# Prestonwood Golf Course
# (Hatchet's Grove)
# Stream Restoration Monitoring Report
## EEP Project # 289
## Monitoring Year – 03
## 2007

Submitted to:

Ecosystem Enhancement PROGRAM

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

**February 2008**

## Monitoring Firm


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## Design Firm

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**Raleigh, NC 27614**
**Phone: (919) 846-5900**
**Fax: (919) 846-9467**

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# EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (EEP) directed the restoration of Hatchet's Grove Tributary and an unnamed tributary to Hatchet's Grove (Meadow Creek). Soil and Environmental Consultants, PA (S&EC) designed the restoration. The watershed of approximately 3.7 square miles 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. The restoration was designed to correct various problems within the existing stream corridor from channelization and poor vegetation maintenance practices. Construction was completed in 2004, and the first and second year monitoring took place in 2005 and 2006, respectively. This report describes the findings of the third year monitoring that took place in 2007.

The riparian buffer zone was planted with sixteen different species of trees and shrubs. The bankfull channel area was live staked with three different species. Six vegetation monitoring plots were established during the as-built survey. Three buffer plots and three stream bank plots were established. During the second year of monitoring, the EEP changed the vegetation monitoring protocol for this project. The new protocol required that the three stream bank plots be repositioned. The three new plots were established during the second year of monitoring and all six of the plots have been assessed using the new monitoring protocol. The third year of monitoring counted an average of 740 stems per acre in the riparian buffer. This site does not have any exotic vegetation problems. The only vegetation problem areas identified during Monitoring Year 03 were poor vegetative coverage on portions of the floodplain and some bare banks. There are also areas where the riparian buffer has been mowed almost to the streambanks, including at the beginning of the project where a sewer line easement overlaping the riparian buffer has been cleared. These areas are depicted in Appendix C, on the Current Conditions Plan View. The third year of monitoring found the vegetation component of the project to meet the vegetation success criterion of 320 stems/acre.

The physical monitoring of the stream's dimension and profile consisted of longitudinal profile of both Hatchet's Grove and Meadow Creek and two cross-sections on Meadow Creek and six cross-sections on Hatchet's Grove. Previous monitoring reports documented the stream had numerous problems with streambank erosion and floodplain scour. The third year monitoring documented many of these same problems with some previous problems stabilizing and some worsening. The third year of monitoring found that, due to the drought conditions and fewer bankfull events that occurred during 2007, some of the larger areas of bank erosion (Station 14+75) did not worsen during Monitoring Year 03. While parts of the stream have stable dimensions, streambank erosion is severe enough to warrant timely attention and possible maintenance/remediation. There is also evidence of bed degradation and scour along much of the stream. This is evident at most of the in-stream structures, where, as illustrated in the profile, the elevation of the header rock is slightly above the elevation of the streambed upstream of it. Monitoring Year 03 has found that the stream is generally functioning appropriately, but the streambank erosion and bed degradation indicate that the stream is susceptible to change and that these issues need to be closely monitored.

# 1.0 PROJECT BACKGROUND

## 1.1 Project Objectives

- 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 education values.

## 1.2 Project Structure, Restoration Type, and Approach

Hatchet's Grove and Meadow Creek, were incised channels flowing through the Prestonwood Golf Course that were restored using channel dimension and profile modifications and by establishing a vegetated riparian zone adjacent to the streams. The channel profile is maintained through the use of rock cross vanes. The new channel pattern was constructed using single vanes, root wads, and vegetation along the channel banks.

## 1.3 Location and Setting

The Prestonwood site is located on a golf course, which is surrounded by apartments and single family homes. Areas of forest and agricultural land are sporadically spaced throughout the watershed. Development pressure will continue to urbanize the watershed, increasing the amount of impervious area.

## 1.4 Project History and Background

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

| Segment / Reach ID | Existing Linear Feet | Type | Approach | Linear Feet | Stationing | Comment |
|---|---|---|---|---|---|---|
| Hatchet's Grove | 3,200 | R | P2 | 3,828 | 00+00 - 38+28 | |
| Meadow Creek | 300 | R | P2 | 295 | 00+00 - 02+95 | |

R = Restoration P2 = Priority 2

**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.**

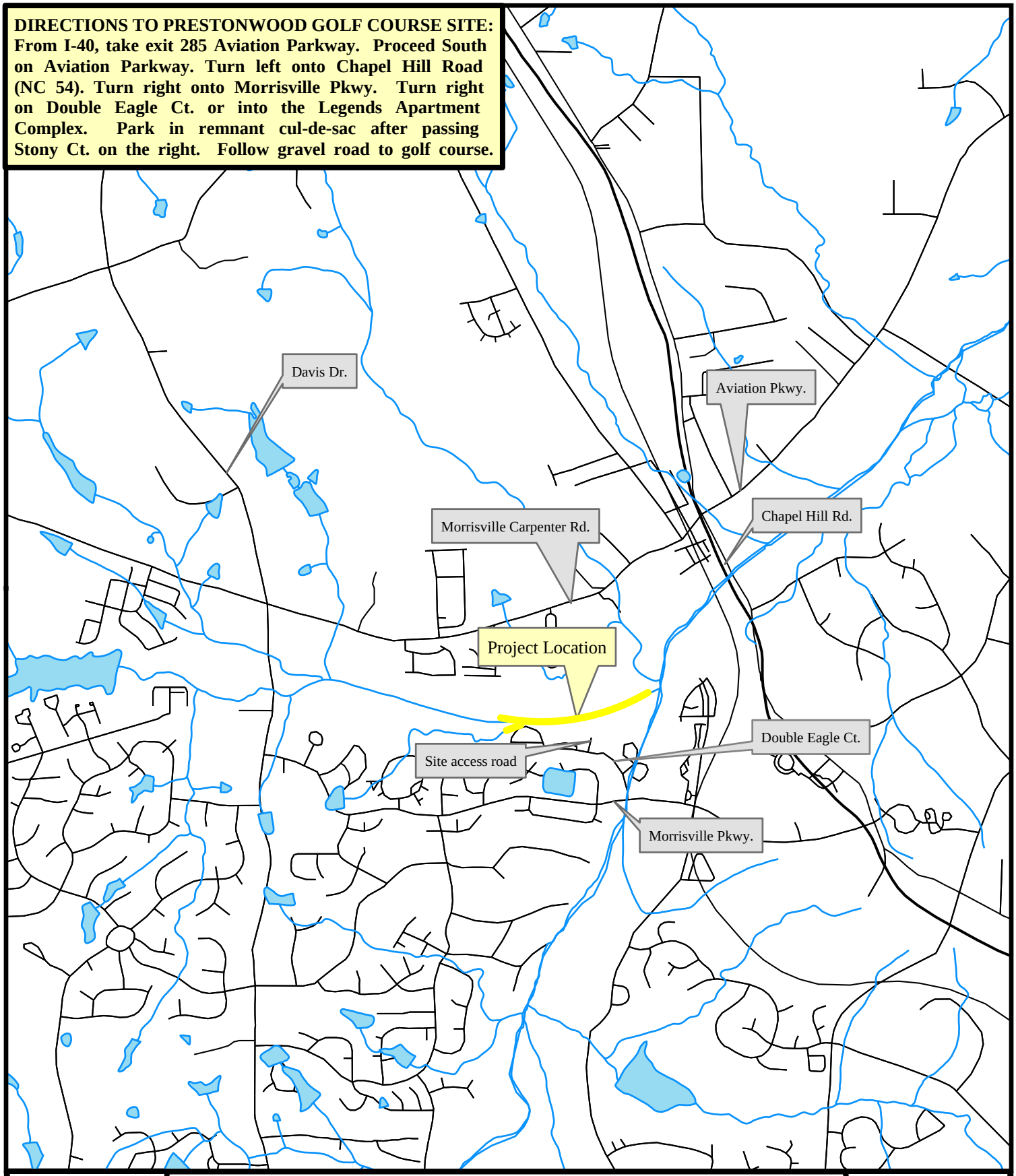



**Figure 1. Site Vicinity Map**
**Prestonwood Golf Course, Wake County, EEP Project # 289 - MY03**

0.25 0.125 0 0.25 0.5
Miles

N

Date: 12/04/07

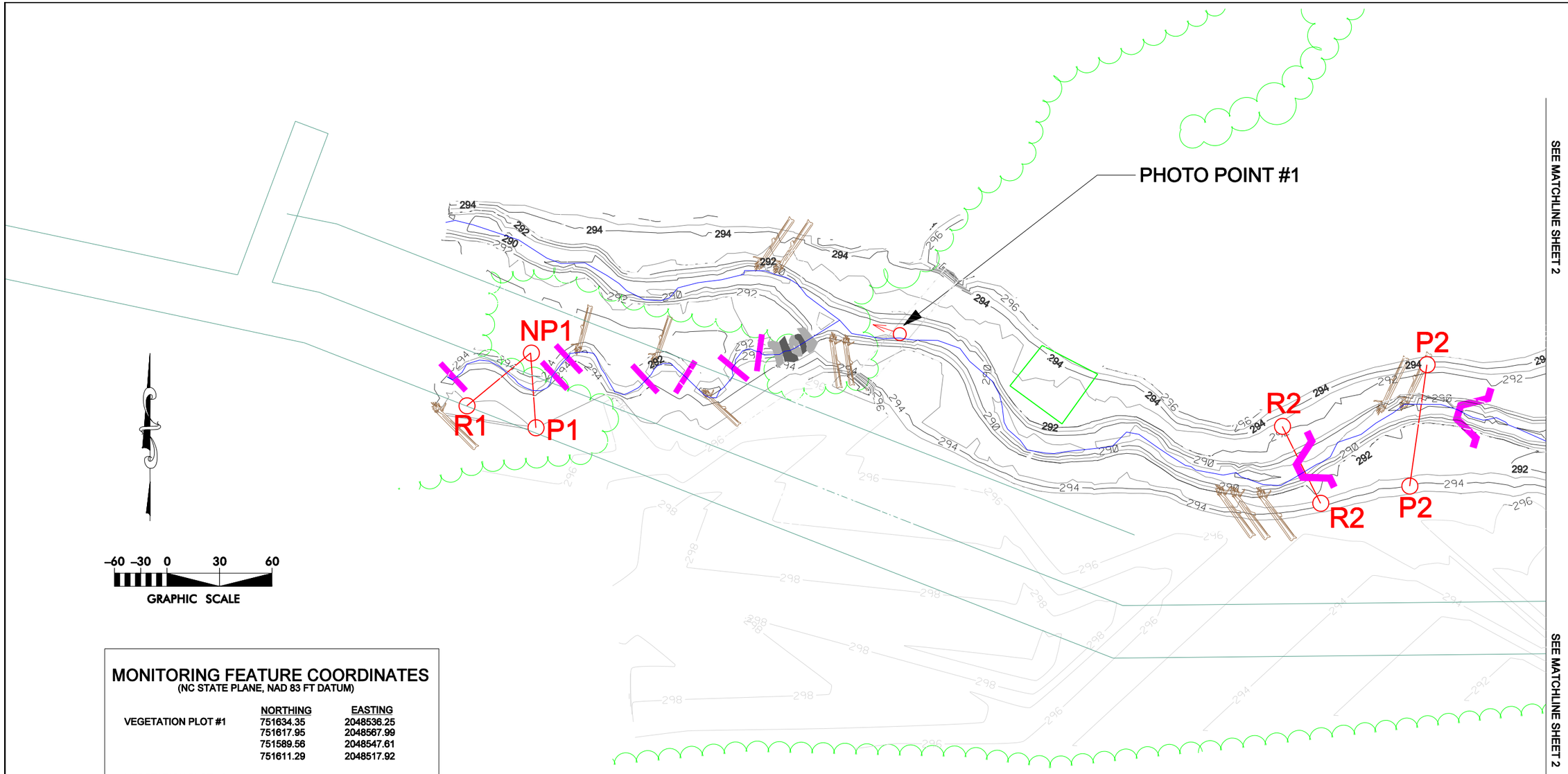
Ecosystem Enhancement Program

KCI Associates of NC

| Table 2. Project Activity and Reporting History<br>Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove) | | |
|---|---|---|
| **Activity or Report** | **Data Collection Complete** | **Actual Completion or Delivery** |
| Restoration Plan | | Oct 02 |
| Final Design - 90% | | |
| Construction | | May 04 |
| Planting | | May 04 |
| Mitigation Plan / As-Built Report | | Sep 06 |
| Year 1 Monitoring | Oct 05 | Apr 06 |
| Year 2 Monitoring | Sep 06 | Jan 07 |
| Year 3 Monitoring | Jul 07 | Jan 08 |

| Table 3. Project Contact Table<br>Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove) | |
|---|---|
| **Design Firms** | S&EC, PA<br>11010 Raven Ridge Rd.<br>Raleigh, North Carolina 27614<br>Phone: (919) 846-5900<br>Fax: (919) 846-9467 |
| **Construction Contractor** | McQueen Construction Co.<br>619 Patrick Rd.<br>Bahama, North Carolina 27503 |
| **Planting Contractor** | Carolina Silvics, Inc.<br>908 Indian Trail Rd.<br>Edenton, North Carolina 27932 |
| **Monitoring Performers** | |
| **MY-01** | S&EC, PA<br>11010 Raven Ridge Rd.<br>Raleigh, North Carolina 27614<br>Contact: Ms. Rebecca Wargo and Ms. Jessica Regan<br>Phone: (919) 846-5900<br>Fax: (919) 846-9467 |
| **MY-02, 03** | KCI Associates of NC<br>Landmark Center II, Suite 220<br>4601 Six Forks Rd.<br>Raleigh, NC 27609<br>Contact: Mr. Adam Spiller<br>Phone: (919) 783-9214<br>Fax: (919) 783-9266 |

| **Table 4. Project Background Table**<br>**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)** | |
|---|---|
| Project County | Wake County |
| Drainage Area | 3.7 sq. mi. (Hatchet's Grove) |
| | 0.23 sq. mi. (Meadow Creek) |
| Drainage Impervious Cover Estimate (%) | 30% |
| Stream Order | Third Order (Hatchet's Grove) |
| | First Order (Meadow Creek) |
| Physiographic Region | Piedmont |
| Ecoregion | Triassic Basin |
| Rosgen Classification of As-built | E5 |
| Dominant Soil Types | Chewacla, Wehadkee |
| Reference Site ID | Sal's Branch |
| | Mill Creek |
| USGS HUC for Project and Reference | 03020201080010 (Hatchet's Grove) |
| | 03020201080 (Sal's Branch) |
| | 03040101090 (Mill Creek) |
| NCDWQ Sub-basin for Project and Reference | 03-04-02 (Hatchet's Grove) |
| | 03-04-02 (Sal's Branch) |
| | 03-07-02 (Mill Creek) |
| NCDWQ Classification for Project and Reference | C - NSW |
| Any portion of the project segment 303d listed? | No |
| Any portion of the project segment upstream of a 303d listed segment? | Yes, Hachet's Grove is a tributary to Crabtree Creek |
| Reasons for 303d Listing or Stressor | Impaired Biological Integrity, Turbidity, Low $O_2$ |
| % of Project Easement Fenced / Marked | 0% |




–60 –30 0 30 60

GRAPHIC SCALE

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

| | NORTHING | EASTING |
|---|---|---|
| VEGETATION PLOT #1 | 751634.35 | 2048536.25 |
| | 751617.95 | 2048567.99 |
| | 751589.56 | 2048547.61 |
| | 751611.29 | 2048517.92 |
| VEGETATION PLOT #2 | 751749.38 | 2049206.36 |
| | 751718.43 | 2049219.10 |
| | 751705.76 | 2049188.93 |
| | 751737.28 | 2049176.42 |
| VEGETATION PLOT #3 | 751773.43 | 2049512.36 |
| | 751757.89 | 2049541.93 |
| | 751729.34 | 2049527.03 |
| | 751743.25 | 2049497.41 |
| VEGETATION PLOT #4 | 751834.26 | 2050320.01 |
| | 751802.15 | 2050327.60 |
| | 751795.57 | 2050295.71 |
| | 751826.82 | 2050290.19 |
| VEGETATION PLOT #5 | 751823.55 | 2050517.95 |
| | 751827.40 | 2050552.74 |
| | 751794.53 | 2050553.96 |
| | 751791.98 | 2050521.07 |
| VEGETATION PLOT #6 | 751878.20 | 2050778.32 |
| | 751848.27 | 2050788.06 |
| | 751837.65 | 2050758.06 |
| | 751868.18 | 2050748.65 |

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

| | | NORTHING | EASTING | ELEVATION |
|---|---|---|---|---|
| CROSS SECTION R1 | LB | 751630 | 2048244 | 295.16 |
| | RB | 751599 | 2048207 | 295.46 |
| CROSS SECTION P1 | LB | 751630 | 2048244 | 295.16 |
| | RB | 751587 | 2048247 | 294.95 |
| CROSS SECTION R2 | LB | 751589 | 2048673 | 292.49 |
| | RB | 751544 | 2048696 | 293.49 |
| CROSS SECTION P2 | LB | 751624 | 2048756 | 293.48 |
| | RB | 751554 | 2048746 | 294.02 |
| CROSS SECTION R3 | LB | 751836 | 2049763 | 290.49 |
| | RB | 751829 | 2049836 | 289.07 |
| CROSS SECTION P3 | LB | 751906 | 2049813 | 290.42 |
| | RB | 751829 | 2049836 | 289.07 |
| CROSS SECTION R4 | LB | 751819 | 2050653 | 287.24 |
| | RB | 751753 | 2050616 | 287.74 |
| CROSS SECTION P4 | LB | 751819 | 2050653 | 287.24 |
| | RB | 751819 | 2050653 | 287.74 |

## LEGEND

PHOTO REFERENCE POINT

VEGETATIVE BUFFER BOUNDARY

CROSS SECTION P2

ROOT WAD

CHANNEL SILL

ROCK CROSS VANE

ROCK J-HOOK

| NO. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | REVISIONS | | |

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PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

STATION 10+00 TO STATION 17+26

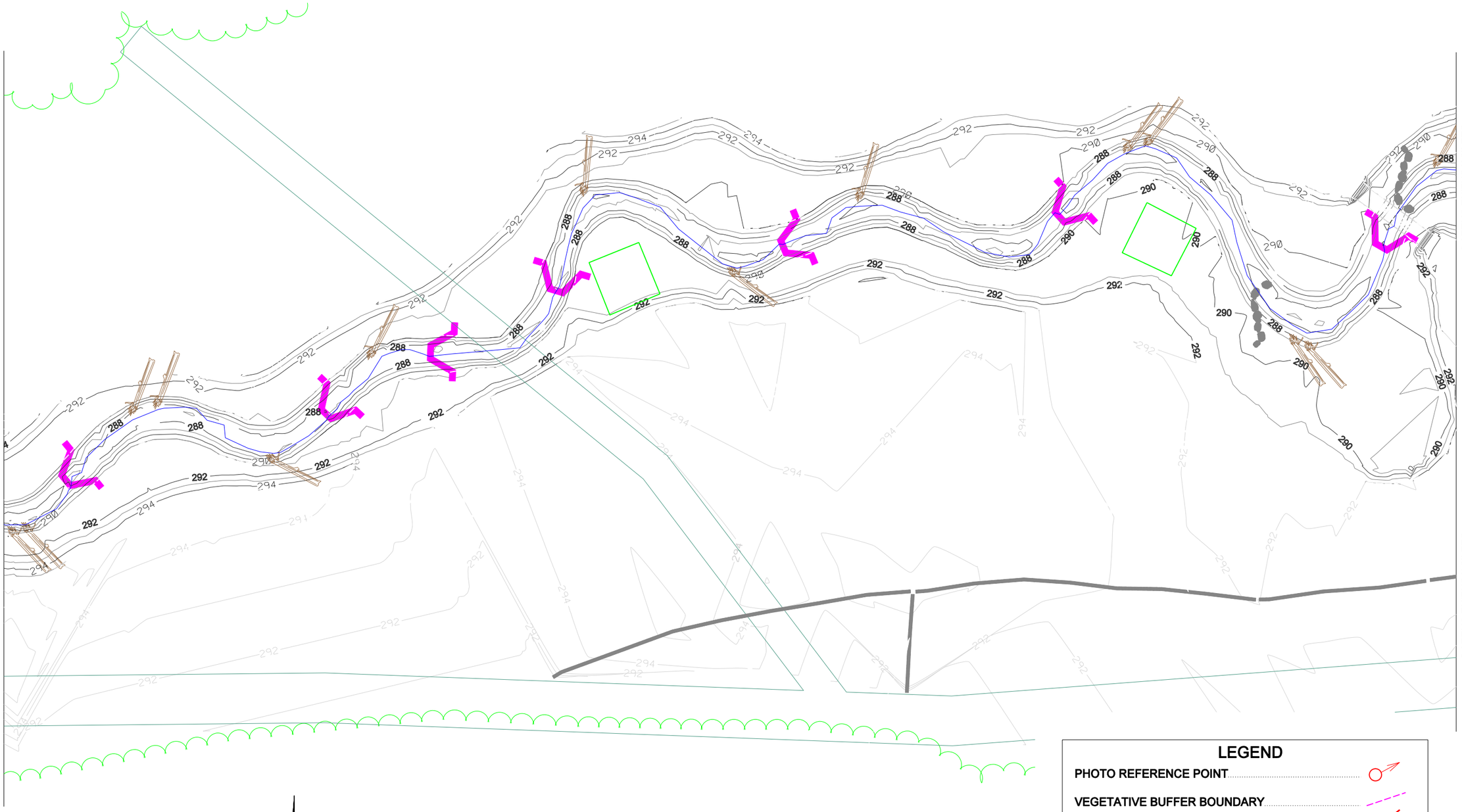
DATE: NOVEMBER 2007
SCALE: SEE SHEET

MONITORING PLAN VIEW

SHEET 1 OF 4

SEE MATCHLINE SHEET 1

SEE MATCHLINE SHEET 3




SEE MATCHLINE SHEET 1

SEE MATCHLINE SHEET 3

–60 –30 0 30 60

GRAPHIC SCALE

## LEGEND

- PHOTO REFERENCE POINT
- VEGETATIVE BUFFER BOUNDARY
- CROSS SECTION (P2)
- ROOT WAD
- CHANNEL SILL
- ROCK CROSS VANE
- ROCK J-HOOK

| NO. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | REVISIONS | | |

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WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

STATION 17+26 TO STATION 29+14

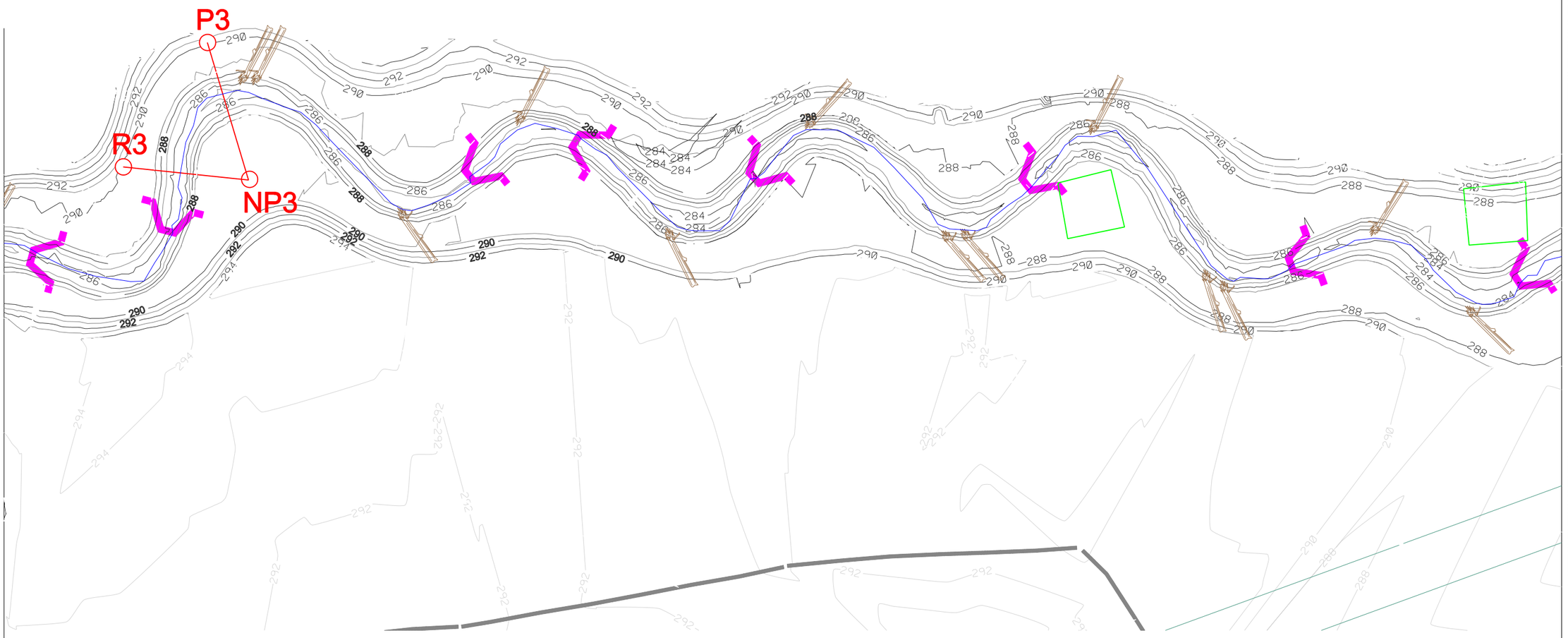
DATE: NOVEMBER 2007
SCALE: SEE SHEET

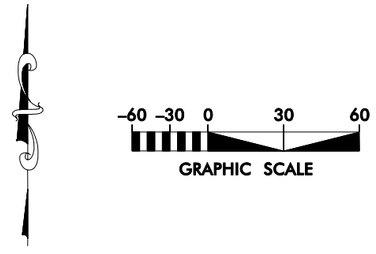
MONITORING PLAN VIEW

SHEET 2 OF 4

SEE MATCHLINE SHEET 2

SEE MATCHLINE SHEET 4




## LEGEND

- PHOTO REFERENCE POINT
- VEGETATIVE BUFFER BOUNDARY
- CROSS SECTION (P2)
- ROOT WAD
- CHANNEL SILL
- ROCK CROSS VANE
- ROCK J-HOOK

| NO. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | REVISIONS | | |

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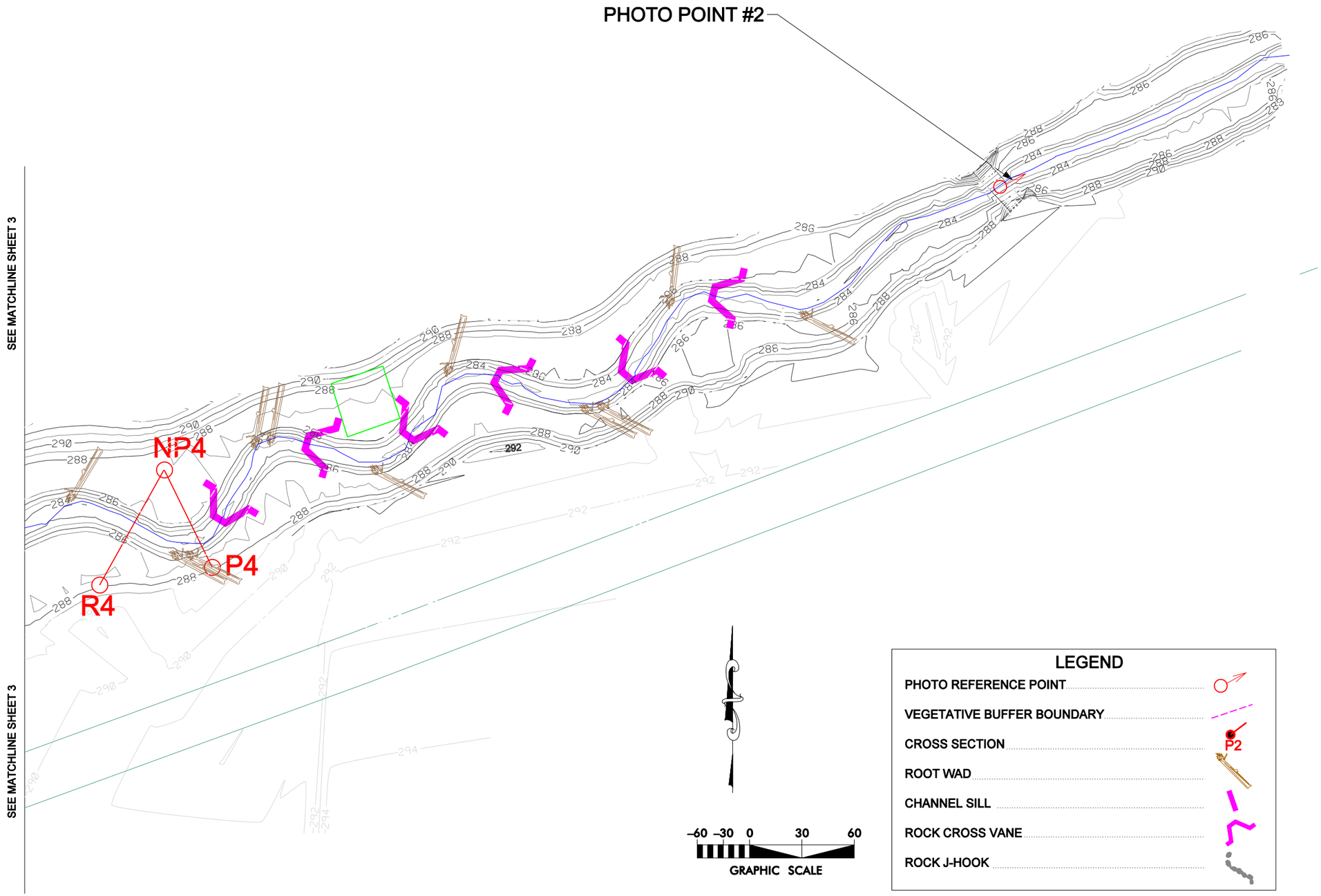
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

STATION 29+14 TO STATION 40+87

DATE: NOVEMBER 2007
SCALE: SEE SHEET

MONITORING PLAN VIEW




| REVISIONS | | | |
|---|---|---|---|
| SYM. | DESCRIPTION | DATE | APPROVED |

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PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

STATION 40+87 TO STATION 49+70

DATE: NOVEMBER 2007
SCALE: SEE SHEET

MONITORING PLAN VIEW

## 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

### 2.2.1.a Verification of Bankfull Events Table

**Table 5. Verification of Bankfull Events**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**

| Date of Data Collection | Date of Occurence | Method | Photo Number |
|---|---|---|---|
| 10/1/2005 | Unknown | Bankfull Indicators | N/A |
| 6/14/2006 | 6/15/2006 | Site visit evaluating bankfull indicators after storm event | N/A |

### 2.2.1.b BEHI and Sediment Export Table

**Table 6. BEHI and Sediment Export Estimates**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**

BEHI will be completed in Monitoring Year 05

### 2.2.2 Stability Assessment Table

**Table 7a. Categorical Stream Feature Visual Stability Assessment**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**
**Segment/Reach: Hatchet's Grove (3,828 ft.)**

| Feature | Initial | MY - 01 | MY - 02 | MY - 03 | MY - 04 | MY - 05 |
|---|---|---|---|---|---|---|
| A. Riffles | 100% | N/A | 70% | 56% | | |
| B. Pools | 100% | N/A | 96% | 100% | | |
| C. Thalweg | 100% | N/A | 68% | 68% | | |
| D. Meanders | 100% | N/A | 61% | 61% | | |
| E. Bed General | 100% | N/A | 89% | 94% | | |
| F. Bank Condition | 100% | N/A | 87% | 90% | | |
| G. Vanes / J Hooks etc. | 100% | N/A | 92% | 92% | | |
| H. Wads and Boulders | 100% | N/A | 74% | 74% | | |

**Table 7b. Categorical Stream Feature Visual Stability Assessment**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**
**Segment/Reach: Meadow Creek (295 ft.)**

| Feature | Initial | MY - 01 | MY - 02 | MY - 03 | MY - 04 | MY - 05 |
|---|---|---|---|---|---|---|
| A. Riffles | 100% | N/A | – | – | | |
| B. Pools | 100% | N/A | – | – | | |
| C. Thalweg | 100% | N/A | 60% | 60% | | |
| D. Meanders | 100% | N/A | 80% | 80% | | |
| E. Bed General | 100% | N/A | 80% | 75% | | |
| F. Bank Condition | 100% | N/A | 80% | 80% | | |
| G. Sills | 100% | N/A | 60% | 60% | | |
| H. Wads and Boulders | 100% | N/A | 80% | 80% | | |

## 2.2.3 Quantitative Measures Summary Tables

**Table 8a. Baseline Morphology and Hydraulic Summary**
**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 | Med |
| 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 |
| Wetted Perimeter (ft) | | | | | | | | | | | | | | | | | | |
| Hydraulic Radius (ft) | | | | | | | | | | | | | | | | | | |
| **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 | 0.01 | 0.037 | 0.022 | 0.01 | 0.01 | 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 | | | | |

**Table 8b. Baseline Morphology and Hydraulic Summary**
**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 | Med |
| 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 |
| 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) | | | | | | | | | | | | | | | | | | |
| d84 (mm) | | | | | | | | | | | | | | | | | | |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | | | | | | | | | | | | | | | | | | |
| Channel Length (ft) | | | | | | | | | | | | | | | | | | |
| Sinuosity | | | | | | | | | | | | | | | | | | |
| Water Surface Slope (ft/ft) | | | | | | | | | | | | | | | | | | |
| BF Slope (ft/ft) | | | | | | | | | | | | | | | | | | |
| Rosgen Classification | | | | | | | | | | | | | | | | | | |

*As-built data is from a single cross section survey.

**Table 9a. Morphology and Hydraulic Monitoring Summary**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**
**Segment Reach: Meadow Creek (295 ft.)**

| Parameter | Cross Section - Riffle 1 Riffle | | | | | | Cross Section - Pool 1 Pool | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ |
| Bankfull Width (ft) | 9.8 | 9.4 | 9.4 | | | | 11.8 | 16.3 | 15.0 | | | |
| Floodprone Width (ft) | 90 | 90 | 90 | | | | | 100 | 100 | | | |
| Bankfull Cross Sectional Area ($ft^2$) | 10.7 | 9.7 | 9.6 | | | | 13.6 | 17.4 | 18.4 | | | |
| Bankfull Mean Depth (ft) | 1.1 | 1.0 | 1.0 | | | | 1.2 | 1.1 | 1.2 | | | |
| Bankfull Maximum Depth (ft) | 2.5 | 2.3 | 2.4 | | | | 2.7 | 2.8 | 2.9 | | | |
| Width/Depth Ratio | 8.9 | 9.1 | 9.3 | | | | 10.3 | 15.3 | 12.3 | | | |
| Entrenchment Ratio | 9.2 | 9.6 | 9.6 | | | | | 6.1 | 6.7 | | | |
| Bank Height Ratio | 1.0 | 1.0 | 1.0 | | | | 1.0 | 1.0 | 0.8 | | | |
| Wetted Perimeter (ft) | | 10.9 | 11.8 | | | | | 18.2 | 17.6 | | | |
| Hydraulic Radius (ft) | | 0.9 | 0.8 | | | | | 1.0 | 1.0 | | | |
| **Substrate** | | | | | | | | | | | | |
| d50 (mm) | | 0.1 | 0.2 | | | | | 0.7 | 0.06 | | | |
| d84 (mm) | | 0.3 | 0.4 | | | | | 2.0 | 0.06 | | | |

**Table 9b. Morphology and Hydraulic Monitoring Summary**
**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** | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ |
| Bankfull Width (ft) | 22.2 | 16.8 | 16.6 | | | | 21.7 | 21.7 | 20.0 | | | | | 25.3 | 25.8 | | | |
| Floodprone Width (ft) | 60 | 60 | 60 | | | | | 80 | 80 | | | | | 100 | 100 | | | |
| Bankfull Cross Sectional Area ($ft^2$) | 52.3 | 39.7 | 42.1 | | | | 54.4 | 58.3 | 50.8 | | | | | 60.7 | 62.2 | | | |
| Bankfull Mean Depth (ft) | 2.4 | 2.4 | 2.5 | | | | 2.5 | 2.7 | 2.5 | | | | | 2.4 | 2.4 | | | |
| Bankfull Maximum Depth (ft) | 2.1 | 3.2 | 3.2 | | | | 4.5 | 4.6 | 4.3 | | | | | 4.4 | 4.4 | | | |
| Width/Depth Ratio | 9.4 | 7.1 | 6.5 | | | | 8.7 | 8.1 | 7.9 | | | | | 10.5 | 10.7 | | | |
| Entrenchment Ratio | 2.7 | 3.6 | 3.6 | | | | | 3.7 | 4.0 | | | | | 4.0 | 3.9 | | | |
| Bank Height Ratio | 1.0 | 1.0 | 1.1 | | | | 1.0 | 1.0 | 1.0 | | | | | 1.0 | 1.0 | | | |
| Wetted Perimeter (ft) | | 19.3 | 19.8 | | | | | 24.4 | 23.3 | | | | | 27.9 | 29.5 | | | |
| Hydraulic Radius (ft) | | 2.1 | 2.1 | | | | | 2.4 | 2.2 | | | | | 2.2 | 2.1 | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | |
| d50 (mm) | | 0.6 | 0.9 | | | | | 0.6 | 0.5 | | | | | 0.3 | 0.5 | | | |
| d84 (mm) | | 2.0 | 2.4 | | | | | 2.0 | 1.4 | | | | | 1.0 | 3.9 | | | |

**Table 9b cont. Morphology and Hydraulic Monitoring Summary**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**
**Segment Reach: Hatchet's Grove (3,828 ft.)**

| **Parameter** | Cross Section - Pool 3 Pool | | | | | | Cross Section - Riffle 4 Riffle | | | | | | Cross Section - Pool 4 Pool | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ | MY1 | MY2 | MY3 | MY4 | MY5 | MY+ |
| Bankfull Width (ft) | 29.5 | 26.7 | 25.5 | | | | | 23.0 | 18.9 | | | | | 20.9 | 19.9 | | | |
| Floodprone Width (ft) | | 110 | 110 | | | | | 95 | 95 | | | | | 95 | 95 | | | |
| Bankfull Cross Sectional Area ($ft^2$) | 64.9 | 55.9 | 51.1 | | | | | 42.5 | 43.3 | | | | | 47.1 | 47.8 | | | |
| Bankfull Mean Depth (ft) | 2.2 | 2.1 | 2.0 | | | | | 1.8 | 2.3 | | | | | 2.3 | 2.4 | | | |
| Bankfull Maximum Depth (ft) | 4.8 | 4.4 | 4.5 | | | | | 3.5 | 3.6 | | | | | 4.5 | 5.3 | | | |
| Width/Depth Ratio | | 12.8 | 12.7 | | | | | 12.4 | 8.3 | | | | | 9.3 | 8.3 | | | |
| Entrenchment Ratio | | 4.1 | 4.3 | | | | | 4.1 | 5.0 | | | | | 4.5 | 4.8 | | | |
| Bank Height Ratio | 1.0 | 1.0 | 1.0 | | | | | 1.0 | 1.1 | | | | | 1.0 | 1.0 | | | |
| Wetted Perimeter (ft) | | 28.7 | 28.3 | | | | | 20.7 | 21.9 | | | | | 24.2 | 25.0 | | | |
| Hydraulic Radius (ft) | | 1.9 | 1.8 | | | | | 2.1 | 2.0 | | | | | 2.0 | 1.9 | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | |
| d50 (mm) | | 0.5 | 0.9 | | | | | 0.7 | 0.5 | | | | | 0.5 | 1.0 | | | |
| d84 (mm) | | 1.0 | 1.9 | | | | | 2.0 | 2.1 | | | | | 1.0 | 1.8 | | | |

**Table 9c. Morphology and Hydraulic Monitoring Summary**
**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) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pattern** | Min | Max | Med | Min | Max | Med | Min | Max | Med | Min | Max | Med | Min | Max | Med |
| Channel Beltwidth (ft) | | | | 30 | 37 | 31 | 30 | 37 | 31 | | | | | | |
| Radius of Curvature (ft) | | | | 10 | 14 | 11 | 10 | 14 | 11 | | | | | | |
| Meander Wavelength (ft) | | | | 46 | 59 | 50 | 46 | 59 | 50 | | | | | | |
| Meander Width Ratio* | | | | 3.1 | 3.9 | 3.3 | 3.1 | 3.9 | 3.3 | | | | | | |
| **Profile**** | | | | | | | | | | | | | | | |
| Riffle Length (ft) | | | | | | | | | | | | | | | |
| Riffle Slope (ft/ft) | | | | | | | | | | | | | | | |
| Pool Length (ft) | | | | | | | | | | | | | | | |
| Pool Spacing (ft) | | | | | | | | | | | | | | | |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | |
| Valley Length (ft) | | | | 206 | | | 206 | | | | | | | | |
| Channel Length (ft) | | | | 272 | | | 272 | | | | | | | | |
| Sinuosity | | | | 1.3 | | | 1.3 | | | | | | | | |
| Water Surface Slope (ft/ft) | | | | 0.009 | | | 0.008 | | | | | | | | |
| Bankfull Slope (ft/ft) | | | | 0.005 | | | 0.005 | | | | | | | | |
| Rosgen Classification | | | | E5 | | | E5 | | | | | | | | |

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

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

**Table 9d. Morphology and Hydraulic Monitoring Summary**
**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) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pattern** | Min | Max | Med | Min | Max | Med | Min | Max | Med | Min | Max | Med | Min | Max | Med |
| Channel Beltwidth (ft) | | | | 38 | 104 | 52 | 38 | 104 | 52 | | | | | | |
| Radius of Curvature (ft) | | | | 23 | 55 | 36 | 23 | 55 | 36 | | | | | | |
| Meander Wavelength (ft) | | | | 106 | 193 | 150 | 106 | 193 | 150 | | | | | | |
| Meander Width Ratio* | | | | 1.7 | 4.5 | 2.3 | 1.9 | 5.1 | 2.5 | | | | | | |
| **Profile** | | | | | | | | | | | | | | | |
| Riffle Length (ft) | | | | 6 | 67 | 19 | 3 | 55 | 11 | | | | | | |
| Riffle Slope (ft/ft) | | | | 0.0003 | 0.0582 | 0.0017 | 0.0004 | 0.0531 | 0.0088 | | | | | | |
| Pool Length (ft) | | | | 5 | 76 | 18 | 4 | 54 | 9 | | | | | | |
| Pool Spacing (ft) | | | | 22 | 212 | 76 | 14 | 273 | 63 | | | | | | |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | |
| Valley Length (ft) | | | | | 3,121 | | | 3,121 | | | | | | | |
| Channel Length (ft) | | | | | 3,828 | | | 3,828 | | | | | | | |
| Sinuosity | | | | | 1.2 | | | 1.2 | | | | | | | |
| Water Surface Slope (ft/ft) | | | | | 0.0020 | | | 0.0023 | | | | | | | |
| Bankfull Slope (ft/ft) | | | | | 0.0019 | | | 0.0021 | | | | | | | |
| Rosgen Classification | | | | | E5 | | | E5 | | | | | | | |

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

# Appendix A
# Vegetation Data

# A1 –Vegetation Data Tables

**Table A1. Vegetation Metadata**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**

| | |
|---|---|
| **Report Prepared By** | Brian Roberts |
| **Date Prepared** | 11/20/2007 13:57 |
| **Database Name** | CVS_EEP_EntryTool_v220.mdb |
| **Database Location** | M:\2005\12053743_EEP_OpenEnd_Design\F_EEPMon0607\Vegetation database |

**PROJECT SUMMARY----------**

| Project Code | Project Name | Description | Length (ft) | Stream-to-Edge Width (ft) | Area (sq m) | Required Plots (calculated) | Sampled Plots |
|---|---|---|---|---|---|---|---|
| 289 | Prestonwood | Stream restoration site on Golf Course in Cary, NC | 3800 | 25 | 17,650 | 6 | 6 |

**Table A2. Vegetation Vigor by Species**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**

| | Species | 4 | 3 | 2 | 1 | 0 | Missing |
|---|---|---|---|---|---|---|---|
| | *Alnus serrulata* | 1 | 1 | | | | |
| | *Aronia arbutifolia* | 5 | 2 | | | | |
| | *Betula nigra* | 1 | 2 | | | | |
| | *Cornus amomum* | 3 | 5 | 1 | | | |
| | *Diospyros virginiana* | 4 | 9 | 1 | | | |
| | *Nyssa sylvatica* | | | 1 | | | |
| | *Quercus laurifolia* | 4 | 22 | 4 | | | 1 |
| | *Quercus michauxii* | 3 | 22 | 4 | | | |
| | *Quercus phellos* | | 6 | 1 | | | |
| | *Salix nigra* | 2 | | | | | |
| | *Hamamelis virginiana* | 3 | 3 | | | | |
| **TOT:** | **11** | **26** | **72** | **12** | | | **1** |

**Table A3. Vegetation Damage by Species**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**

| | Species | All Damage Categories | No Damage | Other Damage |
|---|---|---|---|---|
| | *Alnus serrulata* | 2 | 2 | |
| | *Aronia arbutifolia* | 7 | 6 | 1 |
| | *Betula nigra* | 3 | 3 | |
| | *Cornus amomum* | 9 | 6 | 3 |
| | *Diospyros virginiana* | 14 | 14 | |
| | *Hamamelis virginiana* | 6 | 6 | |
| | *Nyssa sylvatica* | 1 | 1 | |
| | *Quercus laurifolia* | 29 | 27 | 2 |
| | *Quercus michauxii* | 30 | 25 | |
| | *Quercus phellos* | 7 | 7 | |
| | *Salix nigra* | 2 | 2 | |
| **TOT:** | **11** | **111** | **105** | **6** |

**Table A4. Vegetation Damage by Plot**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**

| | Plot | All Damage Categories | No Damage | Other Damage |
|---|---|---|---|---|
| | 289-01-0001-year:3 | 18 | 14 | 4 |
| | 289-01-0002-year:3 | 8 | 8 | |
| | 289-01-0003-year:3 | 12 | 12 | |
| | 289-01-0004-year:3 | 9 | 8 | 1 |
| | 289-01-0005-year:3 | 29 | 28 | 1 |
| | 289-01-0006-year:3 | 35 | 35 | |
| **TOT:** | **6** | **111** | **105** | **1** |

**Table A5. Stem Count by Plot and Species**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**

| | Species | Total Stems | # Plots | Avg # Stems | plot 289-01-0001-year:3 | plot 289-01-0002-year:3 | plot 289-01-0003-year:3 | plot 289-01-0004-year:3 | plot 289-01-0005-year:3 | plot 289-01-0006-year:3 |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Alnus serrulata* | 2 | 2 | 1.00 | 1 | | | | | 1 |
| | *Aronia arbutifolia* | 7 | 2 | 3.50 | 4 | | | | | 3 |
| | *Betula nigra* | 3 | 2 | 1.50 | | 1 | | | 2 | |
| | *Cornus amomum* | 9 | 1 | 9.00 | 9 | | | | | |
| | *Diospyros virginiana* | 14 | 3 | 4.67 | | | | 2 | 11 | 1 |
| | *Hamamelis virginiana* | 6 | 2 | 3.00 | 3 | | | | | 3 |
| | *Nyssa sylvatica* | 1 | 1 | 1.00 | | | | | 1 | |
| | *Quercus laurifolia* | 30 | 4 | 7.75 | | 3 | | 7 | 7 | 13 |
| | *Quercus michauxii* | 29 | 4 | 7.25 | | 2 | 12 | | 5 | 10 |
| | *Quercus phellos* | 7 | 3 | 2.33 | | 1 | | | 2 | 4 |
| | *Salix nigra* | 2 | 2 | 1.00 | 1 | 1 | | | | |
| **TOT:** | **11** | | | | **18** | **8** | **12** | **9** | **28** | **35** |

During the first monitoring year, the plots were renumbered according to the new vegetation monitoring protocol set out by the EEP. Of the six plots at the site, three of these are the buffer monitoring plots that were set up for first year monitoring and three are new plots that were set up for second year monitoring. For comparison to the first year monitoring report, the new Plot 1 is the same as the first year Plot 1, the new Plot 3 is the same as the first year Plot 2, and the new Plot 6 is the same as the first year Plot 3. The third year vegetation monitoring revealed one missing *Quercus laurifolia* in Plot 5, the cause of which is unknown. There was also an increase in *Quercus michauxii* in Plot 4. These trees were not counted previously because a bankfull event concealed the trees under sediment and debris. The new trees were surveyed and added to the plot data. In Plot 1, several trees were cut by the golf course staff, due to the plot being in a play over area. This play over area appears to be periodically mowed and the woody vegetation is pruned back. The other area

of the buffer that is impacted by the golf course is the riparian buffer along the right bank of Meadow Creek. Two exotic species, Japanese honeysuckle (*Lonicera japonica*) and Chinese lespedeza (*Lespedeza cuneata*), were found at the site. However, these species were only established sporadically throughout the site.

It should be noted that most of the areas called out as bank erosion on the Current Conditions Plan View are raw banks and therefore devoid of vegetation. This can be seen in the representative photos for these problem areas.

# A2 – Representative Vegetation Problem Area Photos

VP1 – Photo taken at cleared sewer easement near the confluence looking downstream. 11/13/07 - MY 03

VP2 - Sparsely vegetated floodplain near Station 30+00. 11/13/07 - MY 03

# A3 – Vegetation Monitoring Plot Photos

Vegetation Plot 1. 6/18/07 - MY 03.

Vegetation Plot 2. 6/18/07 - MY 03.

Vegetation Plot 3. 6/18/07 - MY 03.

Vegetation Plot 4. 11/13/07 - MY 03.

Vegetation Plot 5. 6/28/07 - MY 03.

Vegetation Plot 6. 6/28/07 - MY 03.

# Appendix B
# Geomorphologic Data

The Hatchet's Grove stream has extended areas of severe bank erosion. While the specific cause of the bank erosion is unknown, the radius of curvature applied to many of the meanders appears to be too small for this suburban watershed, causing instability throughout the meanders. These eroded banks should be closely monitored to determine if corrective actions are warranted. Floodplain conditions along the stream varied in terms of erosion and deposition. Most of the floodplain scour likely occurred immediately following construction before vegetation stabilized the floodplain surface. Monitoring Year 03 found that some of these areas continue to stabilize as vegetative cover becomes more established. The lower third of the stream has a stable floodplain with no significant aggradation or degradation noted during the third monitoring year.

The Monitoring Plan View illustrates how the existing cross vanes are located at the beginning of tangent sections (heads of riffles) on the stream planform. A typical cross vane should concentrate flow in the center of the channel and induce scour to help maintain pools. The arms should also slow water in the near bank region before redirecting it. At Prestonwood, The placement of the structures in their current location likely had an adverse impact on the bed stability of the restored channel in these areas. The cross vanes on Hatchet's Grove stream act as grade controls, but also promote the formation of pools where riffles should be beginning. The installed cross vane arms do not extend up to the bankfull elevation or angle out away from the center boulder. Instead of directing water away from the banks, the vane arms act as large stone toe bank protection. Because of their placement, the cross vanes they have been evaluated primarily as grade control measures and stone toe stabilization, in which case most are functional.

Fewer areas of streambank erosion were noted in Monitoring Year 03 than in previous years. This is primarily due to some of the eroding areas becoming stabilized by vegetation. Many of the banks along the main channel are close to vertical due to previous erosion at the toe of the bank, but there is less overall active erosion than in former years.

Two new beaver dams have been built just downstream of the project boundary, 15 feet apart, but still on the main channel. The previous beaver dam along the downstream portion of the project is no longer present. The new beaver dam is ponding the lower portion of the stream, as described in the Current Conditions Plan View. This beaver dam should be removed to allow normal stream flow.

Monitoring Year 03 found that the beaver dams along Meadow Creek as documented in Monitoring Year 02 had washed away and were no longer present. As illustrated in the longitudinal profile, Meadow Creek has a highly unstable streambed that is experiencing continued degradation. The grade of the streambed is somewhat controlled by stone sills, which are the only grade control in this stream.

# B1 – Representative Stream Problem Area Photos

SP1 - Bank erosion. Photo taken near Station 18+60. 11/13/07 - MY 03

SP2 - Severe bank erosion and floodplain scour. Photo taken near Station 14+75, looking down on an eroded bank and a scour hole in the floodplain. 11/13/07 - MY 03

SP3 - Scour around rootwad. Vegetation and coir matting partially obscure the erosion behind the rootwad. Photo taken near Station 37+50. 11/13/07 - MY 03

SP4 - Rock from cross vane has moved and bank has eroded behind cross vane arm. Photo taken near Station 16+75. 11/13/07 - MY 03

SP5 – Upstream Beaver dam. Photo taken near Station 49+75. 11/13/06 - MY 03

SP6 - Bank erosion. Photo taken near Station 00+75. 11/13/07 - MY 03

SP7 - Back scour around rootwad and bank erosion. Rootwad partially obscured by coir matting. Photo taken near Station 02+10. 11/13/07 - MY 03

# B2 – Stream Photo Station Photos

Photo Point 1 – Taken looking upstream from golf cart bridge at the upper 300 feet of the Hatchet's Grove. 11/13/07 - MY 03

Photo Point 2 – Taken looking downstream from golf cart bridge at the lower 300 feet of the Hatchet's Grove. 11/13/07 - MY 03

# B3 – Qualitative Visual Stability Assessment

**Table B2. Qualitative Visual Stability Assessment**
**Project Number and Name: 289 – Prestonwood Golf Course (Hatchet's Grove)**
**Segment/Reach: Hatchet's Grove (3,828 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? | 25 | 44 | N/A | 57% | |
| | 2. Armor stable (e.g. no displacement)?** | N/A | 44 | N/A | N/A | |
| | 3. Facet grade appears stable? | 25 | 44 | N/A | 57% | |
| | 4. Minimal evidence of embedding/fining? | 25 | 44 | N/A | 57% | |
| | 5. Length appropriate? | 23 | 44 | N/A | 53% | **56%** |
| B. Pools | 1. Present? (e.g. no severe aggradation) | 44 | 42 | N/A | 105% | |
| | 2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?) | 42 | 42 | N/A | 100% | |
| | 3. Length appropriate? | 40 | 42 | N/A | 95% | **100%** |
| C. Thalweg | 1. Upstream of meander bend centering? | 30 | 44 | N/A | 68% | |
| | 2. Downstream of meander centering? | 30 | 44 | N/A | 68% | **68%** |
| D. Meanders | 1. Outer bend in state of limited/controlled erosion? | 20 | 44 | N/A | 45% | |
| | 2. Of those eroding, # w/ concomitant point bar formation? | 3 | 24 | N/A | 13% | |
| | 3. Apparent Rc within spec? | 38 | 44 | N/A | 86% | |
| | 4. Sufficient floodplain access and relief? | 44 | 44 | N/A | 100% | **61%** |
| E. Bed General | 1.General channel bed aggradation areas (bar formation) | N/A | N/A | 2 / 20 | 99% | |
| | 2. Channel bed degradation - areas of increasing down cutting or head cutting? | N/A | N/A | 7 / 140 | 94% | **94%** |
| F. Bank | 1. Actively eroding, wasting, or slumping bank | N/A | N/A | 26 / 780 | 90% | **90%** |
| G. Vanes | 1. Free of back or arm scour? | 23 | 25 | N/A | 92% | |
| | 2. Height appropriate? | 24 | 25 | N/A | 96% | |
| | 3. Angle and geometry appear appropriate?*** | N/A | 25 | N/A | N/A | |
| | 4. Free of piping or other structural failures? | 22 | 25 | N/A | 88% | **92%** |
| H. Wads / Boulders | 1. Free of scour? | 20 | 34 | N/A | 59% | |
| | 2. Footing stable? | 30 | 34 | N/A | 88% | **74%** |

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

** Hatchet's Grove is a sand bed stream so there is no armor on the riffles.

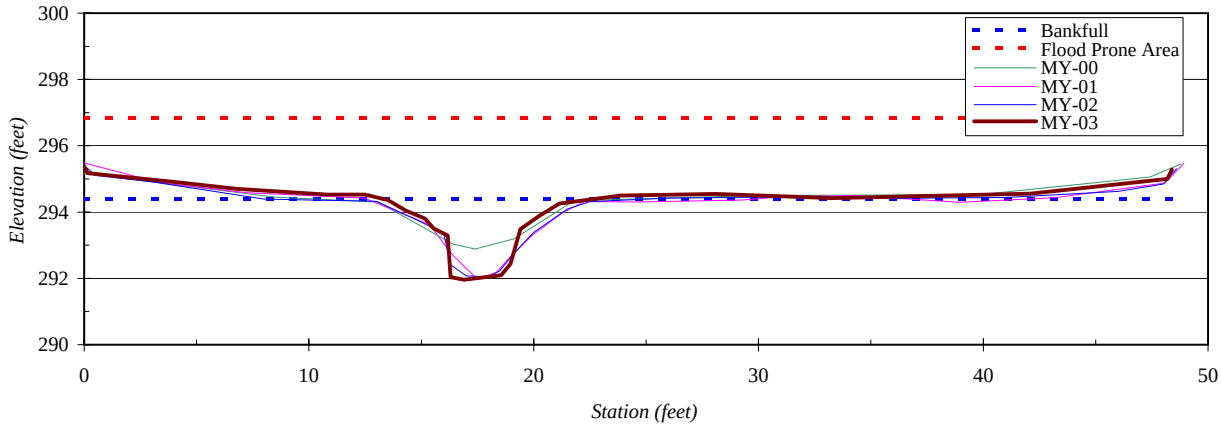
***See note concerning cross vanes in App B2. (These structures generally serve as toe stabilization and are functioning as such)

# B4 - Cross Section Plots and Data Tables

| | |
|---|---|
| **River Basin:** | Neuse |
| **Watershed:** | UT to Hatchet's Grove |
| **XS ID** | XS R1 |
| **Drainage Area (sq mi):** | 0.23 |
| **Date:** | 6/13/2007 |
| **Field Crew:** | B. Roberts, C. Wolf |

| Station | Elevation |
|---|---|
| 0.00 | 295.38 |
| 0.16 | 295.17 |
| 3.95 | 294.91 |
| 6.78 | 294.70 |
| 10.81 | 294.52 |
| 12.51 | 294.53 |
| 13.51 | 294.36 |
| 14.30 | 294.05 |
| 15.17 | 293.81 |
| 15.55 | 293.50 |
| 16.17 | 293.29 |
| 16.30 | 292.04 |
| 16.90 | 291.96 |
| 18.55 | 292.09 |
| 18.97 | 292.43 |
| 19.40 | 293.48 |
| 20.21 | 293.88 |
| 21.15 | 294.26 |
| 23.87 | 294.50 |
| 28.11 | 294.54 |
| 33.28 | 294.42 |
| 42.12 | 294.55 |
| 48.19 | 295.00 |
| 48.39 | 295.28 |

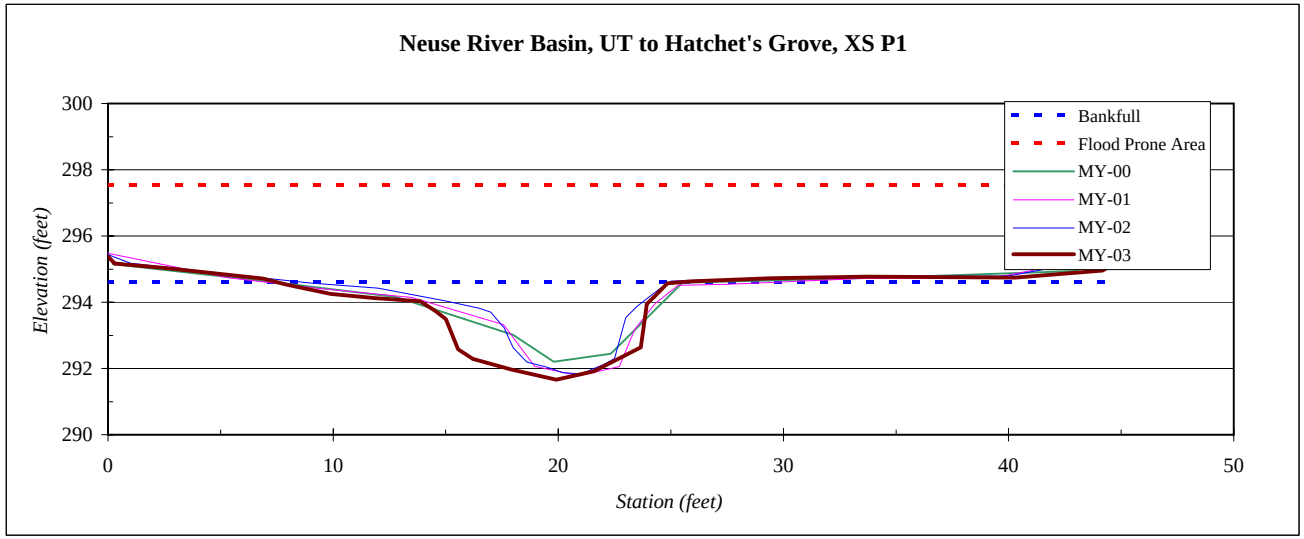
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 294.4 |
| **Bankfull Cross-Sectional Area:** | 9.6 |
| **Bankfull Width:** | 9.4 |
| **Flood Prone Area Elevation:** | 296.8 |
| **Flood Prone Width:** | 90 |
| **Max Depth at Bankfull:** | 2.4 |
| **Mean Depth at Bankfull:** | 1.0 |
| **W / D Ratio:** | 9.2 |
| **Entrenchment Ratio:** | 9.6 |
| **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:** | 6/13/2007 |
| **Field Crew:** | B. Roberts, C. Wolf |

| Station | Elevation |
|---|---|
| 0.00 | 295.38 |
| 0.29 | 295.17 |
| 2.53 | 295.03 |
| 6.88 | 294.72 |
| 7.94 | 294.53 |
| 9.90 | 294.25 |
| 11.84 | 294.13 |
| 13.88 | 294.02 |
| 14.55 | 293.73 |
| 15.01 | 293.49 |
| 15.55 | 292.58 |
| 16.20 | 292.29 |
| 17.89 | 291.97 |
| 19.91 | 291.66 |
| 21.58 | 291.91 |
| 22.38 | 292.19 |
| 23.66 | 292.64 |
| 23.93 | 293.95 |
| 24.27 | 294.17 |
| 24.85 | 294.57 |
| 25.82 | 294.63 |
| 29.46 | 294.72 |
| 33.70 | 294.78 |
| 40.31 | 294.74 |
| 44.18 | 294.96 |
| 44.44 | 295.06 |

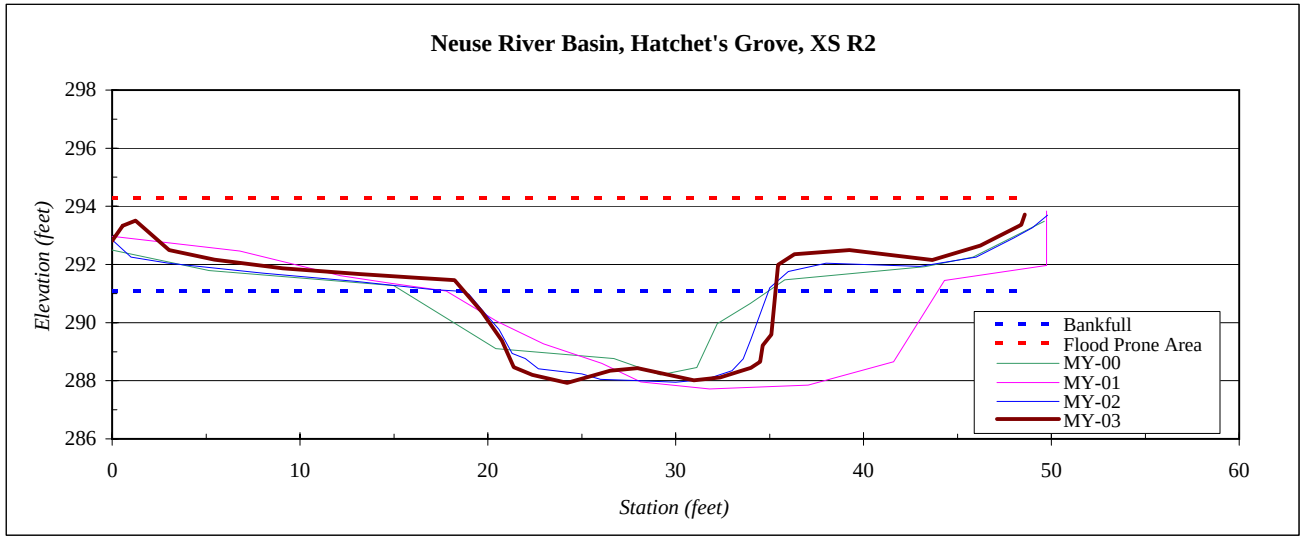
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 294.6 |
| **Bankfull Cross-Sectional Area:** | 18.4 |
| **Bankfull Width:** | 15.0 |
| **Flood Prone Area Elevation:** | 297.5 |
| **Flood Prone Width:** | 100 |
| **Max Depth at Bankfull:** | 2.9 |
| **Mean Depth at Bankfull:** | 1.2 |
| **W / D Ratio:** | 12.2 |
| **Entrenchment Ratio:** | 6.7 |
| **Bank Height Ratio:** | 0.8 |



| | |
|---|---|
| **River Basin:** | Neuse |
| **Watershed:** | Hatchet's Grove |
| **XS ID** | XS R2 |
| **Drainage Area (sq mi):** | 3.7 |
| **Date:** | 6/28/2007 |
| **Field Crew:** | B. Roberts, Z. Mryncza |

| Station | Elevation |
|---|---|
| 0.0 | 292.82 |
| 0.6 | 293.33 |
| 1.2 | 293.51 |
| 3.0 | 292.50 |
| 5.4 | 292.17 |
| 9.1 | 291.87 |
| 13.2 | 291.66 |
| 16.3 | 291.54 |
| 18.2 | 291.46 |
| 19.7 | 290.36 |
| 20.7 | 289.38 |
| 21.4 | 288.47 |
| 22.4 | 288.20 |
| 24.2 | 287.92 |
| 26.5 | 288.35 |
| 28.0 | 288.43 |
| 31.0 | 288.01 |
| 32.4 | 288.11 |
| 34.0 | 288.44 |
| 34.5 | 288.66 |
| 34.6 | 289.21 |
| 35.1 | 289.59 |
| 35.5 | 291.99 |
| 36.3 | 292.35 |
| 39.3 | 292.50 |
| 43.7 | 292.16 |
| 46.2 | 292.65 |
| 48.4 | 293.37 |
| 48.6 | 293.72 |

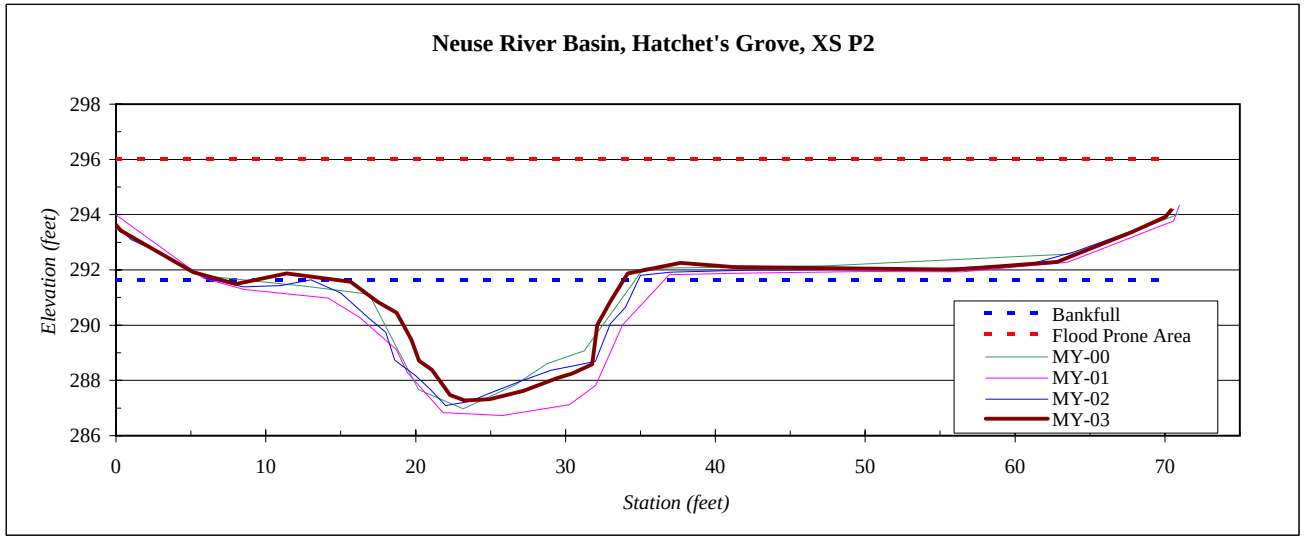
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 291.1 |
| **Bankfull Cross-Sectional Area:** | 42.1 |
| **Bankfull Width:** | 16.6 |
| **Flood Prone Area Elevation:** | 294.3 |
| **Flood Prone Width:** | 60 |
| **Max Depth at Bankfull:** | 3.2 |
| **Mean Depth at Bankfull:** | 2.5 |
| **W / D Ratio:** | 6.5 |
| **Entrenchment Ratio:** | 3.6 |
| **Bank Height Ratio:** | 1.1 |



| | |
|---|---|
| **River Basin:** | Neuse |
| **Watershed:** | Hatchet's Grove |
| **XS ID** | XS P2 |
| **Drainage Area (sq mi):** | 3.7 |
| **Date:** | 6/28/2007 |
| **Field Crew:** | B. Roberts, Z. Mryncza |

| Station | Elevation |
|---|---|
| 0.0 | 293.64 |
| 0.3 | 293.43 |
| 5.1 | 291.91 |
| 8.0 | 291.49 |
| 11.4 | 291.88 |
| 15.7 | 291.57 |
| 17.5 | 290.84 |
| 18.7 | 290.45 |
| 19.7 | 289.47 |
| 20.2 | 288.71 |
| 21.1 | 288.39 |
| 22.3 | 287.47 |
| 23.3 | 287.28 |
| 24.9 | 287.32 |
| 27.2 | 287.63 |
| 29.4 | 288.09 |
| 30.4 | 288.25 |
| 31.8 | 288.58 |
| 32.1 | 290.01 |
| 33.0 | 290.90 |
| 34.1 | 291.87 |
| 37.7 | 292.26 |
| 41.2 | 292.11 |
| 56.0 | 292.01 |
| 59.2 | 292.14 |
| 62.8 | 292.29 |
| 67.8 | 293.37 |
| 70.0 | 293.93 |
| 70.4 | 294.17 |

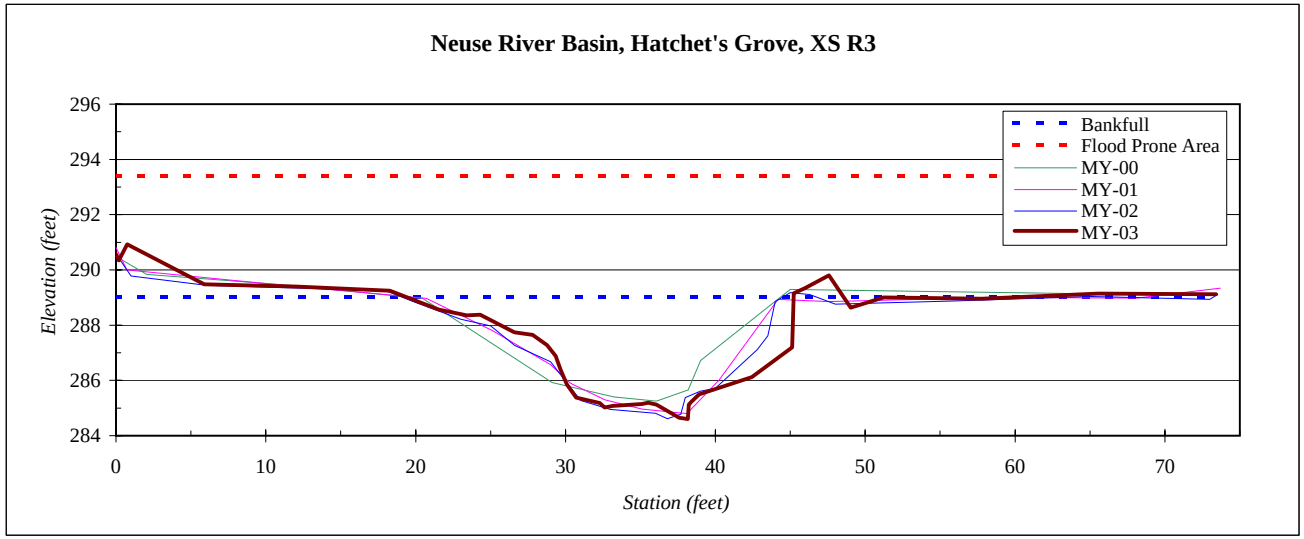
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 291.6 |
| **Bankfull Cross-Sectional Area:** | 50.8 |
| **Bankfull Width:** | 20.0 |
| **Flood Prone Area Elevation:** | 296.0 |
| **Flood Prone Width:** | 80 |
| **Max Depth at Bankfull:** | 4.4 |
| **Mean Depth at Bankfull:** | 2.5 |
| **W / D Ratio:** | 7.9 |
| **Entrenchment Ratio:** | 4.0 |
| **Bank Height Ratio:** | 1.0 |



| | |
|---|---|
| **River Basin:** | Neuse |
| **Watershed:** | Hatchet's Grove |
| **XS ID** | XS R3 |
| **Drainage Area (sq mi):** | 3.7 |
| **Date:** | 6/28/2007 |
| **Field Crew:** | B. Roberts, Z. Mryncza |

| Station | Elevation |
|---|---|
| 0.0 | 290.58 |
| 0.2 | 290.35 |
| 0.8 | 290.92 |
| 5.9 | 289.48 |
| 12.0 | 289.40 |
| 18.3 | 289.25 |
| 21.5 | 288.56 |
| 23.4 | 288.35 |
| 24.3 | 288.37 |
| 26.6 | 287.75 |
| 27.8 | 287.64 |
| 28.8 | 287.28 |
| 29.3 | 286.89 |
| 29.7 | 286.40 |
| 30.1 | 285.85 |
| 30.7 | 285.38 |
| 32.3 | 285.19 |
| 32.6 | 285.02 |
| 33.1 | 285.08 |
| 35.1 | 285.14 |
| 35.5 | 285.19 |
| 36.1 | 285.13 |
| 37.6 | 284.65 |
| 38.2 | 284.60 |
| 38.2 | 285.12 |
| 38.4 | 285.20 |
| 38.9 | 285.49 |
| 42.4 | 286.13 |
| 45.1 | 287.19 |
| 45.2 | 289.15 |
| 46.0 | 289.34 |
| 47.6 | 289.80 |
| 49.0 | 288.64 |
| 73.3 | 289.12 |
| 73.4 | 289.12 |

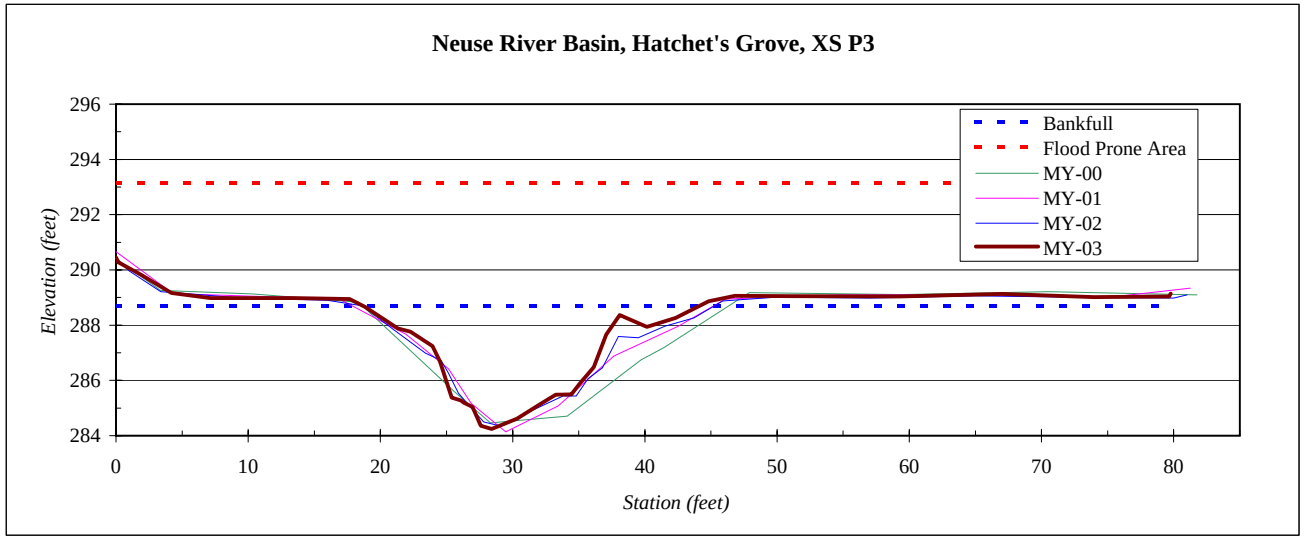
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 289.0 |
| **Bankfull Cross-Sectional Area:** | 62.2 |
| **Bankfull Width:** | 25.8 |
| **Flood Prone Area Elevation:** | 293.4 |
| **Flood Prone Width:** | 100 |
| **Max Depth at Bankfull:** | 4.4 |
| **Mean Depth at Bankfull:** | 2.4 |
| **W / D Ratio:** | 10.7 |
| **Entrenchment Ratio:** | 3.9 |
| **Bank Height Ratio:** | 1.0 |



| | |
|---|---|
| **River Basin:** | Neuse |
| **Watershed:** | Hatchet's Grove |
| **XS ID** | XS P3 |
| **Drainage Area (sq mi):** | 3.7 |
| **Date:** | 6/28/2007 |
| **Field Crew:** | B. Roberts, Z. Mryncza |

| Station | Elevation |
|---|---|
| 0.0 | 290.45 |
| 0.2 | 290.28 |
| 1.9 | 289.82 |
| 4.2 | 289.17 |
| 7.1 | 288.98 |
| 13.5 | 288.98 |
| 17.7 | 288.95 |
| 18.8 | 288.66 |
| 21.3 | 287.88 |
| 22.3 | 287.76 |
| 23.9 | 287.25 |
| 24.5 | 286.70 |
| 25.4 | 285.37 |
| 26.1 | 285.28 |
| 26.3 | 285.19 |
| 27.0 | 285.05 |
| 27.6 | 284.36 |
| 28.4 | 284.24 |
| 30.3 | 284.61 |
| 32.1 | 285.16 |
| 33.2 | 285.48 |
| 34.4 | 285.49 |
| 35.1 | 285.91 |
| 36.1 | 286.48 |
| 37.1 | 287.66 |
| 38.1 | 288.36 |
| 40.2 | 287.94 |
| 42.3 | 288.27 |
| 44.8 | 288.86 |
| 46.8 | 289.06 |
| 51.2 | 289.05 |
| 74.0 | 289.01 |
| 79.7 | 289.04 |
| 79.8 | 289.14 |

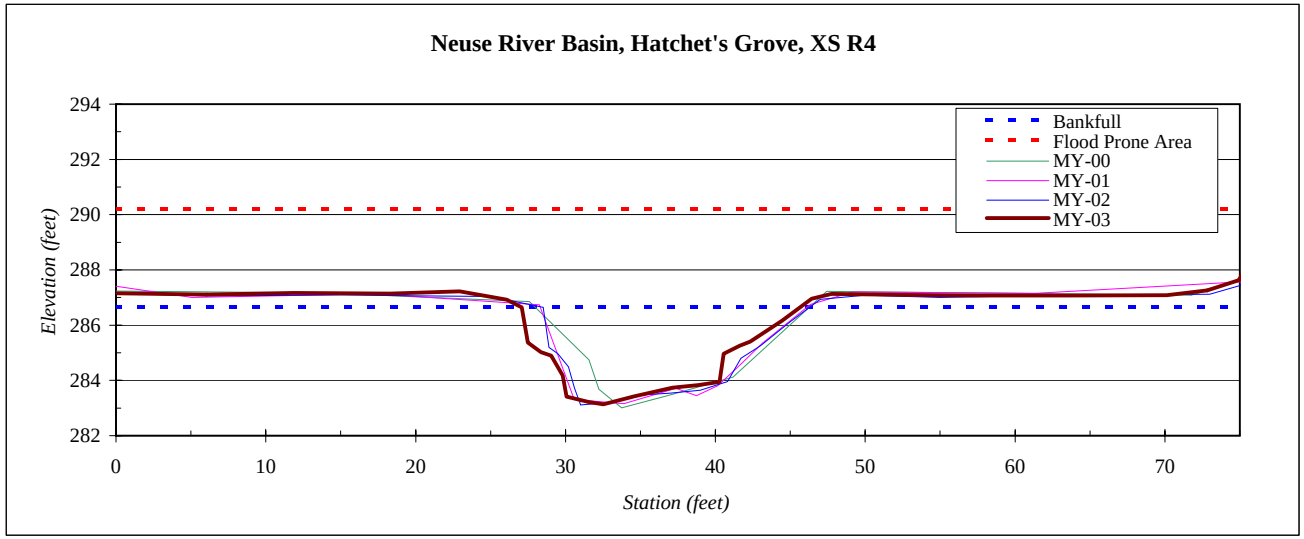
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 288.7 |
| **Bankfull Cross-Sectional Area:** | 51.1 |
| **Bankfull Width:** | 25.5 |
| **Flood Prone Area Elevation:** | 293.2 |
| **Flood Prone Width:** | 110 |
| **Max Depth at Bankfull:** | 4.5 |
| **Mean Depth at Bankfull:** | 2.0 |
| **W / D Ratio:** | 12.7 |
| **Entrenchment Ratio:** | 4.3 |
| **Bank Height Ratio:** | 1.0 |



| | |
|---|---|
| **River Basin:** | Neuse |
| **Watershed:** | Hatchet's Grove |
| **XS ID** | XS R4 |
| **Drainage Area (sq mi):** | 3.7 |
| **Date:** | 6/28/2007 |
| **Field Crew:** | B. Roberts, Z. Mryncza |

| Station | Elevation |
|---|---|
| 0.0 | 287.17 |
| 1.0 | 287.14 |
| 6.0 | 287.06 |
| 10.0 | 287.08 |
| 15.0 | 287.10 |
| 20.0 | 287.06 |
| 25.0 | 287.04 |
| 28.5 | 286.65 |
| 28.9 | 285.19 |
| 29.5 | 284.97 |
| 30.2 | 284.49 |
| 30.6 | 283.71 |
| 31.0 | 283.12 |
| 32.0 | 283.16 |
| 33.0 | 283.20 |
| 35.0 | 283.47 |
| 37.0 | 283.55 |
| 39.0 | 283.64 |
| 40.8 | 283.96 |
| 41.7 | 284.80 |
| 43.0 | 285.26 |
| 45.0 | 286.12 |
| 47.0 | 286.93 |
| 50.0 | 287.09 |
| 55.0 | 287.01 |
| 63.0 | 287.08 |
| 73.0 | 287.12 |
| 75.0 | 287.44 |
| 76.0 | 287.82 |

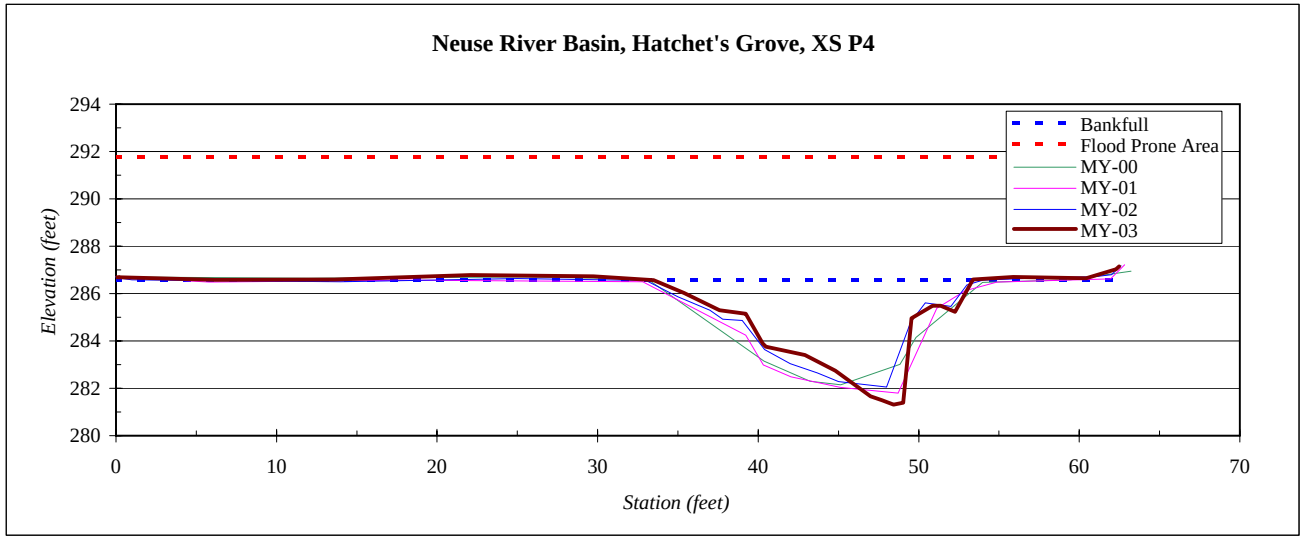
| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 286.7 |
| **Bankfull Cross-Sectional Area:** | 43.3 |
| **Bankfull Width:** | 18.9 |
| **Flood Prone Area Elevation:** | 290.2 |
| **Flood Prone Width:** | 95 |
| **Max Depth at Bankfull:** | 3.5 |
| **Mean Depth at Bankfull:** | 2.3 |
| **W / D Ratio:** | 8.2 |
| **Entrenchment Ratio:** | 5.0 |
| **Bank Height Ratio:** | 1.1 |



| | |
|---|---|
| **River Basin:** | Neuse |
| **Watershed:** | Hatchet's Grove |
| **XS ID** | XS P4 |
| **Drainage Area (sq mi):** | 3.7 |
| **Date:** | 6/28/2007 |
| **Field Crew:** | B. Roberts, Z. Mryncza |

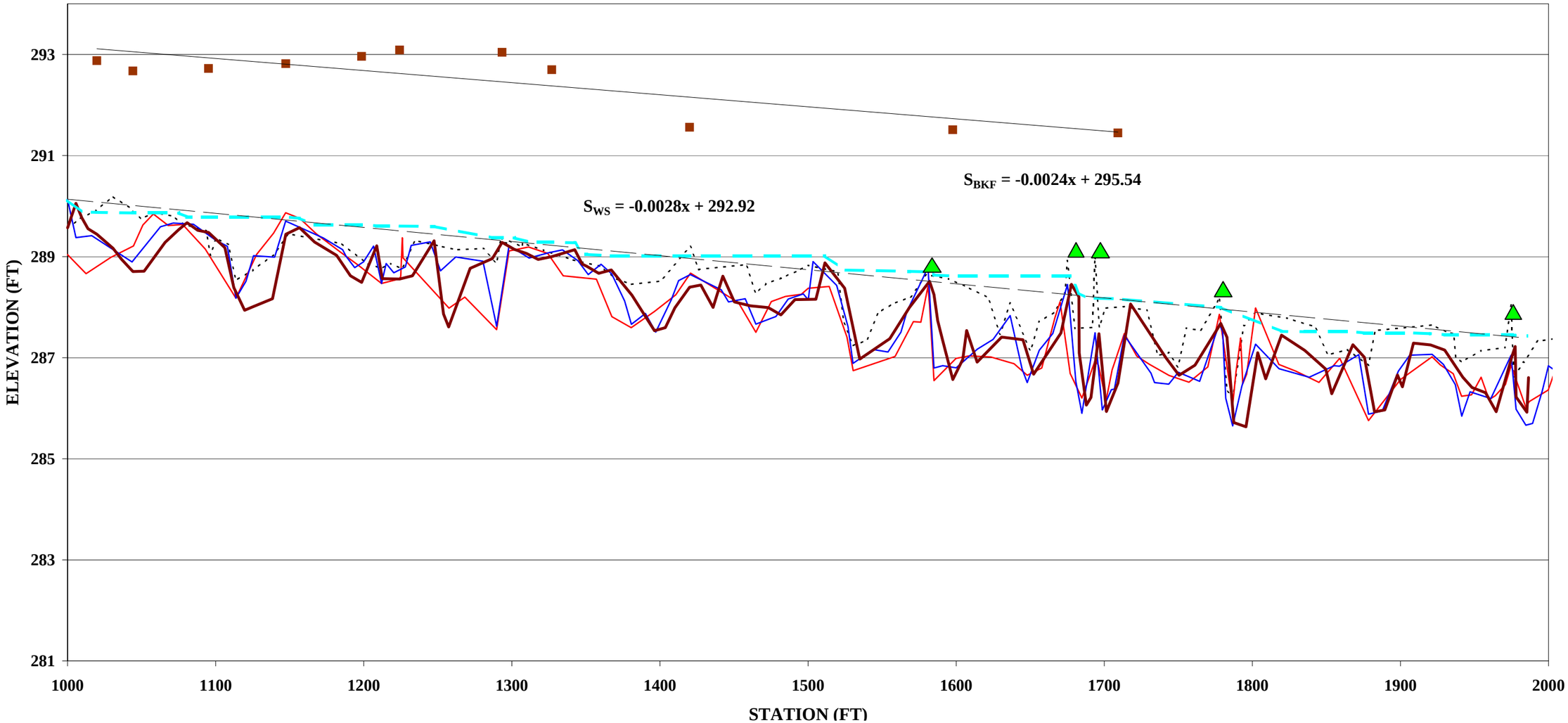
| Station | Elevation |
|---|---|
| 0.0 | 286.69 |
| 0.2 | 286.69 |
| 6.2 | 286.58 |
| 13.6 | 286.60 |
| 22.1 | 286.78 |
| 29.7 | 286.72 |
| 33.5 | 286.57 |
| 35.4 | 286.03 |
| 37.6 | 285.29 |
| 39.2 | 285.15 |
| 40.3 | 283.89 |
| 40.5 | 283.76 |
| 42.9 | 283.40 |
| 44.8 | 282.74 |
| 47.0 | 281.66 |
| 47.7 | 281.50 |
| 48.4 | 281.32 |
| 49.0 | 281.39 |
| 49.5 | 284.96 |
| 50.9 | 285.49 |
| 51.4 | 285.48 |
| 52.3 | 285.23 |
| 53.4 | 286.59 |
| 55.9 | 286.70 |
| 60.4 | 286.65 |
| 62.3 | 287.02 |
| 62.5 | 287.15 |

| SUMMARY DATA | |
|---|---|
| **Bankfull Elevation:** | 286.6 |
| **Bankfull Cross-Sectional Area:** | 47.8 |
| **Bankfull Width:** | 19.9 |
| **Flood Prone Area Elevation:** | 291.8 |
| **Flood Prone Width:** | 95 |
| **Max Depth at Bankfull:** | 5.2 |
| **Mean Depth at Bankfull:** | 2.4 |
| **W / D Ratio:** | 8.3 |
| **Entrenchment Ratio:** | 4.8 |
| **Bank Height Ratio:** | 1.0 |

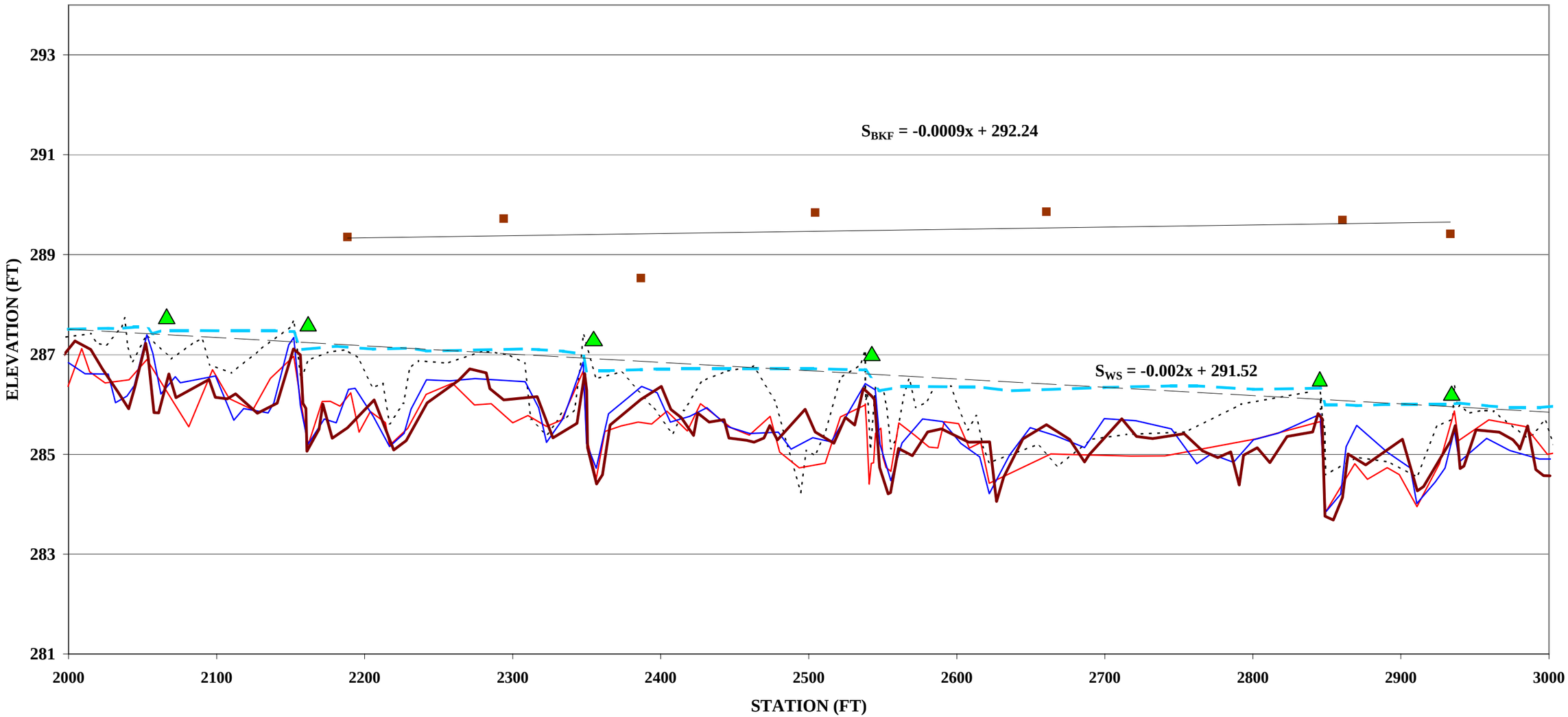


# B5 - Longitudinal Plots

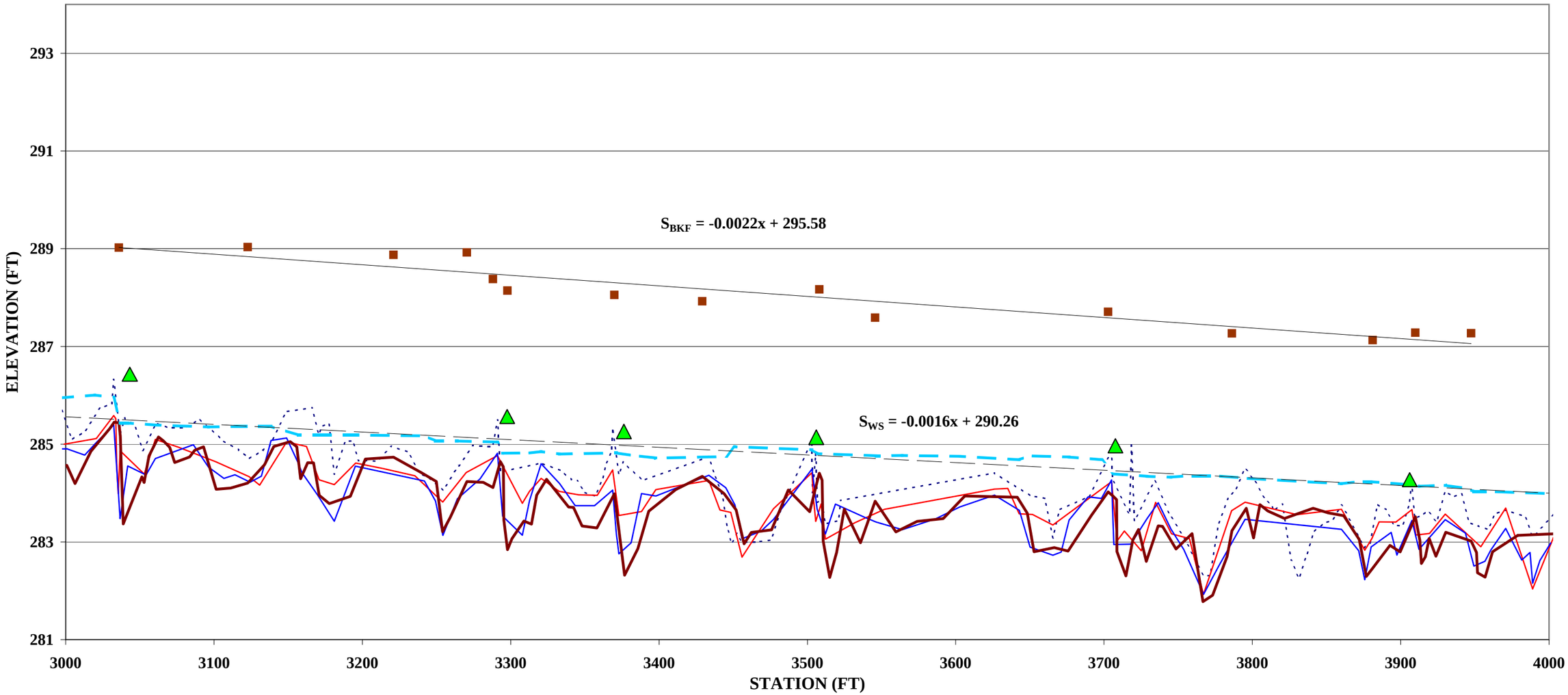
## Longitudinal Profile
## Prestonwood Golf Course - Hatchet's Grove
## EEP Project Number 289 - MY03
## Stations 10+00-20+00



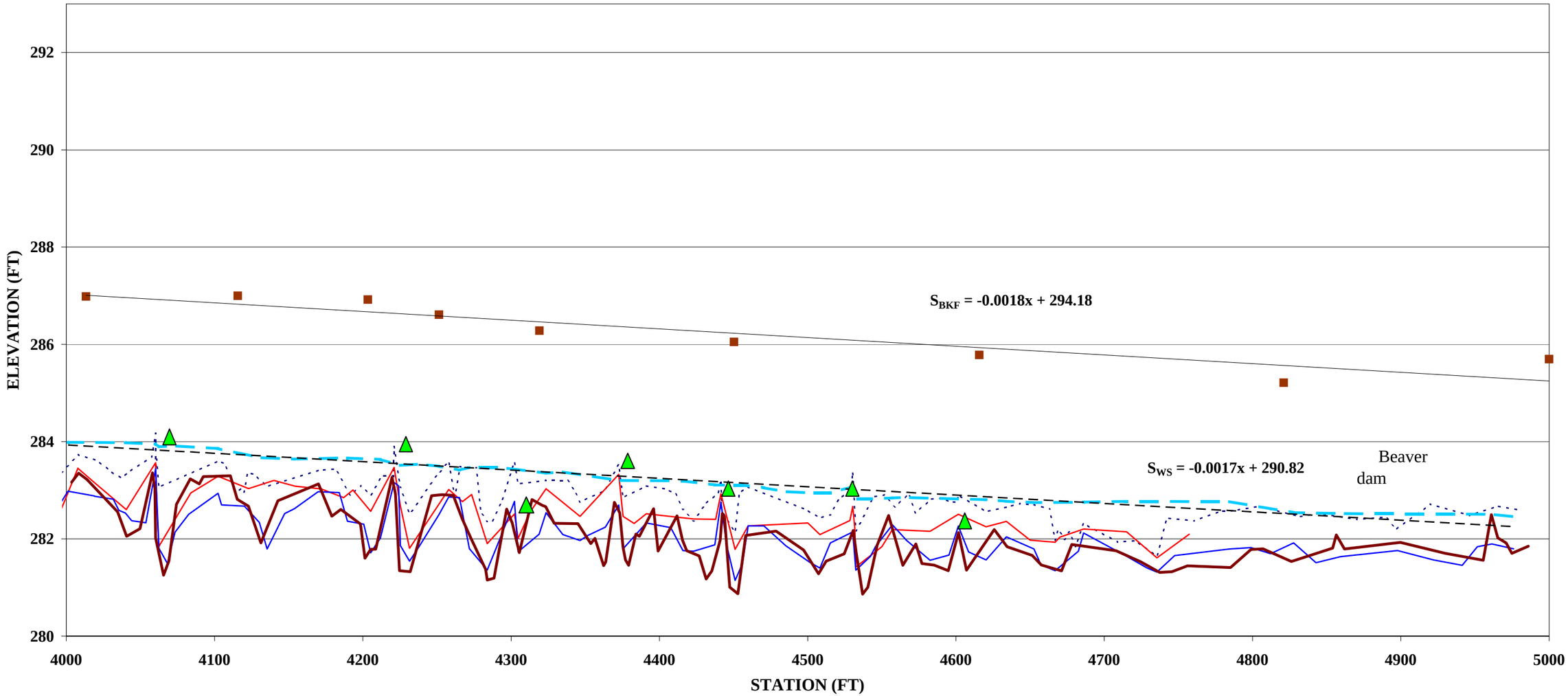
# Longitudinal Profile
# Prestonwood Golf Course - Hatchet's Grove
# EEP Project Number 289 - MY03
# Stations 20+00-30+00



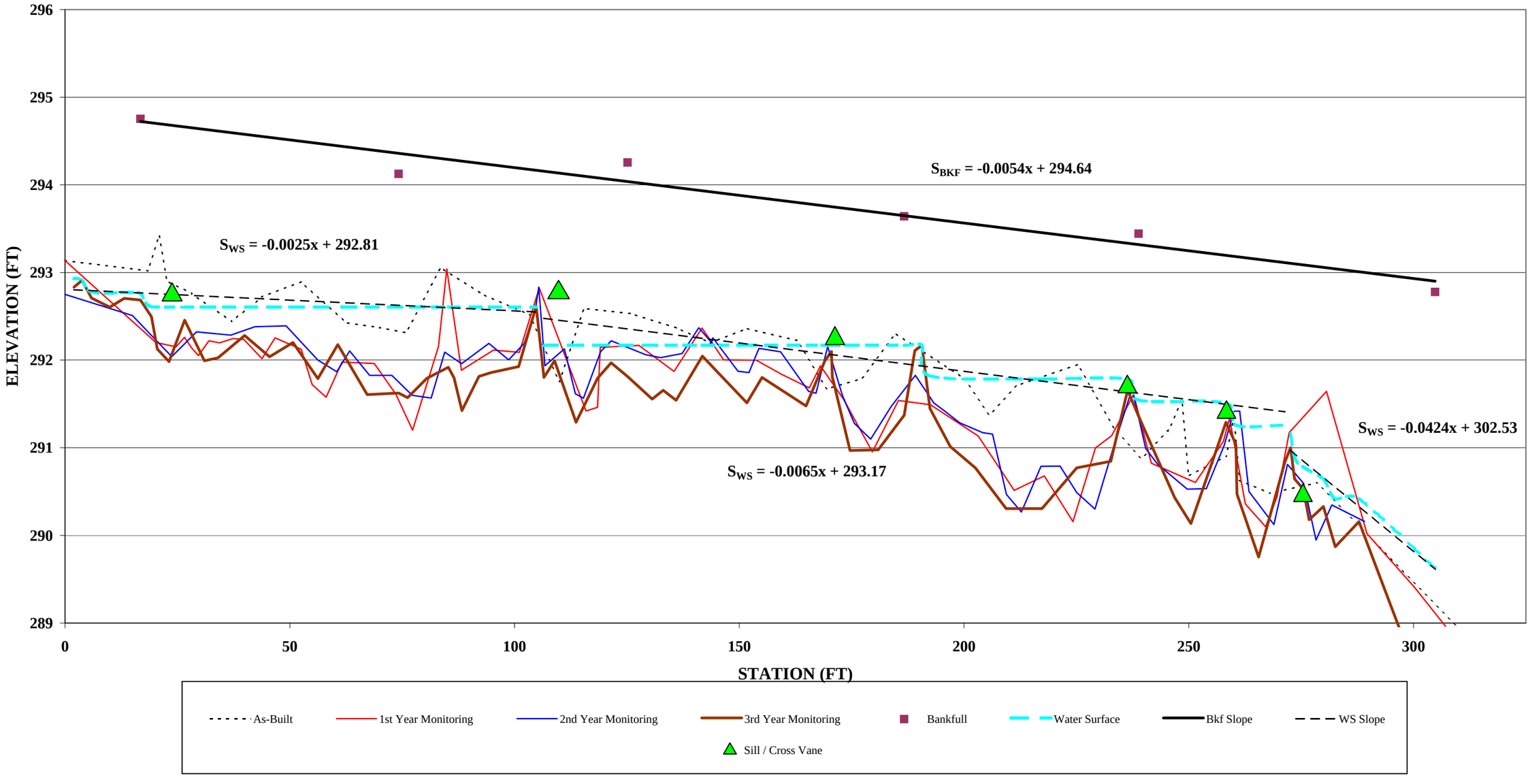
# Longitudinal Profile
# Prestonwood Golf Course - Hatchet's Grove
# EEP Project Number 289 - MY03
# Stations 30+00-40+00



# Longitudinal Profile
# Prestonwood Golf Course - Hatchet's Grove
# EEP Project Number 289 - MY03
# Stations 40+00-50+00



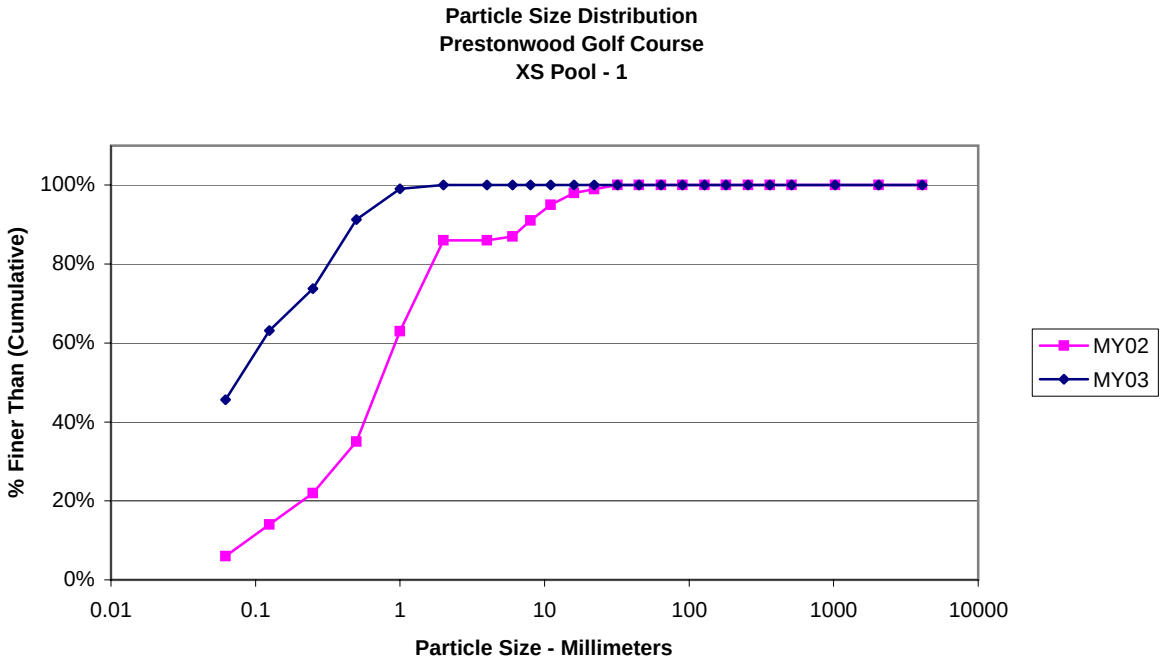
# Longitudinal Profile
# Prestonwood Golf Course - Meadow Creek
# EEP Project Number 289 - MY03
# Stations 00+00 - 03+00



# B6 - Pebble Count Plots

| Cross Section Pool 1 - MY03 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | 47 |
| Very Fine | .062 - .125 | S | 18 |
| Fine | .125 - .25 | A | 11 |
| Medium | .25 - .50 | N | 18 |
| Coarse | .50 - 1 | D | 8 |
| Very Coarse | 1 - 2 | S | 1 |
| 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:



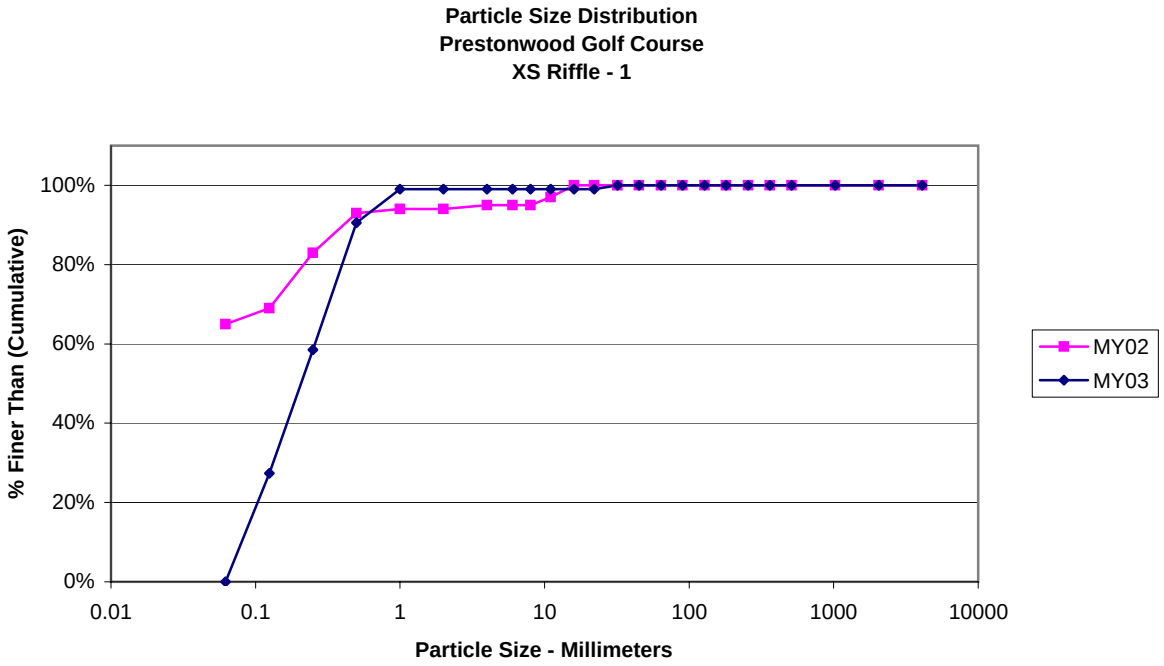

| Size (mm) | |
|---|---|
| D16 | 0.062 |
| D35 | 0.062 |
| D50 | 0.074 |
| D65 | 0.14 |
| D84 | 0.37 |
| D95 | 0.7 |

| Size Distribution | |
|---|---|
| mean | 0.2 |
| dispersion | 3.1 |
| skewness | 0.35 |

| Type | |
|---|---|
| silt/clay | 46% |
| sand | 54% |
| gravel | 0% |
| cobble | 0% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

| Cross Section Riffle 1 - MY03 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | |
| Very Fine | .062 - .125 | S | 29 |
| Fine | .125 - .25 | A | 33 |
| Medium | .25 - .50 | N | 34 |
| Coarse | .50 - 1 | D | 9 |
| 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 | 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** | 106 |

Note:



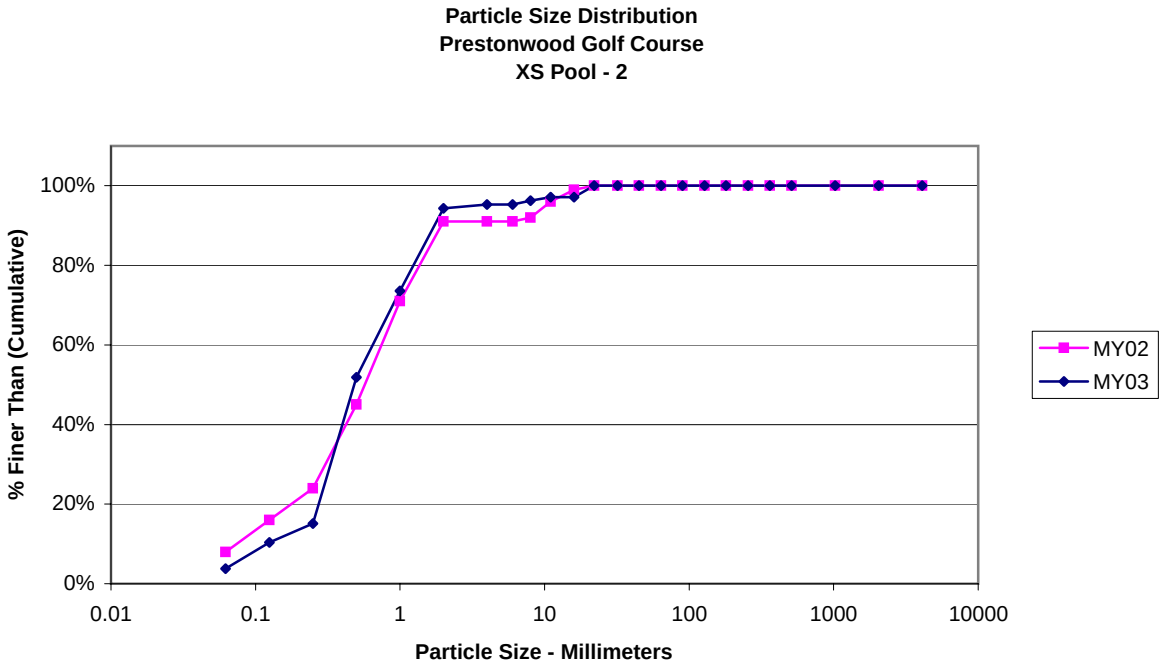

| Size (mm) | |
|---|---|
| D16 | 0.093 |
| D35 | 0.15 |
| D50 | 0.21 |
| D65 | 0.29 |
| D84 | 0.43 |
| D95 | 0.72 |

| Size Distribution | |
|---|---|
| mean | 0.2 |
| dispersion | 2.2 |
| skewness | -0.03 |

| Type | |
|---|---|
| silt/clay | 0% |
| sand | 99% |
| gravel | 1% |
| cobble | 0% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

| Cross Section Pool 2 - MY03 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | 4 |
| Very Fine | .062 - .125 | S | 7 |
| Fine | .125 - .25 | A | 5 |
| Medium | .25 - .50 | N | 39 |
| Coarse | .50 - 1 | D | 23 |
| Very Coarse | 1 - 2 | S | 22 |
| Very Fine | 2 - 4 | | 1 |
| Fine | 4 - 5.7 | G | |
| Fine | 5.7 - 8 | R | 1 |
| Medium | 8 - 11.3 | A | 1 |
| Medium | 11.3 - 16 | V | |
| Coarse | 16 - 22.6 | E | 3 |
| 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** | 106 |

Note:



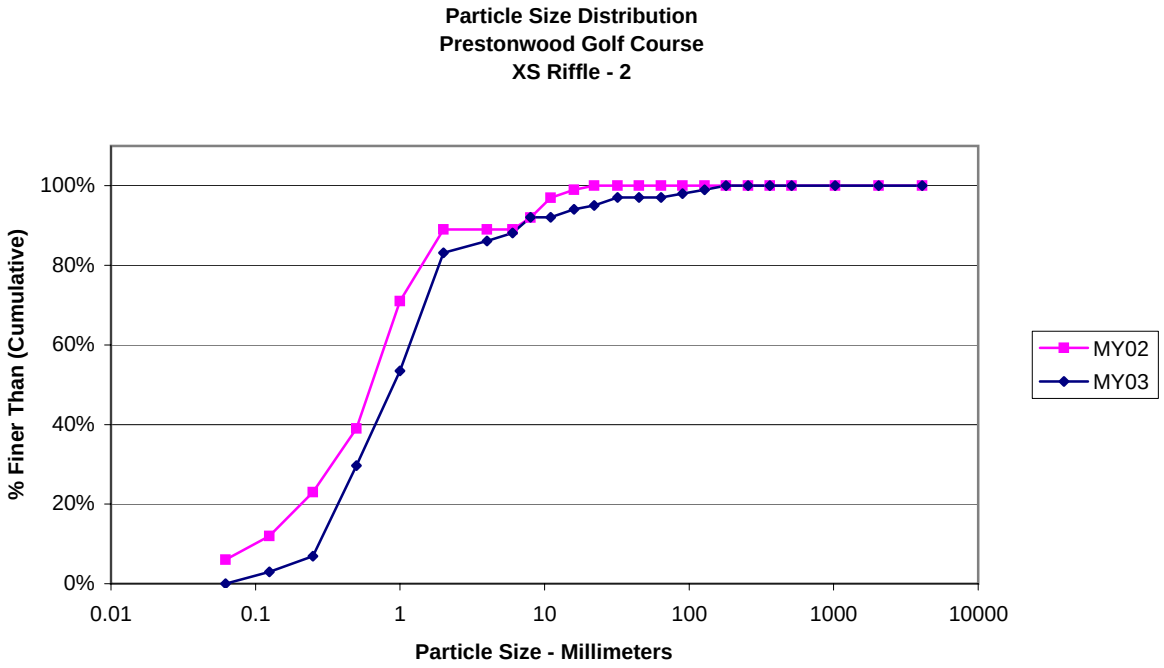

| Size (mm) | |
|---|---|
| D16 | 0.25 |
| D35 | 0.36 |
| D50 | 0.48 |
| D65 | 0.76 |
| D84 | 1.4 |
| D95 | 3.2 |

| Size Distribution | |
|---|---|
| mean | 0.6 |
| dispersion | 2.4 |
| skewness | 0.10 |

| Type | |
|---|---|
| silt/clay | 4% |
| sand | 91% |
| gravel | 6% |
| cobble | 0% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

| Cross Section Riffle 2 - MY03 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | |
| Very Fine | .062 - .125 | S | 3 |
| Fine | .125 - .25 | A | 4 |
| Medium | .25 - .50 | N | 23 |
| Coarse | .50 - 1 | D | 24 |
| Very Coarse | 1 - 2 | S | 30 |
| Very Fine | 2 - 4 | | 3 |
| Fine | 4 - 5.7 | G | 2 |
| Fine | 5.7 - 8 | R | 4 |
| Medium | 8 - 11.3 | A | |
| Medium | 11.3 - 16 | V | 2 |
| Coarse | 16 - 22.6 | E | 1 |
| Coarse | 22.6 - 32 | L | 2 |
| Very Coarse | 32 - 45 | S | |
| Very Coarse | 45 - 64 | | |
| Small | 64 - 90 | C | 1 |
| Small | 90 - 128 | O | 1 |
| Large | 128 - 180 | B | 1 |
| 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:



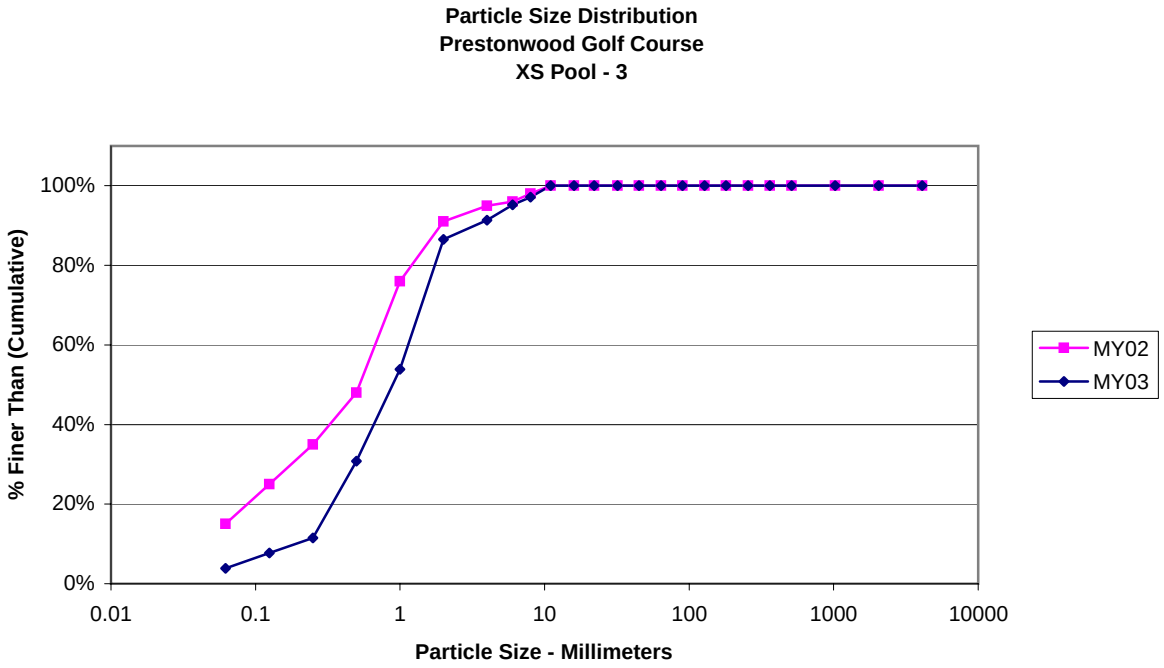

| Size (mm) | |
|---|---|
| D16 | 0.33 |
| D35 | 0.58 |
| D50 | 0.9 |
| D65 | 1.3 |
| D84 | 2.4 |
| D95 | 22 |

| Size Distribution | |
|---|---|
| mean | 0.9 |
| dispersion | 2.7 |
| skewness | -0.01 |

| Type | |
|---|---|
| silt/clay | 0% |
| sand | 83% |
| gravel | 14% |
| cobble | 3% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

| Cross Section Pool 3 - MY03 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | 4 |
| Very Fine | .062 - .125 | S | 4 |
| Fine | .125 - .25 | A | 4 |
| Medium | .25 - .50 | N | 20 |
| Coarse | .50 - 1 | D | 24 |
| Very Coarse | 1 - 2 | S | 34 |
| Very Fine | 2 - 4 | | 5 |
| Fine | 4 - 5.7 | G | 4 |
| Fine | 5.7 - 8 | R | 2 |
| Medium | 8 - 11.3 | A | 3 |
| 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** | 104 |

Note:



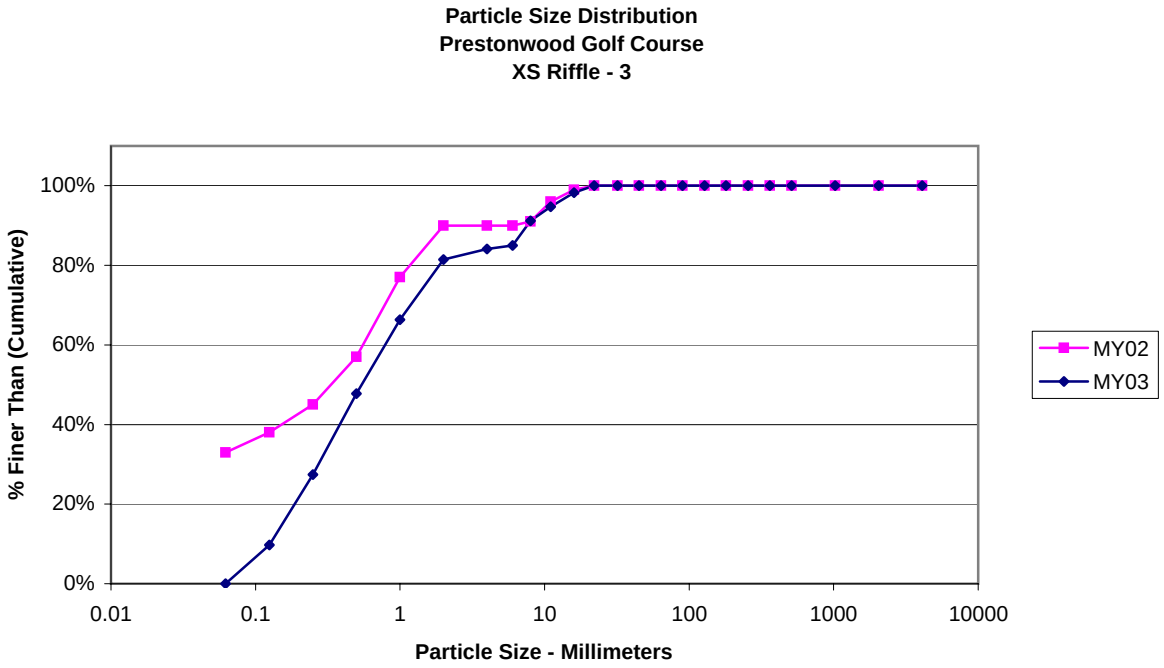

| Size (mm) | |
|---|---|
| D16 | 0.29 |
| D35 | 0.57 |
| D50 | 0.89 |
| D65 | 1.3 |
| D84 | 1.9 |
| D95 | 5.9 |

| Size Distribution | |
|---|---|
| mean | 0.7 |
| dispersion | 2.6 |
| skewness | -0.09 |

| Type | |
|---|---|
| silt/clay | 4% |
| sand | 83% |
| gravel | 13% |
| cobble | 0% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

| Cross Section Riffle 3 - MY03 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | |
| Very Fine | .062 - .125 | S | 11 |
| Fine | .125 - .25 | A | 20 |
| Medium | .25 - .50 | N | 23 |
| Coarse | .50 - 1 | D | 21 |
| Very Coarse | 1 - 2 | S | 17 |
| Very Fine | 2 - 4 | | 3 |
| Fine | 4 - 5.7 | G | 1 |
| Fine | 5.7 - 8 | R | 7 |
| Medium | 8 - 11.3 | A | 4 |
| Medium | 11.3 - 16 | V | 4 |
| Coarse | 16 - 22.6 | E | 2 |
| 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** | 113 |

Note:



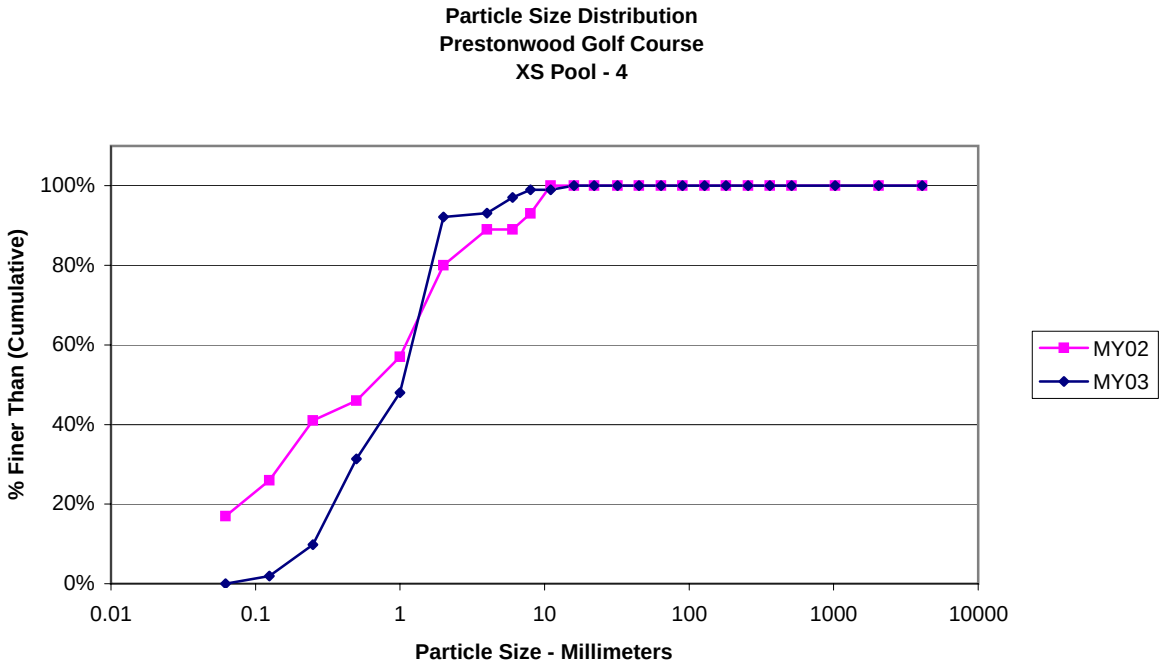

| Size (mm) | |
|---|---|
| D16 | 0.16 |
| D35 | 0.32 |
| D50 | 0.54 |
| D65 | 0.95 |
| D84 | 3.9 |
| D95 | 11 |

| Size Distribution | |
|---|---|
| mean | 0.8 |
| dispersion | 5.3 |
| skewness | 0.14 |

| Type | |
|---|---|
| silt/clay | 0% |
| sand | 81% |
| gravel | 19% |
| cobble | 0% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

| Cross Section Pool 4 - MY03 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | |
| Very Fine | .062 - .125 | S | 2 |
| Fine | .125 - .25 | A | 8 |
| Medium | .25 - .50 | N | 22 |
| Coarse | .50 - 1 | D | 17 |
| Very Coarse | 1 - 2 | S | 45 |
| Very Fine | 2 - 4 | | 1 |
| Fine | 4 - 5.7 | G | 4 |
| Fine | 5.7 - 8 | R | 2 |
| Medium | 8 - 11.3 | A | |
| Medium | 11.3 - 16 | V | 1 |
| 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** | 102 |

Note:



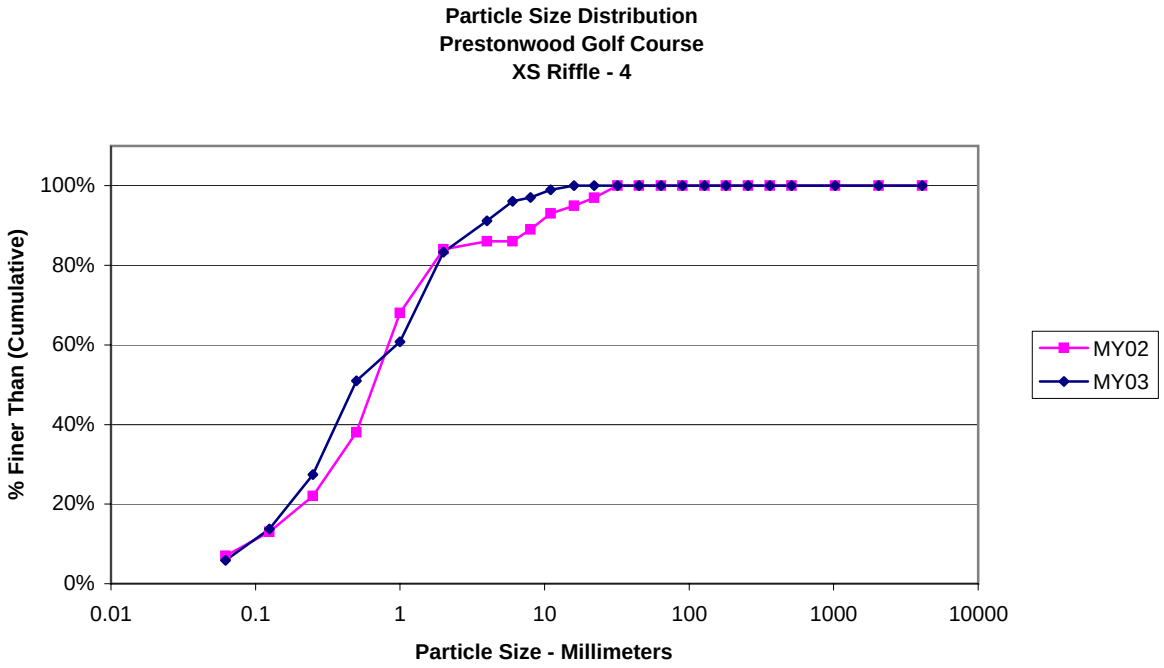

| Size (mm) | |
|---|---|
| D16 | 0.31 |
| D35 | 0.58 |
| D50 | 1 |
| D65 | 1.3 |
| D84 | 1.8 |
| D95 | 4.8 |

| Size Distribution | |
|---|---|
| mean | 0.7 |
| dispersion | 2.5 |
| skewness | -0.14 |

| Type | |
|---|---|
| silt/clay | 0% |
| sand | 92% |
| gravel | 8% |
| cobble | 0% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

| Cross Section Riffle 4 | | | |
|---|---|---|---|
| Particle | Millimeter | | Count |
| Silt/Clay | < 0.062 | S/C | 6 |
| Very Fine | .062 - .125 | S | 8 |
| Fine | .125 - .25 | A | 14 |
| Medium | .25 - .50 | N | 24 |
| Coarse | .50 - 1 | D | 10 |
| Very Coarse | 1 - 2 | S | 23 |
| Very Fine | 2 - 4 | | 8 |
| Fine | 4 - 5.7 | G | 5 |
| Fine | 5.7 - 8 | R | 1 |
| Medium | 8 - 11.3 | A | 2 |
| Medium | 11.3 - 16 | V | 1 |
| 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** | 102 |

Note:

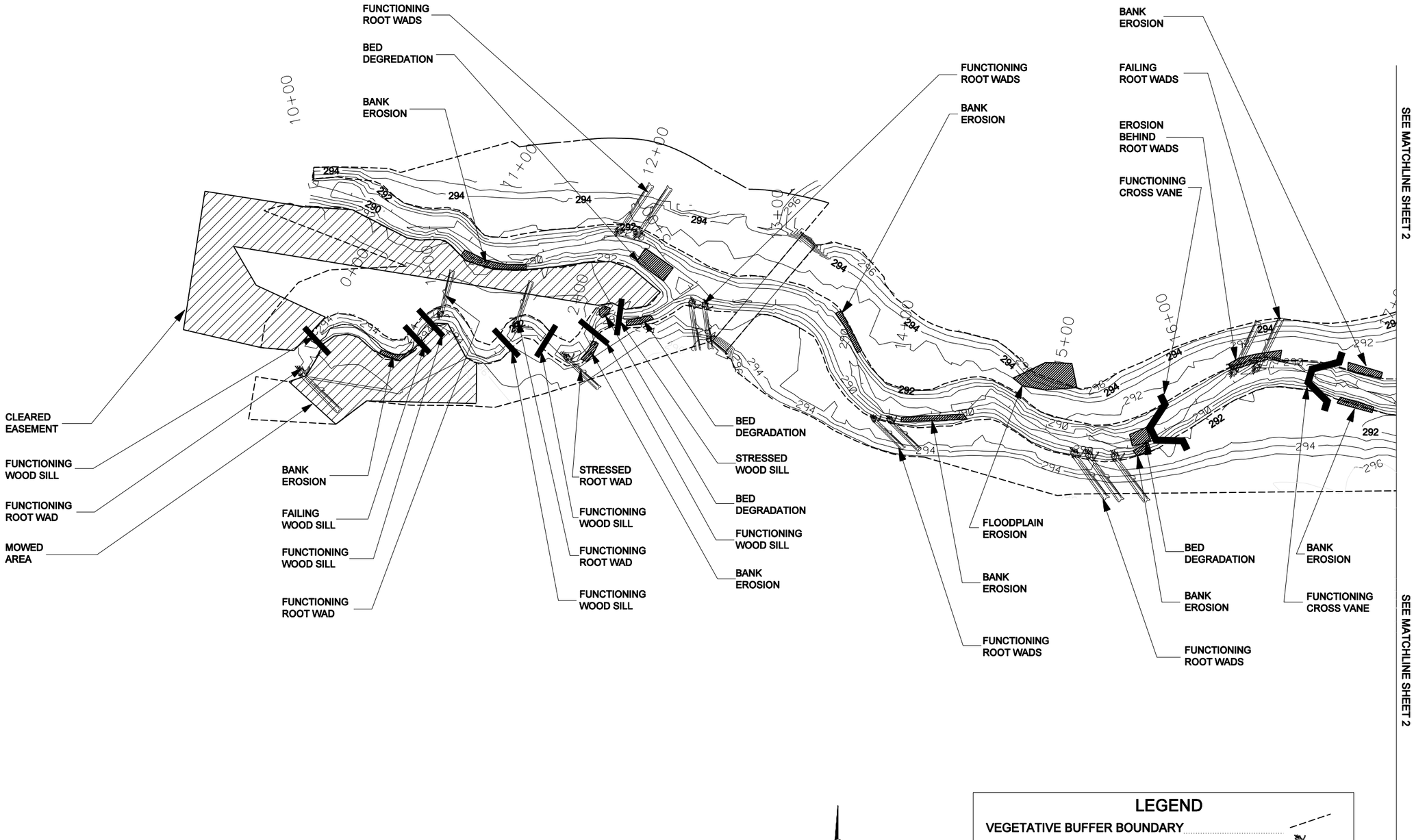



| Size (mm) | |
|---|---|
| D16 | 0.14 |
| D35 | 0.31 |
| D50 | 0.49 |
| D65 | 1.1 |
| D84 | 2.1 |
| D95 | 5.5 |

| Size Distribution | |
|---|---|
| mean | 0.5 |
| dispersion | 3.9 |
| skewness | 0.04 |

| Type | |
|---|---|
| silt/clay | 6% |
| sand | 77% |
| gravel | 17% |
| cobble | 0% |
| boulder | 0% |
| bedrock | 0% |
| hardpan | 0% |
| wood/det | 0% |
| artificial | 0% |

# Appendix C
# Current Conditions Plan View




–60 –30 0 30 60

GRAPHIC SCALE

## LEGEND

VEGETATIVE BUFFER BOUNDARY

ROOT WAD

CHANNEL SILL

ROCK CROSS VANE

ROCK J-HOOK

| NO. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | REVISIONS | | |

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

PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

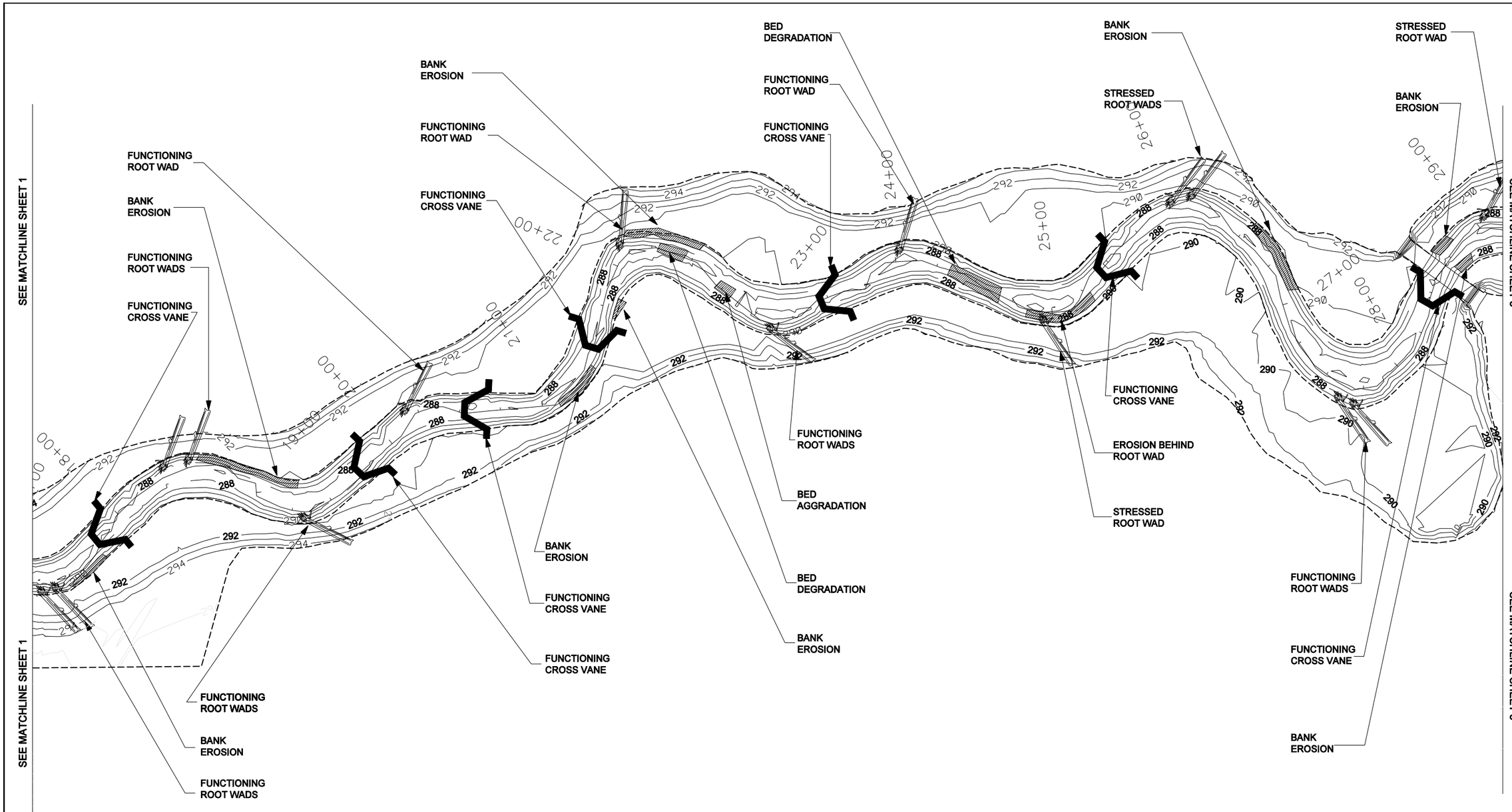
STATION 10+00 TO STATION 17+26

DATE: NOVEMBER 2007

SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW

SHEET 1 OF 4




–60 –30 0 30 60

GRAPHIC SCALE

## LEGEND

- VEGETATIVE BUFFER BOUNDARY
- ROOT WAD
- CHANNEL SILL
- ROCK CROSS VANE
- ROCK J-HOOK

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | REVISIONS | | |

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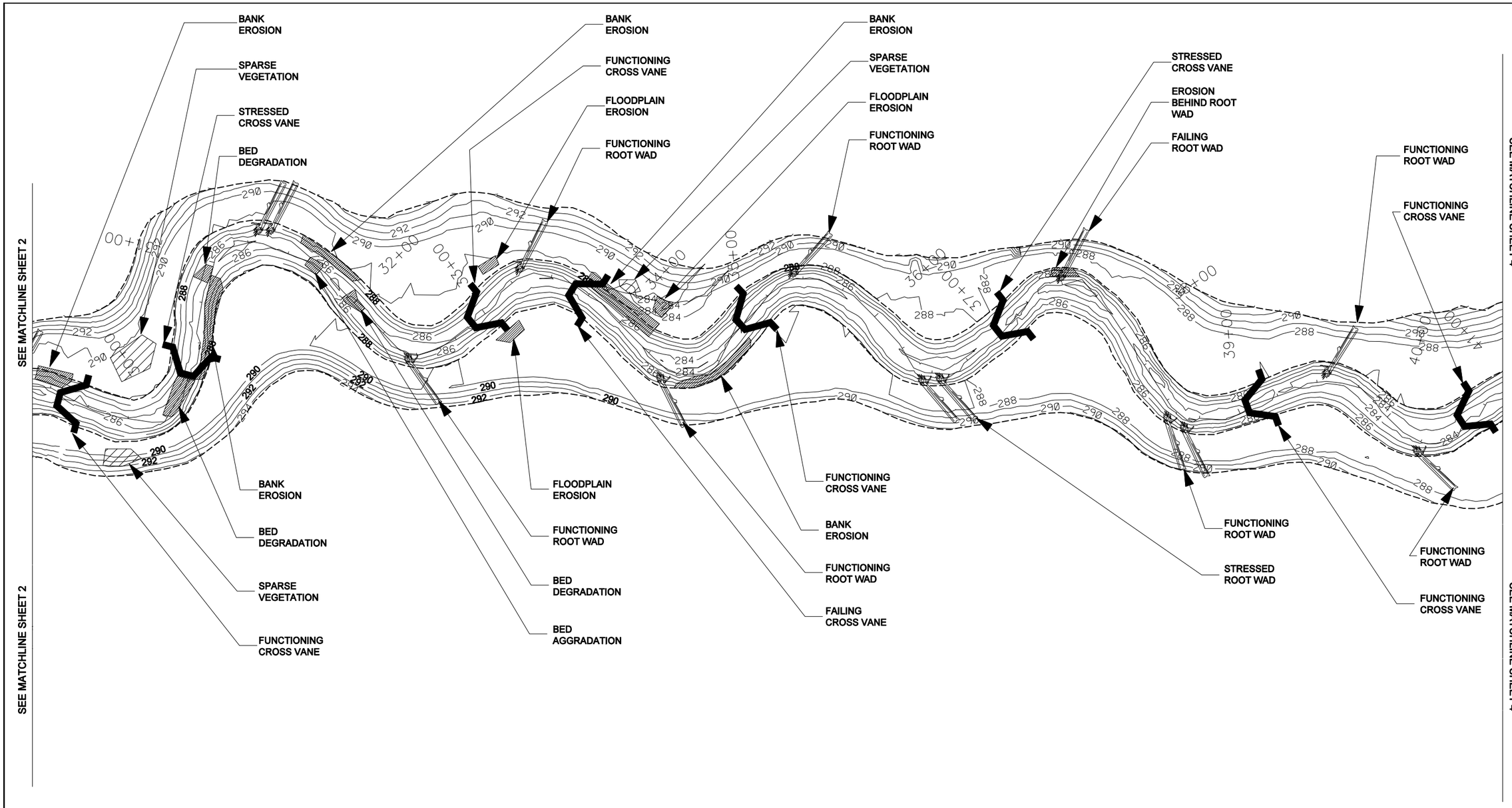
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

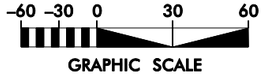
PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

STATION 17+26 TO STATION 29+14

DATE: NOVEMBER 2007
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW




## LEGEND

- VEGETATIVE BUFFER BOUNDARY
- ROOT WAD
- CHANNEL SILL
- ROCK CROSS VANE
- ROCK J-HOOK

| REVISIONS | | | |
|---|---|---|---|
| SYM. | DESCRIPTION | DATE | APPROVED |

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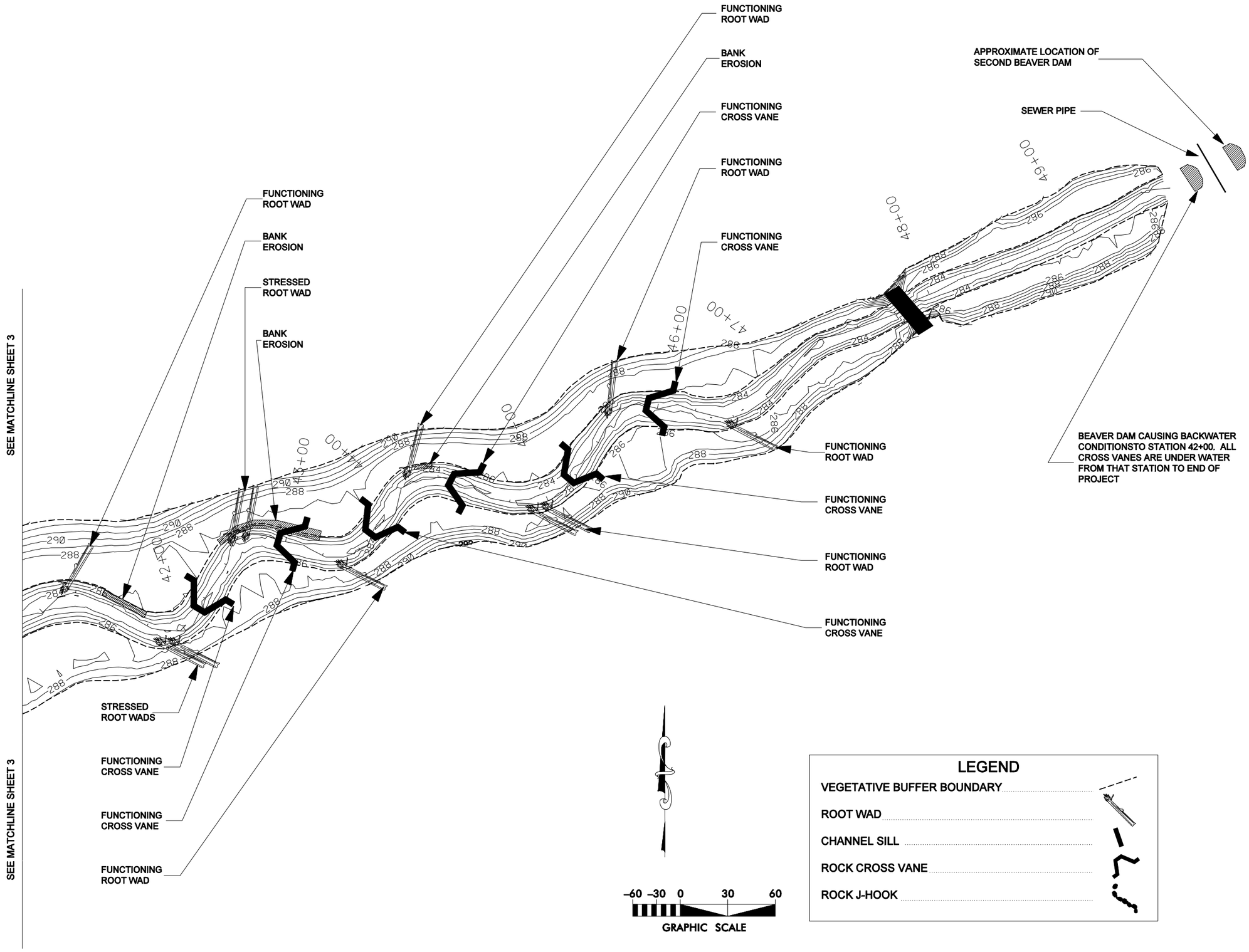
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

STATION 29+15 TO STATION 40+85

DATE: NOVEMBER 2007
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW




| STA. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|

REVISIONS

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RALEIGH, NORTH CAROLINA 27609

PRESTONWOOD GOLF COURSE
WAKE COUNTY
EEP PROJECT NUMBER 289 - MY03

STATION40+86 TO STATION 49+65

DATE: NOVEMBER 2007
SCALE: SEE SHEET

CURRENT CONDITIONS PLAN VIEW

SHEET 4 OF 4