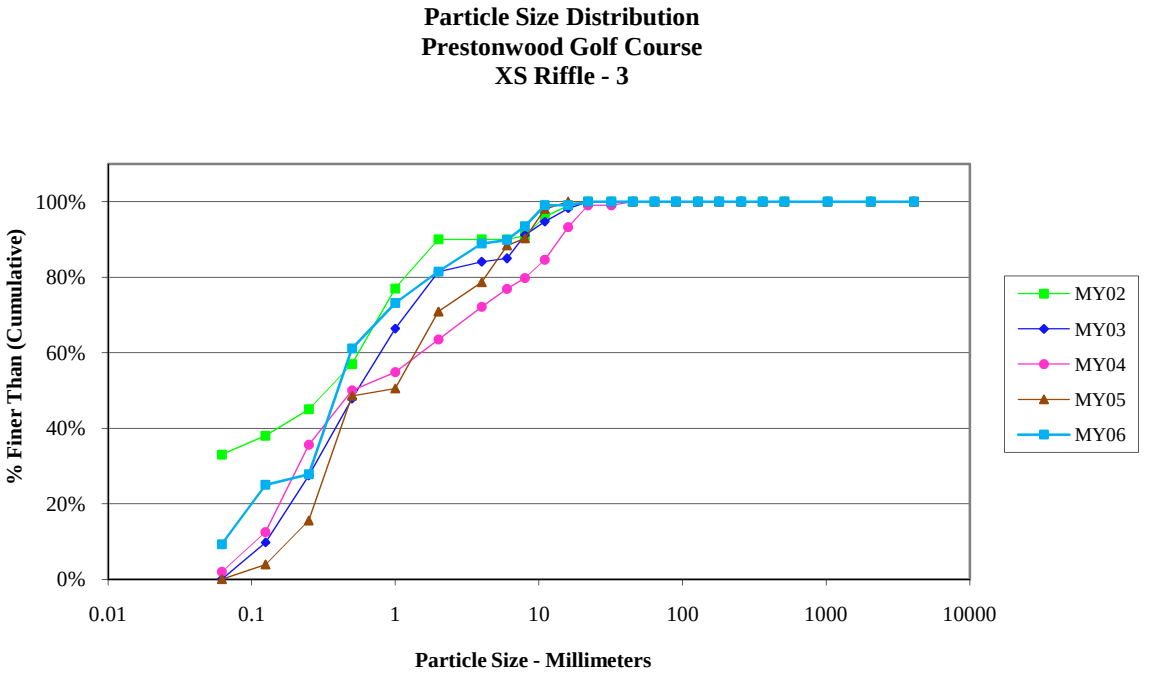
Size (mm)	
D16	0.28
D35	0.38
D50	0.49
D65	0.9
D84	12
D95	32

Size Distribution	
mean	1.8
dispersion	13.1
skewness	0.45

Type	
silt/clay	0%
sand	74%
gravel	25%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 3 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	10
Very Fine	.062 - .125	S	17
Fine	.125 - .25	A	3
Medium	.25 - .50	N	36
Coarse	.50 - 1	D	13
Very Coarse	1 - 2	S	9
Very Fine	2 - 4		8
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
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	108

Note:



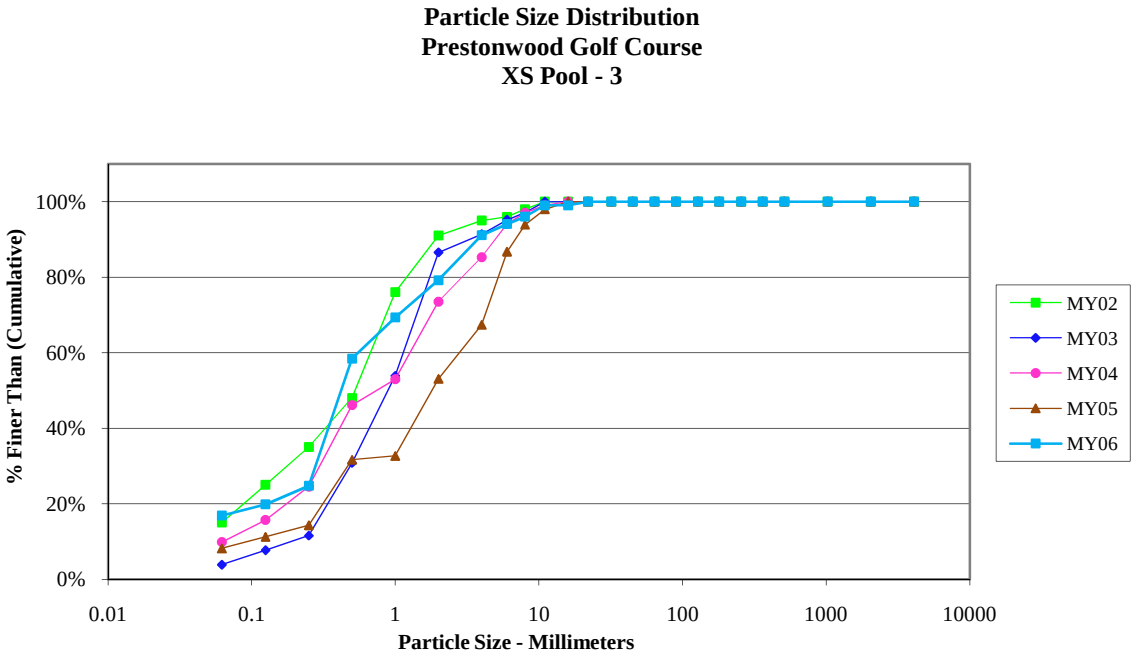
Size (mm)	
D16	0.062
D35	0.29
D50	0.4
D65	0.63
D84	2.5
D95	8.7

Size Distribution	
mean	0.4
dispersion	6.4
skewness	-0.01

Type	
silt/clay	9%
sand	72%
gravel	19%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 3 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	17
Very Fine	.062 - .125	S	3
Fine	.125 - .25	A	5
Medium	.25 - .50	N	34
Coarse	.50 - 1	D	11
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		12
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
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	101

Note:



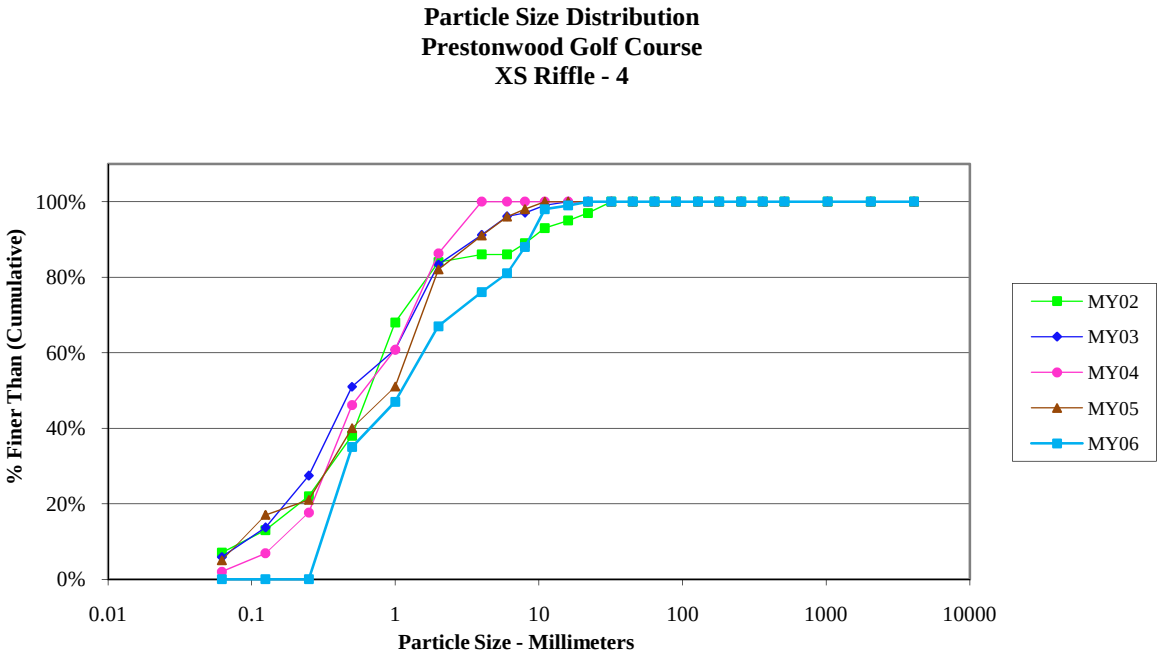
Size (mm)	
D16	0.062
D35	0.31
D50	0.42
D65	0.76
D84	2.6
D95	6.9

Size Distribution	
mean	0.4
dispersion	6.5
skewness	-0.02

Type	
silt/clay	17%
sand	62%
gravel	21%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Riffle 4 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	35
Coarse	.50 - 1	D	12
Very Coarse	1 - 2	S	20
Very Fine	2 - 4		9
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	7
Medium	8 - 11.3	A	10
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
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:



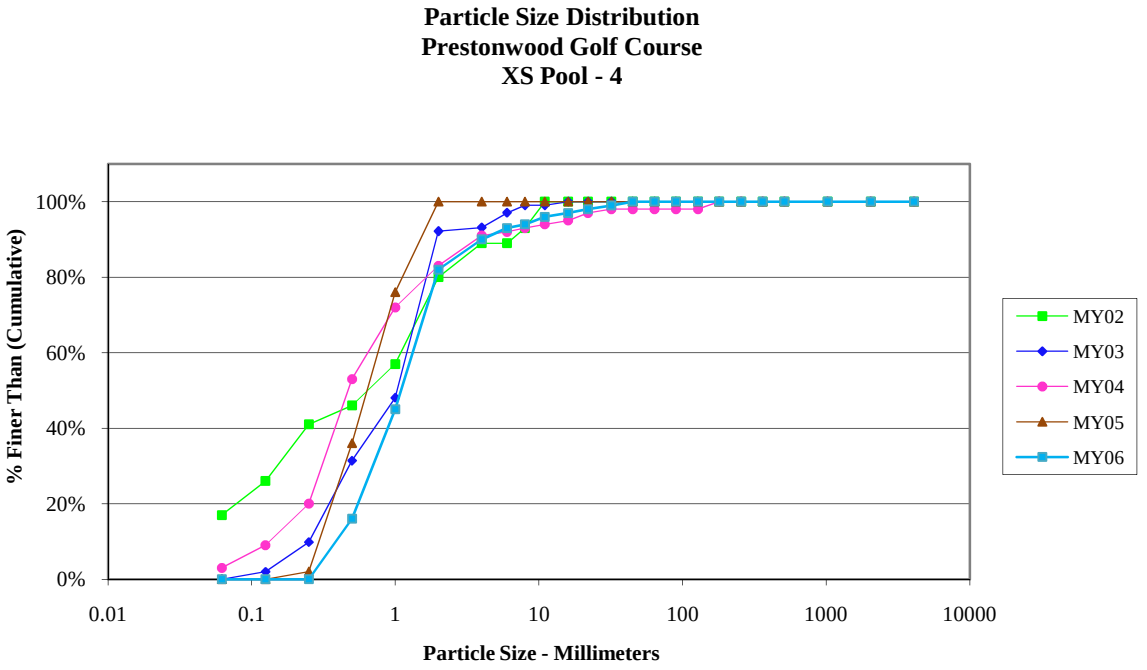
Size (mm)	
D16	0.34
D35	0.5
D50	1.1
D65	1.9
D84	6.8
D95	10

Size Distribution	
mean	1.5
dispersion	4.7
skewness	0.12

Type	
silt/clay	0%
sand	67%
gravel	33%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section Pool 4 - MY06			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	16
Coarse	.50 - 1	D	29
Very Coarse	1 - 2	S	37
Very Fine	2 - 4		8
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	1
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	
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	0.5
D35	0.79
D50	1.1
D65	1.5
D84	2.4
D95	9.4

Size Distribution	
mean	1.1
dispersion	2.2
skewness	0.00

Type	
silt/clay	0%
sand	82%
gravel	18%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Appendix D

Stream Assessment Data

Table 10 Baseline Stream Data Summary Table
Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)
Segment Reach: Hatchet's Grove (3,828 ft.)

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Mean	Min	Max	Med	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bankfull Width (ft)									21.7			18.4			20	19.8	24.5	20.8
Floodprone Width (ft)									170			200			200	60	100	100
Bankfull Cross-Sectional Area (ft^2)									45.1			27.5	50	60	55	37.5	52.6	43.1
Bankfull Mean Depth (ft)									2.1			1.5			2.5	1.8	2.2	2.2
Bankfull Maximum Depth (ft)									3.5			2.9	3.5	3.6	3.55	3.1	3.8	3.7
Width/Depth Ratio									10.8			12			8	9.1	11.6	11.4
Entrenchment Ratio									7.7			10.9			10	2.9	5	4.1
Bank Height Ratio															1.0			1.0
Pattern																		
Channel Beltwidth (ft)										40	76	58	40	110	75			
Radius of Curvature (ft)										30	44	37	30	60	45			
Meander Wavelength (ft)										40	76	58	80	150	115			
Meander Width Ratio										2.2	4.1	3.2	2	5.5	3.8			
Profile																		
Riffle Length (ft)							27	68	48	12	60	36	15	50	33			
Riffle Slope (ft/ft)							0.003	0.03	0.017	0.007	0.037	0.022	0.005	0.010	0.008			
Pool Length (ft)							60	182	121	21	53	37	20	70	45			
Pool Spacing (ft)							68	202	135	30	84	57	50	140	95			
Substrate																		
d50 (mm)															2			
d84 (mm)															13			
Additional Reach Parameters																		
Valley Length (ft)																		
Channel Length (ft)																		
Sinuosity								1.1			1.8			1.2				
Water Surface Slope (ft/ft)																		
BF Slope (ft/ft)								0.002			0.008			0.002				
Rosgen Classification								E5/F5			E4			E5			E5	

Table 10 Baseline Stream Data Summary Table
Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)
Segment Reach: Meadow Creek (295 ft.)

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Mean	Min	Max	Med	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bankfull Width (ft)																		8.7
Floodprone Width (ft)																		90
Bankfull Cross-Sectional Area (ft^2)																		7.1
Bankfull Mean Depth (ft)																		0.8
Bankfull Maximum Depth (ft)																		1.4
Width/Depth Ratio																		10.8
Entrenchment Ratio																		10.3
Bank Height Ratio																		1.0
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)																		
d84 (mm)																		
Additional Reach Parameters																		
Valley Length (ft)																		
Channel Length (ft)																		
Sinuosity																		
Water Surface Slope (ft/ft)																		
BF Slope (ft/ft)																		
Rosgen Classification																		E5

Table 11a. Monitoring - Cross-Section Morphology Data Tables
Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)
Segment Reach: Meadow Creek (295 ft.)

Parameter	Cross-Section - Riffle 1							Cross-Section - Pool 1						
	Riffle							Pool						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY0	MY1	MY2	MY3	MY4	MY5	MY6
Record Elevation (datum) used			294.3	294.4	294.4	294.4	294.4			294.6	294.6	294.6	294.6	294.6
Bankfull Width (ft)		9.8	9.4	9.4	9.6	8.1	8.4		11.8	16.3	15.0	14.4	16.5	17.0
Floodprone Width (ft)		90	90	90	90	90	90			100	100	100	100	100
Bankfull Cross-Sectional Area (ft^2)		10.7	9.7	9.6	9.6	12.1	14.0		13.6	17.4	18.4	18.7	20.7	21.9
Bankfull Mean Depth (ft)		1.1	1.0	1.0	1.0	1.5	1.7		1.2	1.1	1.2	1.3	1.3	1.3
Bankfull Maximum Depth (ft)		2.5	2.3	2.4	2.7	2.9	3.0		2.7	2.8	2.9	3.0	3.1	3.2
Width/Depth Ratio		8.9	9.1	9.3	9.6	5.4	5.0		10.3	15.3	12.3	11.1	13.1	13.2
Entrenchment Ratio		9.2	9.6	9.6	9.4	11.1	10.7			6.1	6.7	6.9	6.1	5.9
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	0.9
Cross-Sectional Area Between End Pins (ft^2)							44.7							25.0
d50 (mm)			0.1	0.2	0.2	0.1	0.1			0.7	0.1	0.2	0.4	0.1

Table 11a. Monitoring - Cross-Section Morphology Data Tables

Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)

Segment Reach: Hatchet's Grove (3,828 ft.)

Parameter	Cross-Section - Riffle 2 Riffle							Cross-Section - Pool 2 Pool							Cross-Section - Riffle 3 Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY0	MY1	MY2	MY3	MY4	MY5	MY6
Record Elevation (datum) used			291.1	291.1	291.1	291.1	291.1			291.6	291.6	291.6	291.6	291.6			289.0	289.0	288.6	288.6	288.6
Bankfull Width (ft)			16.8	16.6	17.1	15.8	16.4		21.7	21.7	20.0	17.5	19.7	19.1			25.3	25.8	24.4	24.0	25.0
Floodprone Width (ft)			60	60	60	60	60			80	80	80	80	80			100	100	100	100	100
Bankfull Cross-Sectional Area (ft^2)			39.7	42.1	47.1	45.1	53.4		54.4	58.3	50.8	49.3	57.8	59.0			60.7	62.2	53.2	56.8	57.2
Bankfull Mean Depth (ft)			2.4	2.5	2.8	2.9	3.3		2.5	2.7	2.5	2.8	2.9	3.1			2.4	2.4	2.2	2.4	2.3
Bankfull Maximum Depth (ft)			3.2	3.2	3.3	3.5	3.9		4.5	4.6	4.3	4.3	4.5	4.5			4.4	4.4	3.8	4.1	4.1
Width/Depth Ratio			7.1	6.5	6.2	5.5	5.0		8.7	8.1	7.9	6.2	6.7	6.2			10.5	10.7	11.2	10.1	10.9
Entrenchment Ratio			3.6	3.6	3.5	3.8	3.7			3.7	4.0	4.6	4.1	4.2			4.0	3.9	4.1	4.2	4.0
Bank Height Ratio			1.0	1.1	1.1	1.2	1.1		1.0	1.0	1.0	1.0	1.1	1.1			1.0	1.0	1.0	1.0	1.0
Cross-Sectional Area Between End Pins (ft^2)							101.9							70.9							72.9
d50 (mm)			0.6	0.9	2.8	12.0	1.2			0.6	0.5	1.5	2.2	0.49			0.3	0.5	0.5	0.8	0.4

Parameter	Cross-Section - Pool 3 Pool							Cross-Section - Riffle 4 Riffle							Cross-Section - Pool 4 Pool						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY0	MY1	MY2	MY3	MY4	MY5	MY6
Record Elevation (datum) used			288.7	288.7	288.7	288.7	288.7			286.7	286.7	286.7	286.7	286.7			286.6	286.6	286.6	286.6	286.6
Bankfull Width (ft)		29.5	26.7	25.5	24.4	25.9	22.7			23.0	18.9	18.3	18.8	18.8			20.9	19.9	22.9	20.7	17.5
Floodprone Width (ft)			110	110	110	110	110			95	95	95	95	95			95	95	95	95	95
Bankfull Cross-Sectional Area (ft^2)		64.9	55.9	51.1	46.8	48.2	35.8			42.5	43.3	43.7	42.8	41.8			47.1	47.8	51.9	48.4	45.1
Bankfull Mean Depth (ft)		2.2	2.1	2.0	1.9	1.9	1.6			1.8	2.3	2.4	2.3	2.2			2.3	2.4	2.3	2.3	2.6
Bankfull Maximum Depth (ft)		4.8	4.4	4.5	4.7	4.4	3.6			3.5	3.6	3.8	3.6	3.7			4.5	5.3	5.5	5.1	5.0
Width/Depth Ratio			12.8	12.7	12.8	13.9	14.4			12.4	8.3	7.7	8.3	8.5			9.3	8.3	10.1	8.9	6.8
Entrenchment Ratio			4.1	4.3	4.5	4.2	4.8			4.1	5.0	5.2	5.1	5.1			4.5	4.8	4.1	4.6	5.4
Bank Height Ratio		1.0	1.0	1.0	1.0	1.1	1.0			1.0	1.0	1.0	1.1	1.1			1.0	1.0	1.0	1.0	1.0
Cross-Sectional Area Between End Pins (ft^2)							46.6							52.4							55.7
d50 (mm)			0.5	0.9	0.7	1.8	0.4			0.7	0.5	0.6	0.9	1.1			0.5	1.0	0.5	0.6	1.1

Table 11b. Morphology and Hydraulic Monitoring Summary (Reach Parameters)
Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)
Segment Reach: Meadow Creek (295 ft.)

Parameter	MY - 01 (2005)						MY - 02 (2006)						MY - 03 (2007)						MY - 04 (2008)						MY - 05 (2009)						MY - 06 (2010)					
Dimension	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	9.8	12.9	12.2	14.4	5.9	2	9.4	12.9	12.9	16.3	4.88	2	9.4	12.2	12.2	15.0	3.96	2	9.6	12.0	12.0	14.4	3.39	2	8.1	12.3	12.3	16.5	5.94	2	8.4	12.7	12.7	17.0	6.08	2
Floodprone Width (ft)	90	95	95	100	7.1	2	90	95	95	100	7.07	2	90	95	95	100	7.07	2	90	95	95	100	7.07	2	90	95	95	100	7.07	2	90	95	95	100	7.07	2
Bankfull Mean Depth (ft)	10.7	13.6	14.0	18.7	6.1	2	9.7	13.6	13.6	17.4	5.44	2	9.6	14	14	18.4	6.22	2	9.6	14.15	14.2	18.7	6.43	2	12.1	16.4	16.4	20.7	6.08	2	14.0	18.0	18.0	21.9	5.59	2
Bankfull Max Depth (ft)	1.1	1.1	1.1	1.3	0.1	2	1.0	1.1	1.05	1.1	0.07	2	1.0	1.1	1.1	1.2	0.14	2	1.0	1.15	1.15	1.3	0.21	2	1.3	1.4	1.4	1.5	0.14	2	1.3	1.5	1.5	1.7	0.28	2
Bankfull Cross-Sectional Area (ft^2)	2.5	2.6	2.7	3.0	0.1	2	2.3	2.6	2.55	2.8	0.35	2	2.4	2.65	2.65	2.9	0.35	2	2.7	2.85	2.85	3.0	0.21	2	2.9	3.0	3.0	3.1	0.14	2	3.0	3.1	3.1	3.2	0.14	2
Width/Depth Ratio	8.9	12.2	10.8	11.1	5.4	2	9.1	12.2	12.2	15.3	4.38	2	9.3	10.8	10.8	12.3	2.12	2	9.6	10.35	10.4	11.1	1.06	2	5.4	9.25	9.25	13.1	5.44	2	5.0	9.1	9.1	13.2	5.80	2
Entrenchment Ratio	9.2	7.9	8.2	9.4	3.5	2	6.1	7.9	7.85	9.6	2.47	2	6.7	8.15	8.15	9.6	2.05	2	6.9	8.15	8.15	9.4	1.77	2	6.1	8.6	8.6	11.1	3.54	2	5.9	8.3	8.3	10.7	3.39	2
Bank Height Ratio	1.0	1.0	1.0	1.0	0	2	1.0	1.0	1.0	1.0	0	2	1.0	1.0	1.0	1.0	0	2	1.0	1.0	1.0	1.0	0	2	1.0	1.0	1.0	1.0	0	2	0.9	1.0	1.0	1.0	0.07	2
Pattern																																				
Channel Beltwidth (ft)							30		31	37			30		31	37			30		31	37			30		31	37			30		31	37		
Radius of Curvature (ft)							10		11	14			10		11	14			10		11	14			10		11	14			10		11	14		
Rad. of Curv. : Bankfull Width (ft/ft)																																				
Meander Wavelength (ft)							46		50	59			46		50	59			46		50	59			46		50	59			46		50	59		
Meander Width Ratio*							2.3		2.4	2.9			2.5		2.5	3.0			2.5		2.6	3.1			2.4		2.5	3.0			2.4		2.4	2.9		
Profile**																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max Depth (ft)																																				
Pool Spacing (ft)																																				
Additional Reach Parameters																																				
Valley Length (ft)							206						206						206						206						206					
Channel Thalweg Length (ft)							272						272						272						272						272					
Sinuosity							1.3						1.3						1.3						1.3						1.3					
Water Surface Slope (ft/ft)							0.009						0.008						0.008						***						0.010					
Bankfull Slope (ft/ft)							0.005						0.005						0.005						0.005						0.006					
Rosgen Classification							E5						E5						E5						E5						E5					
Ri% / Ru% / P% / G% / S%																																				
SC% / Sa% / G% / C% / B% / Be%																															65% / 32% / 3% / - / - / -					
d16 / d35 / d50 / d84 / d95																															0.01 / 0.01 / 0.01 / 0.1 / 0.45					
% of Reach with Eroding Banks																																				

* For calculation, used current monitoring year's mean riffle Wbkf.

**Because of the small size of Meadow Creek and inconsistent nature of the streambed, there are no discernable features on the profile.

***No water surface taken due to lack of water in the stream.

Table 11b. Morphology and Hydraulic Monitoring Summary (Reach Parameters)
Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)
Segment Reach: Hatchet's Grove (3,828 ft.)

Parameter	MY - 01 (2005)						MY - 02 (2006)						MY - 03 (2007)						MY - 04 (2008)						MY - 05 (2009)						MY - 06 (2010)					
Dimension	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	21.7	25.6	25.6	29.5	5.52	2	16.8	22.4	22.4	26.7	3.50	6	16.6	21.1	20.0	25.8	3.72	6	17.1	20.8	20.6	24.4	3.50	6	15.8	20.8	20.2	25.9	3.65	6	16.4	19.9	19.0	25.0	3.28	6
Floodprone Width (ft)							60	90	95	110	17.61	6	60	90	95	110	17.61	6	60	90	95	110	17.61	6	60	90	95	110	17.61	6	60	90	95	110	17.61	6
Bankfull Mean Depth (ft)	54.4	59.7	59.7	64.9	7.42	2	39.7	50.7	51.5	60.7	8.79	6	42.1	49.6	49.3	62.2	7.23	6	43.7	48.7	48.2	53.2	3.52	6	42.8	49.9	48.3	57.8	6.14	6	35.8	48.7	49.3	59.0	9.25	6
Bankfull Max Depth (ft)	2.2	2.4	2.4	2.5	0.21	2	1.8	2.3	2.35	2.7	0.31	6	2.0	2.4	2.4	2.5	0.19	6	1.9	2.4	2.4	2.8	0.35	6	1.9	2.5	2.4	2.9	0.39	6	1.6	2.5	2.5	3.3	0.62	6
Bankfull Cross-Sectional Area (ft^2)	4.5	4.7	4.7	4.8	0.21	2	3.2	4.1	4.4	4.6	0.59	6	3.2	4.2	4.4	5.3	0.74	6	3.3	4.2	4.1	5.5	0.78	6	3.5	4.2	4.3	5.1	0.60	6	3.6	4.1	4.0	5.0	0.53	6
Width/Depth Ratio		8.7				1	7.1	10.0	9.9	12.8	2.30	6	6.5	9.1	8.3	12.7	2.24	6	6.2	9.0	8.9	12.8	2.75	6	5.5	8.9	8.6	13.9	2.94	6	5.0	8.6	7.7	14.4	3.49	6
Entrenchment Ratio							3.6	4.0	4.05	4.5	0.32	6	3.6	4.3	4.2	5.0	0.54	6	3.5	4.3	4.3	5.2	0.58	6	3.8	4.3	4.2	5.1	0.45	6	3.7	4.5	4.5	5.4	0.67	6
Bank Height Ratio	1.0	1.0	1.0	1.0	0.00	2	1.0	1.0	1.0	1.0	0.00	6	1.0	1.0	1.0	1.1	0.04	6	1.0	1.0	1.0	1.1	0.04	6	1.0	1.1	1.1	1.2	0.08	6	1.0	1.1	1.1	1.1	0.05	6
Pattern																																				
Channel Beltwidth (ft)							38		52	104			38		52	104			38		52	104			38		52	104								
Radius of Curvature (ft)							23		36	55			23		36	55			23		36	55			23		36	55								
Rad. of Curv. : Bankfull Width (ft/ft)																																				
Meander Wavelength (ft)							106		150	193			106		150	193			106		150	193			106		150	193								
Meander Width Ratio*							1.7		2.3	4.5			1.9		2.5	5.1			1.6		2.2	4.4			1.6		2.2	4.4								
Profile																																				
Riffle Length (ft)							6		19	67			3		11	55			2		16	33			4		12	33			5	28	23	80	20	19
Riffle Slope (ft/ft)							0.0003		0.0017	0.0582			0.0004		0.0088	0.0531			0.0004		0.0029	0.0528			0.0002		0.0045	0.0416			0.0002	0.0038	0.0011	0.0192	0.0052	19
Pool Length (ft)							5		18	76			4		9	54			4		20	97			4		21	69			4	34	29	102	24	49
Pool Max Depth (ft)							4.5	4.7	4.7	4.8	0.21	2	4.4	4.5	4.5	4.6	0.1	3	4.3	4.7	4.5	5.3	0.53	3	4.4	4.7	4.5	5.1	0.38	3	3.6	4.4	4.5	5.0	0.71	3
Pool Spacing (ft)							22		76	212			14		63	273			22		63	253			21		56	149			29	75	70	212	37	48
Additional Reach Parameters																																				
Valley Length (ft)							3,121						3,121						3,121						3,121						3,121					
Channel Thalweg Length (ft)							3,828						3,828						3,828						3,828						3,828					
Sinuosity							1.2						1.2						1.2						1.2						1.2					
Water Surface Slope (ft/ft)							0.0020						0.0023						0.0019						0.0018						0.0018					
Bankfull Slope (ft/ft)							0.0019						0.0021						0.0018						0.0017						0.0023					
Rosgen Classification							E5						E5						E5						E5						E5					
Ri% / Ru% / P% / G% / S%																																				
SC% / Sa% / G% / C% / B% / Be%																															5% / 69% / 26% / - / - / -					
d16 / d35 / d50 / d84 / d95																															0.28 / 0.43 / 0.71 / 6.8 / 19					
% of Reach with Eroding Banks																															7%					

* For calculation, used current monitoring year's mean riffle Wbkf.

Appendix E

Hydrologic Data

Table 12. Verification of Bankfull Events Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo Number**
10/1/2005	Unknown	Bankfull Indicators	N/A
6/15/2006	6/14/2006	Site visit evaluating bankfull indicators after storm event	N/A
8/26/2008	4/28/2008	Crest Gauge	N/A
9/9/2008	9/7/2008	Crest Gauge	N/A
10/20/2010	9/30/2010	Crest Gauge	N/A