# ELLINGTON BRANCH STREAM RESTORATION SITE
# FULL DELIVERY PROJECT
# WARREN COUNTY, NORTH CAROLINA

## EEP Project No. 16-D06045

## FINAL Monitoring Report #1 (Year 2008)

**Prepared for:**


**NC Department of Environment and Natural Resources**
**Ecosystem Enhancement Program**
**2728 Capital Boulevard, Suite 1H 103**
**Raleigh, NC 27604**

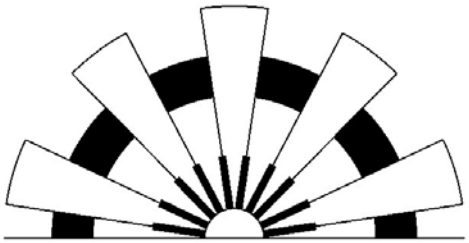

**December 11, 2008**

Prepared by:

Ecological Engineering LLP.

128 Raleigh Street
Holly Springs, NC 27540

Under Contract With:



Sungate Design Group, P.A.
**915 Jones Franklin Road**
**Raleigh, NC 27606**

**Contact Information:**

**G. Lane Sauls Jr. – Principal**

**(919) 557-0929**

**lanesauls@ecologicalengineering.net**

# SECTION III. TABLE OF CONTENTS

## FIGURES



## APPENDIX A VEGETATION RAW DATA



## APPENDIX B. GEOMORPHIC RAW DATA

# SECTION IV. EXECUTIVE SUMMARY

Sungate Design Group, PA (Sungate) entered into a design/build (full delivery) contract with the NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP) on June 21, 2006 to provide 5,000 Stream Mitigation Units (SMUs) in the Roanoke River Basin. The Ellington Branch Stream Restoration Site, hereinafter referred to as the "Project Site," was selected to meet these overall obligations (Figure 1). Ecological Engineering, LLP (Ecological Engineering) is under contract with Sungate to perform the remaining monitoring requirements.

The Project Site is situated in Warren County, North Carolina and includes a portion of Ellington Branch and one of its unnamed tributaries. Ellington Branch is a second order, perennial stream originating approximately one-half mile upstream (south) of the project area. The unnamed tributary (UT) is a first order, perennial stream that unites with Ellington Branch from the west. The project was identified by Sungate in 2005 and selected for full delivery restoration by EEP based its location, attributes, existing condition and overall likelihood for success.

**Vegetation Monitoring**

Vegetation monitoring for Year 1 was performed based on the Carolina Vegetation Survey (CVS) Levels 1 and 2 (Lee et.al., 2006). CVS methodology determines density and survival of planted species, and individuals resulting from natural regeneration. Thirteen individual plot locations were established during the as-built surveys and will remain consistent throughout the monitoring period. Each plot covers $100m^2$ and is shaped in the form of a 10m x 10m square. Their locations were randomly selected.

Vegetation success criteria for the stream riparian areas are based on a minimum survival of 320 stems per acre of planted species through Year 3 and 260 stems per acre at the end of Year 5. Volunteer woody vegetation was not included in the survivability calculations. Based on the Year 1 surveys, all plots exhibited surviving planted and transplanted species in excess of 597 planted stems per acre. Volunteer species only increase the overall total number. The Project Site met and exceeded the established success criteria for vegetation based on the survival of the planted species for Year 1 monitoring.

The first six months of 2008 were extremely dry. Severe drought conditions were present during this period, as well as the majority of the previous year. Mortality was observed on more that half of the tree and shrub species planted. It was most evident on certain species, which is discussed in greater detail in Section 2.1.

**Stream Restoration Monitoring**

Stream restoration success criteria for the two restored stream reaches were met during the Year 1 monitoring assessment. No significant changes to the dimension, pattern, profile or bed material were observed. Location surveys of the constructed features were conducted to verify the performance of both channels. Total station surveys were performed to compare the six previously determined stream longitudinal profiles and the 23 permanent stream cross-sections with as-built data. A modified Wolman pebble count and assessment of the constructed features was also undertaken as part of Year 1 monitoring efforts.

Both Ellington Branch and its UT are stable. All of the structures are functioning as designed and bank erosion is non-existent. Drought conditions however, have become a factor at the Project Site. Ellington Branch was dry for the first half of 2008 while the UT maintained only a trickle of water. As a result, wetland and streamside vegetation has thrived within the bankfull channel areas.

Based on the cross-section surveys, longitudinal profile surveys and visual observations, the channel dimensions and profiles have not significantly changed. Minor adjustments were noted, although these adjustments were more obvious based on data rather than visual observation.

One bankfull event was recorded on September 5 and 6, 2008. It was associated with a two-day, tropical storm event that provided more than five inches of rainfall.

# SECTION V. PROJECT BACKGROUND

## A. Location and Setting

The Project Site is situated approximately four miles south of the Virginia/North Carolina state line in Warren County, North Carolina (Figure 1). SR 1200 (Drewry Road) is approximately 0.3 miles west of the project area, while SR 1221 (Culpepper Road) is approximately 0.2 miles to the east. It can be accessed by using the following directions from Exit 223 along Interstate 85:

- turn left (north) onto SR 1237 (Manson Road), travel approximately 2.5 miles;
- turn right (north) onto Drewry Road, travel approximately 3.0 miles; and
- turn right (east) onto Fleming Farm Road and proceed approximately ¼-mile past homestead and through gate.

Two streams, Ellington Branch and one of its unnamed tributaries, constitute the project. Ellington Branch is oriented in a south to north direction while its UT enters from the west. Both streams meet the NC Division of Water Quality (NCDWQ) perennial stream classification requirements.

## B. Mitigation Structure and Objectives

Prior to restoration, Ellington Branch and its UT were severely degraded due to existing land uses and non-restricted cattle access. The existing stream banks on both channels were eroded and overall channel morphology was significantly altered. A total of 4,904 linear feet of existing stream channel was surveyed within the project area, specifically 4,051 linear feet along Ellington Branch and 853 linear feet along its UT.

The goals and objectives of the project were to ultimately create a continuous wooded stream corridor by restoring and re-vegetating the largest reach of disturbed channel and buffer along Ellington Branch. This in turn, would also improve the overall function and habitat associated with the stream channel and riparian areas. The restoration plan included restoration (dimension, pattern and profile parameters) of Ellington Branch and its UT, as well as the establishment and restoration of an active riparian buffer complex. In addition, the goals and objectives were also to restore the primary stream and buffer functions and values associated with nutrient removal and transformation, sediment reduction and retention, flood-flow attenuation, and wildlife (both aquatic and terrestrial) habitat. The Project Site provided an excellent opportunity to restore and preserve a substantial riparian zone on lands that were currently being utilized for pasture and cattle grazing.

Ellington Branch and its UT were restored with methodology consistent with the C stream type. According to Rosgen (1996), this stream type is a slightly entrenched, meandering, gravel dominated, riffle/pool channel with a well developed floodplain. C stream types have gentle gradients less than two percent, display a high width/depth ratio and exhibit sinuosities greater than 1.2. The riffle/pool sequence averages five to seven bankfull widths in length. Its associated stream banks are generally composed of unconsolidated, heterogeneous, non-cohesive, alluvial materials that are finer than the gravel-dominated bed material. Sediment supplies are generally moderate to high. This stream type is characterized by the presence of point bars and other depositional features (Rosgen, 1996). It was favored versus the E stream type since shear in the near bank region is greatly reduced, especially for newly constructed channels. Once the vegetation becomes established, the width/depth ratio may naturally reduce to the characteristic of an E stream type, which is a hydraulically efficient channel form that maintains a high sediment transport capacity.

According to as-built surveys completed during January 2008, a total of 5,063 linear feet of Ellington Branch and its UT were restored using natural channel design methods consistent with Priority Level II stream restoration protocols. This included 3,735 linear feet along Ellington Branch and 1,328 linear feet along its UT. Exhibit Table I denotes the achievements of the project.

**Exhibit Table I. Project Structure Table**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Project Segment or Reach ID | Mitigation Type | Approach | Linear Footage | Stationing | Comment |
|---|---|---|---|---|---|
| Reach I – Ellington Br. | R | P2 | 1,934 | 10+00 to 29+34.0 | Above Confluence with UT |
| Reach II – Ellington Br. | R | P2 | 1,801 | 29+34.0 to 47+35.0 | Below Confluence with UT |
| Reach III – UT | R | P2 | 1,328 | 10+00 to 23+27.8 | Entire Reach |

R = Restoration
P2 = Priority Level II

Ecological benefits gained with the restoration of Ellington Branch and its UT include reduced nutrient loading, reduced sediment loading, improved habitat diversity (both terrestrial and aquatic) and improved water quality. By restricting cattle access and implementing riparian buffers along Ellington Branch and its UT, the project will reduce the overall amount of pollution (physical and chemical) leaving the Site and concentrating in the waters downstream. Restoration of the stream channels will ultimately increase foraging and spawning habitat for fish, and other species requiring flowing water. The project will provide an ecological uplift for the entire basin.

## C. Project History and Background

The project is undergoing its first formal year of monitoring. Reporting and milestone history for the Project Site is provided in Exhibit Table II. Exhibit Table III provides contact information for all individuals responsible for implementation while relevant background information is provided in Exhibit Table IV.

**Exhibit Table II. Project Activity and Reporting History**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Activity or Report | Scheduled Completion | Data Collection Complete | Actual Completion or Delivery |
|---|---|---|---|
| Restoration Plan | January 2007 | November 2006 | January 2007 |
| Final Design (90%) | February 2007 | | February 2007 |
| Construction | June 2007 | | May 2007 |
| Temporary S&E Mix Applied | June 2007 | | May 2007 |
| Permanent Seed Mix Applied | June 2007 | | May 2007 |
| Bare Root Seedling Installation | December 2007 | | November 2007 |
| Mitigation Plan/ As-Built (Year 0 Monitoring- baseline) | March 2008 | January 2008 | February 2008 |
| Year 1 Monitoring | November 2008 | October 2008 | N/A |
| Year 2 Monitoring | November 2009 | | |
| Year 3 Monitoring | November 2010 | | |
| Year 4 Monitoring | November 2011 | | |
| Year 5 Monitoring | November 2012 | | |

| Exhibit Table III. Project Contact Table<br>Ellington Branch Stream Restoration (Project No. 16-D06045) | |
|---|---|
| **Designer**<br><br>Ecological Engineering, LLP (current)<br>Sungate Design Group, P.A. (previous) | Ms. Jenny S. Fleming, PE<br>128 Raleigh Street<br>Holly Springs, NC 27540<br>(919) 557-0929 |
| **Construction Contractor**<br><br>Shamrock Environmental Corporation | Mr. Robert Lucas<br>P.O. Box 14987<br>Greensboro, NC 27415<br>(336) 375-1989 |
| **Planting Contractor**<br><br>Winstead's Reforestation | Mr. David Winstead<br>536 Jackson Road<br>Nashville, NC 27856<br>(252) 462-0305 |
| **Seeding Contractor**<br><br>Shamrock Environmental Corporation | Mr. Robert Lucas<br>P.O. Box 14987<br>Greensboro, NC 27415<br>(336) 375-1989 |
| Seed Mix Source | Mellow Marsh Farm, Inc.<br>1312 Woody Store Road<br>Siler City, NC 27344<br>(919) 742-1200 |
| Nursery Stock Suppliers | ArborGen (International Paper)<br>SC Supertree Nursery<br>5594 Highway 38 South<br>Blenheim, SC 29516<br>(843) 528-3203<br><br>Mellow Marsh Farm, Inc.<br>1312 Woody Store Road<br>Siler City, NC 27344<br>(919) 742-1200 |
| **Monitoring Performer** | Ecological Engineering, LLP<br>128 Raleigh Street<br>Holly Springs, NC 27540<br>(919) 557-0929 |
| Stream Monitoring POC | Lane Sauls |
| Vegetation Monitoring POC | Lane Sauls |

| Exhibit Table IV. Project Background Table<br>Ellington Branch Stream Restoration (Project No. 16-D06045) | |
|---|---|
| Project County | Warren County |
| Drainage Area | 1.1 sq. miles - Ellington Branch<br>0.1 sq. miles – Unnamed Tributary |
| Impervious Cover Estimate | Less than 5% |
| Stream Order | 2 - Ellington Branch<br>1 – Unnamed Tributary |
| Physiographic Region | Piedmont |
| Ecoregion (Griffith and Omernik) | Northern Outer Piedmont |
| Rosgen Classification of As-built | C5 - Ellington Branch<br>C5 – Unnamed Tributary |
| Cowardin Classification | RSB |
| Dominant Soil Types | Wedowee Sandy Loam |
| Reference Site ID | N/A |
| USGS HUC for Project and Reference | 03010106 |
| NCDWQ Sub-basin for Project and Reference | 03-02-07 |
| Any Portion of any project segment 303d listed? | No |
| Any portion of any project segment upstream of a 303d listed segment. | Yes |
| Reason for 303d listing or stressor | Low DO, Sedimentation & Nutrients |
| Percent of project easement fenced | 100% |

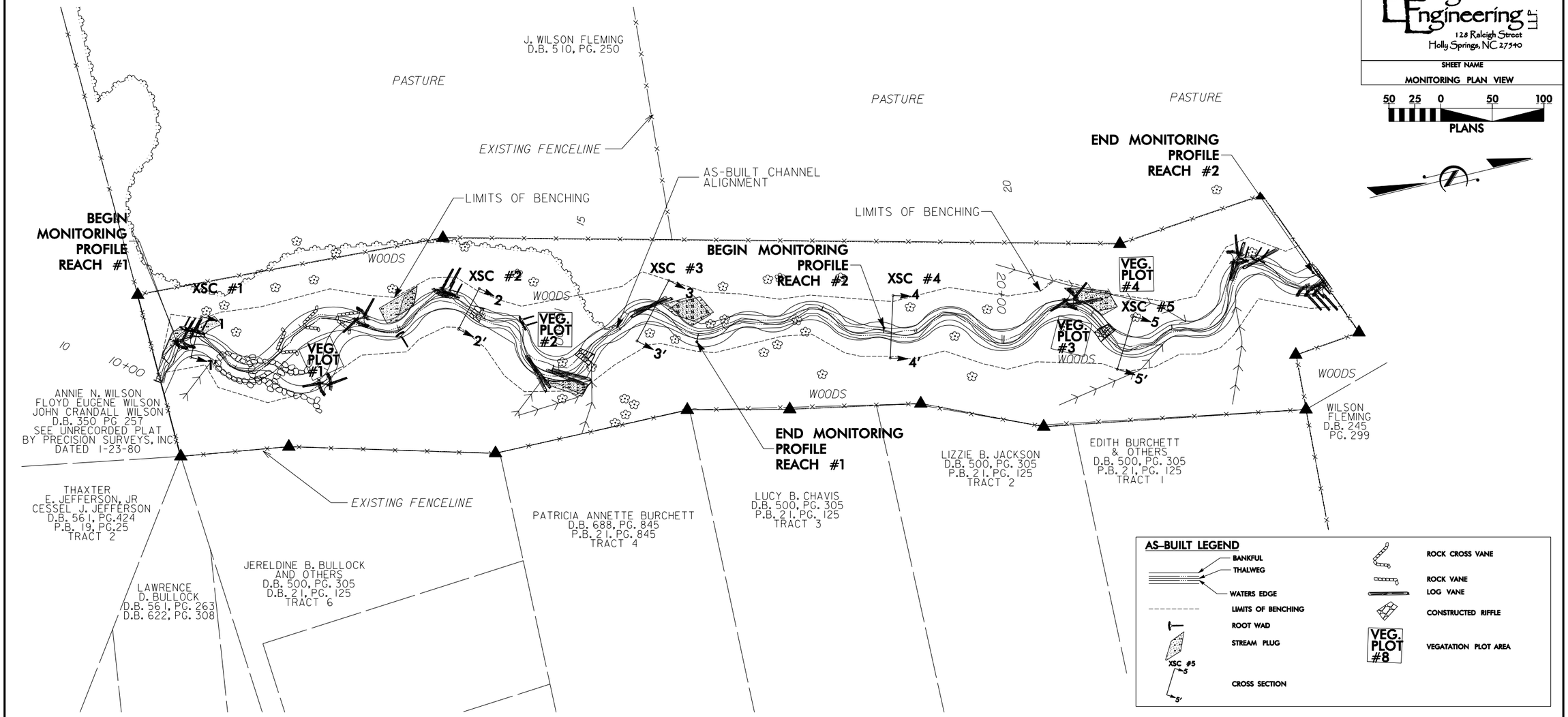
The following pages depict the Monitoring Plan View drawings for Ellington Branch and its UT.

| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 1 |
| PROJECT NAME ELLINGTON BRANCH STREAM RESTORATION | |
| COUNTY WARREN | DATE 11/2008 |

Ecological Engineering LLP
128 Raleigh Street
Holly Springs, NC 27540

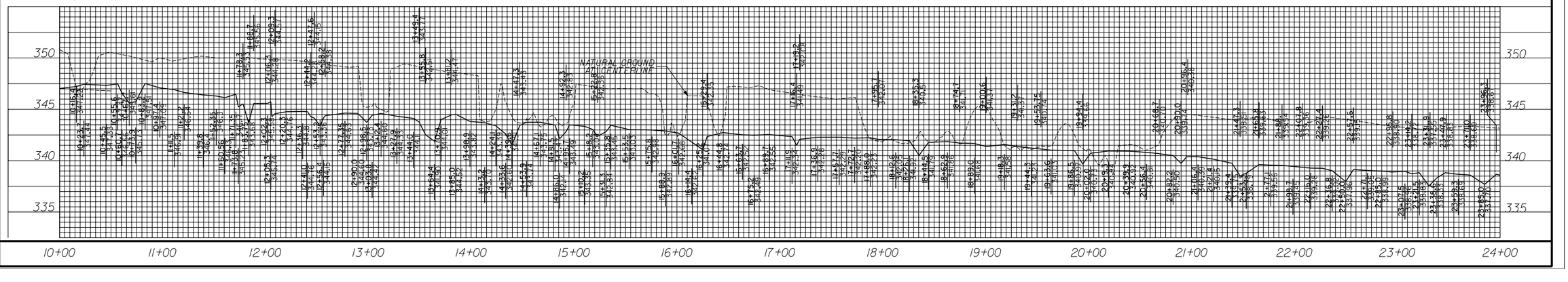
SHEET NAME
MONITORING PLAN VIEW

50 25 0 50 100
PLANS




**AS-BUILT LEGEND**

- BANKFUL
- THALWEG
- WATERS EDGE
- LIMITS OF BENCHING
- ROOT WAD
- STREAM PLUG
- XSC #5 / 5 / 5' — CROSS SECTION
- ROCK CROSS VANE
- ROCK VANE
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8 — VEGATATION PLOT AREA

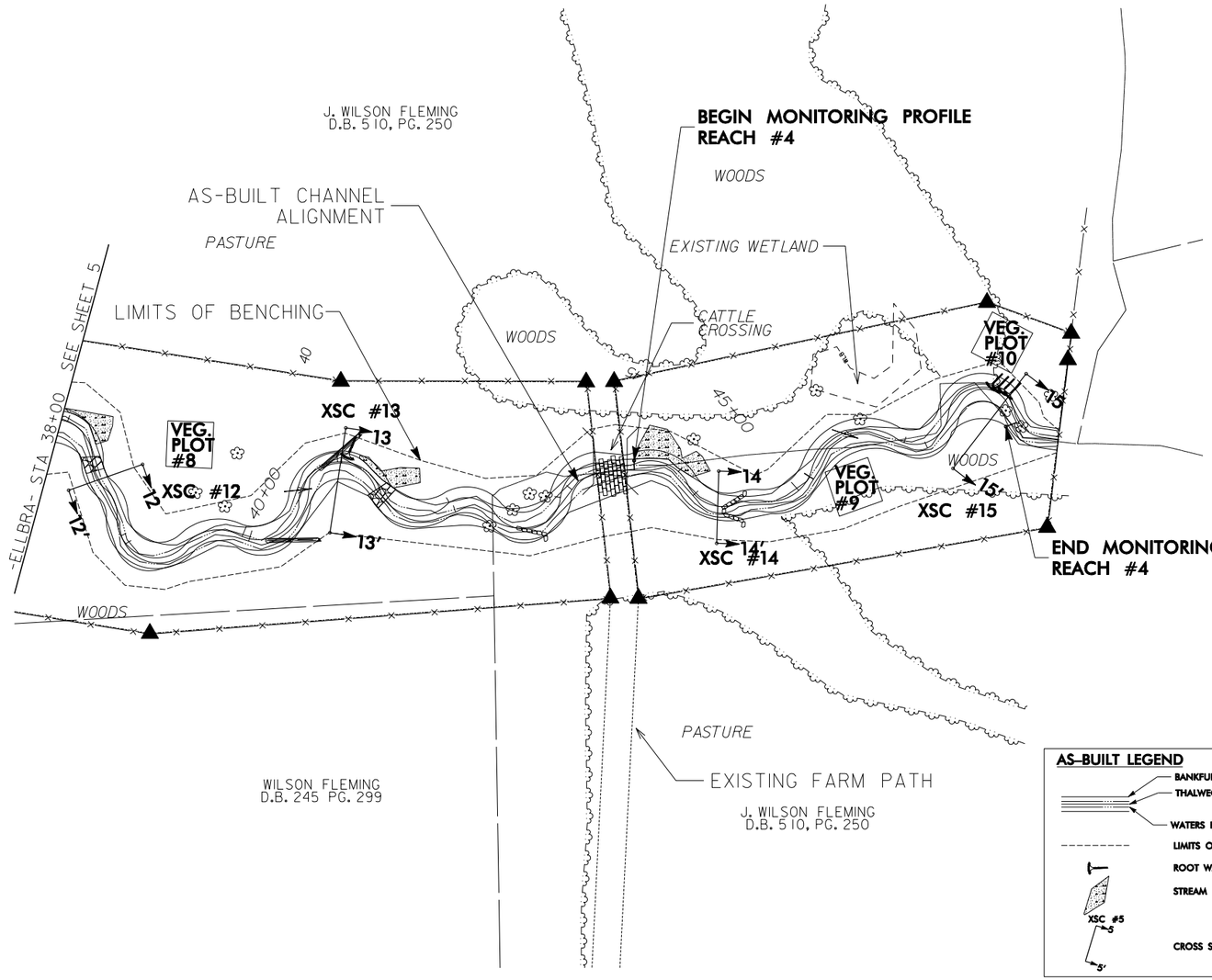


| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 3 |
| PROJECT NAME ELLINGTON BRANCH STREAM RESTORATION | |
| COUNTY WARREN | DATE 11-20-08 |

Ecological Engineering LLP
128 Raleigh Street
Holly Springs, NC 27540

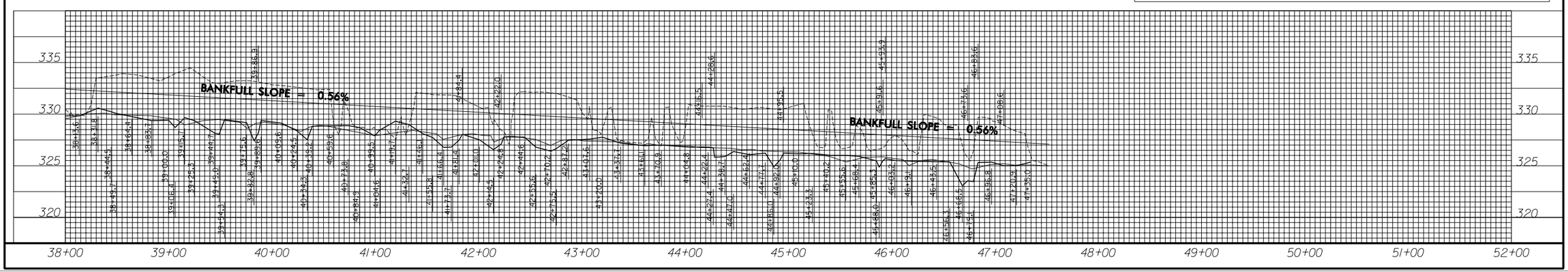
SHEET NAME
MONITORING PLAN VIEW

50 25 0 50 100
PLANS




**AS-BUILT LEGEND**

- BANKFUL
- THALWEG
- WATERS EDGE
- LIMITS OF BENCHING
- ROOT WAD
- STREAM PLUG
- XSC #5 (5' / 5')
- CROSS SECTION
- ROCK CROSS VANE
- ROCK VANE
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8 — VEGATATION PLOT AREA



| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 2 |
| PROJECT NAME ELLINGTON BRANCH STREAM RESTORATION | |
| COUNTY WARREN | DATE 11/2008 |

Ecological Engineering LLP
128 Raleigh Street
Holly Springs, NC 27540

SHEET NAME
MONITORING PLAN VIEW

50 25 0 50 100
PLANS

PLOT #12
XSC #20
CE-40
CE-14
J. WILSON FLEMING
D.B. 510, PG. 250
PASTURE
EXISTING WETLAND
20 TRIB
UNNAMED TRIBUTARY
AS-BUILT CHANNEL
ALIGNMENT
CE-15
XSC #21
VEG. PLOT #13
XSC #22
XSC #23
VEG. PLOT #5
WOODS
XSC #6
CREST GAGE
25+00
ELLBRA- STA 24+00 SEE SHEET 4
CE-11
CE-10
CE-20
XSC #7
XSC #8
CE-9B
BEGIN MONITORING PROFILE REACH #3
LIMITS OF BENCHING
CE-9A
AS-BUILT CHANNEL ALIGNMENT
END MONITORING PROFILE REACH #3
CE-16
VEG. PLOT #6
VEG. PLOT #7
XSC #9
XSC #10
XSC #11
CE-17
ELLBRA- STA 38+00 SEE SHEET 6
CE-8
CE-9
PASTURE
WOODS
PASTURE

AS-BUILT LEGEND
- BANKFUL
- THALWEG
- WATERS EDGE
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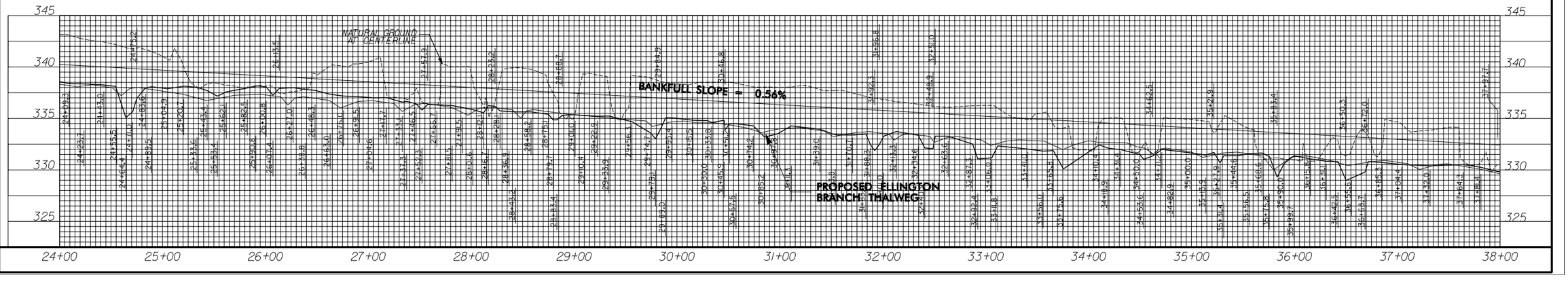
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8 — VEGATATION PLOT AREA



| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 4 |
| PROJECT NAME ELLINGTON BRANCH STREAM RESTORATION | |
| COUNTY WARREN | DATE 11-20-08 |

Ecological Engineering P.L.L.C.
128 Raleigh Street
Holly Springs, NC 27540

SHEET NAME
MONITORING PLAN VIEW

50 25 0 50 100
PLANS

**AS-BUILT LEGEND**

- BANKFUL
- THALWEG
- WATERS EDGE
- LIMITS OF BENCHING
- ROOT WAD
- STREAM PLUG
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- CROSS SECTION
- ROCK CROSS VANE
- ROCK VANE
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8
- VEGATATION PLOT AREA

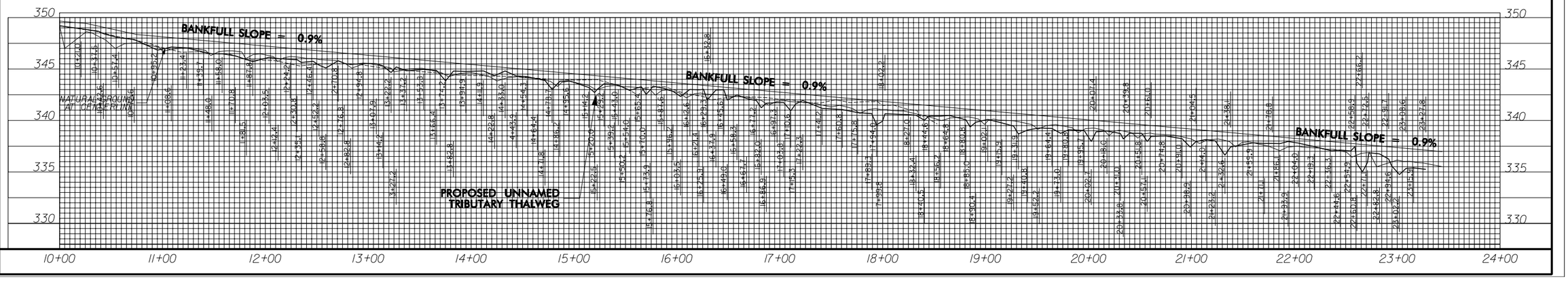
FLEMING FARM ROAD
EXISTING FARM PATH
UNNAMED TRIBUTARY AS-BUILT CHANNEL ALIGNMENT
J. WILSON FLEMING D.B. 510, PG. 250
PASTURE
EXISTING WETLAND
WOODS
10' TRIB
15' TRIB
20' TRIB
AS-BUILT CHANNEL ALIGNMENT
CREST GAGE
NORTH

**BEGIN MONITORING PROFILE REACH #5**
**END MONITORING PROFILE REACH #5**
**BEGIN MONITORING PROFILE REACH #6**
**END MONITORING PROFILE REACH #6**

XSC #16 (16 / 16')
XSC #17 (17 / 17')
XSC #18 (18 / 18')
XSC #19 (19 / 19')
XSC #20 (20 / 20')
XSC #21 (21 / 21')
XSC #22 (22 / 22')
XSC #23 (23 / 23')

VEG. PLOT #5
VEG. PLOT #11
VEG. PLOT #12
VEG. PLOT #13

10+00
15+00
20+00
25+00



# SECTION VI. PROJECT CONDITION AND MONITORING RESULTS

## A. Vegetation Assessment

### 1. Soil Data

Based on available mapping for Warren County (NRCS, 2006), Wedowee soils underlie the entire easement area associated with the Project Site. These soils range in slope from five to 25 percent, depending on their position in the landscape. The Natural Resources Conservation Service (NRCS) is currently in the process of remapping the county and this data was assembled based on mapping provided by the County Soil Scientist. This mapping is not yet available in a published format.

Wedowee soils are classified by the NRCS as clayey, kaolinitic, thermic Typic hapludults. These soils are deep, well drained, moderately permeable soils that formed in residuum from weathered acid crystalline rock of the Piedmont plateau. They occur on narrow sides of ridges with slopes ranging from 8 to 40 percent (Hicks, 1980). The typical pedon, taken approximately eight miles south of the project in Vance County, exhibits an O, Ap, Bt and C horizon. The O horizon varies up to nearly 2 inches in depth and consists primarily of organic material. The Ap horizon is approximately 7 inches in depth and consists of brown, sandy loam. The clayey Bt horizon is 10 to 24 inches in thickness. It is colored yellowish red and is made up of sandy clay. A B3 horizon exists, which is similar in color to the Bt horizon. Its texture is sandy clay loam, clay loam or loam. The C horizon is yellowish red, reddish yellow, pale brown or red saprolite that crushes to sandy loam or sandy clay loam (Hicks, 1980). Exhibit Table V depicts preliminary soil data.

**Exhibit Table V. Preliminary Soil Data**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Series | Max Depth (in.) | % Clay on Surface | K | T | OM % |
|---|---|---|---|---|---|
| Wedowee sandy loam | 72 | 0 | 0.24 | 2 | 0.5-1.5 |

### 2. Vegetative Problem Areas

Vegetative problem areas are defined as those areas either lacking vegetation or containing exotic vegetation and are generally categorized within the following categories: Bare Bank, Bare Bench, Bare Floodplain or Invasive Population. Based on the monitoring site assessment, no significant vegetation problem areas currently exist within the Project Site. There are however, isolated occurrences of invasive species. The occurrences consist mainly of scattered individuals, including Japanese grass (*Microstegium virmineum*) cattail (*Typha latifolia*) and Chinese privet (*Ligustrum sinense*). These areas are shown on the drawing entitled Problem Areas Plan View. Exhibit Table VI summarizes the observations for 2008. No other features or issues were identified during the surveys.

Japanese grass is present along the upstream portion of the UT, specifically in the vicinity of Cross Section #16 (Station Number 11+00). It has become established within the area either as a result from wind dispersal, bird dispersal or via soil disturbance. Additional shading will help to minimize the spread of this species. This area will continue to be monitored throughout the next several years. Spot treatment with herbicide will be performed as necessary.

Cattails were observed in seven separate locales within the Project Site, specifically Station Numbers 14+50, 16+25, 36+50, 43+25, 44+25 and 46+50 along Ellington Branch. It was also observed at Station Number 16+00 along the UT. The occurrences were all scattered and individual counts were minimal. It is apparent that the establishment of cattails is a result of wind and/or bird dispersal. No other cattails were observed on the property. Low water levels and limited floodflows have allowed this species to become established. These areas will continue to be closely monitored throughout the spring and summer of next year. Spot treatments with an aquatic herbicide will be performed, as necessary.

The privet was observed along the eastern project perimeter and both upstream and downstream of the Ellington Branch reach. Ecological Engineering will continue to monitor this species and will perform spot treatments with herbicide as necessary.

**Exhibit Table VI. Vegetative Problem Areas**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Feature/Issue | Station #/ Range | Probable Cause | Photo # |
|---|---|---|---|
| Bare Bank | N/A | N/A | N/A |
| Bare Bench | N/A | N/A | N/A |
| Bare Floodplain | N/A | N/A | N/A |
| Invasive/Exotic Populations | See Problem Area Plan View Drawing | Microstegium: upstream and surrounding seed sources | 31 & 32 |
| | See Problem Area Plan View Drawing | Typha: Surrounding seed sources | N/A |
| | Along eastern perimeter of easement | Ligustrum: Upstream and surrounding seed sources | N/A |

3. Vegetative Problem Areas Plan View

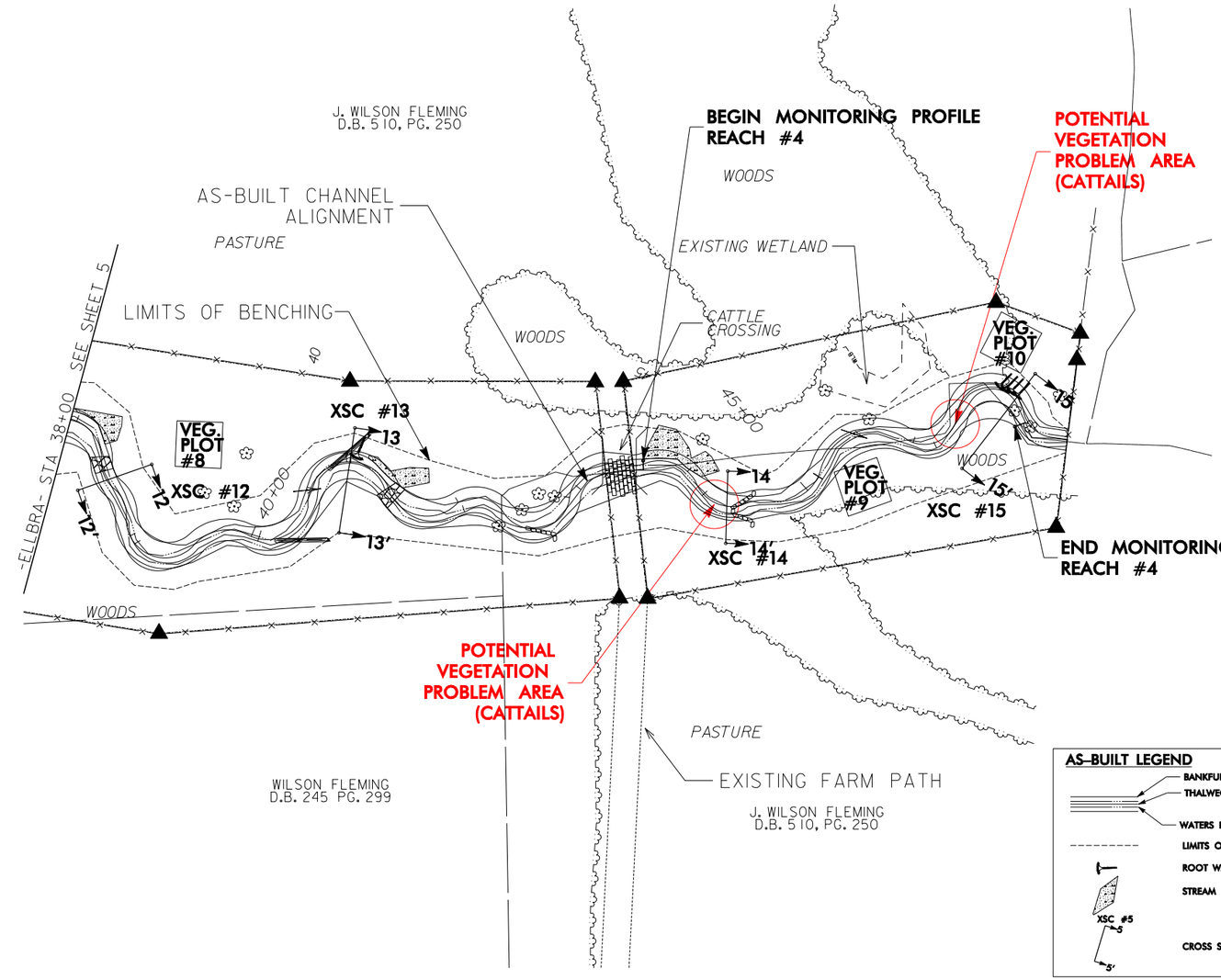
The following plan view drawings depict the locations of the potential vegetative problem areas at the Project Site.

| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 3 |
| PROJECT NAME ELLINGTON BRANCH STREAM RESTORATION | |
| COUNTY WARREN | DATE 11-20-08 |

Ecological Engineering LLP
128 Raleigh Street
Holly Springs, NC 27540

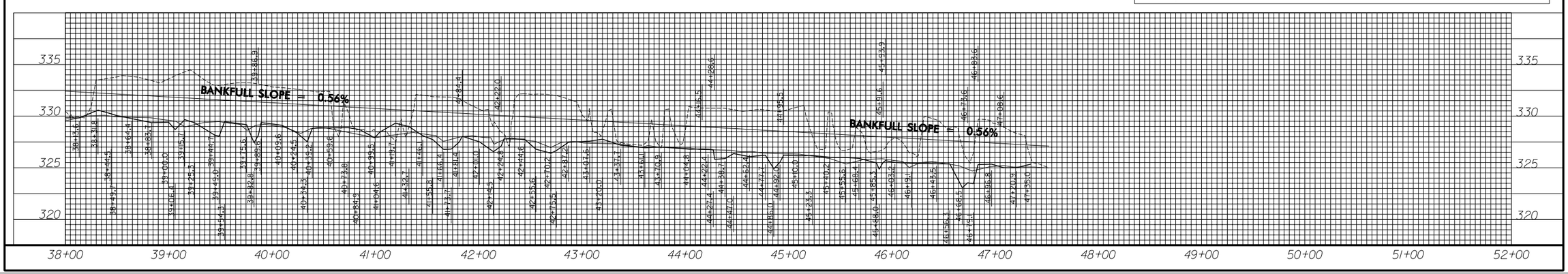
SHEET NAME
PROBLEM AREAS PLAN VIEW

50 25 0 50 100
PLANS




**AS-BUILT LEGEND**

- BANKFUL
- THALWEG
- WATERS EDGE
- LIMITS OF BENCHING
- ROOT WAD
- STREAM PLUG
- XSC #5 (5' / 5')
- CROSS SECTION
- ROCK CROSS VANE
- ROCK VANE
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8 — VEGATATION PLOT AREA



| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 2 |
| PROJECT NAME ELLINGTON BRANCH STREAM RESTORATION | |
| COUNTY WARREN | DATE 11/2008 |

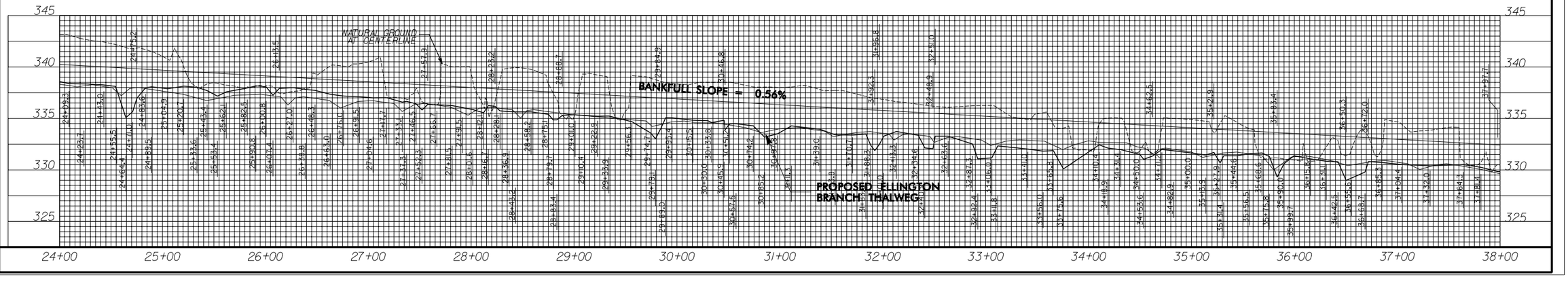
Ecological Engineering LLP
128 Raleigh Street
Holly Springs, NC 27540

SHEET NAME
PROBLEM AREAS PLAN VIEW

50 25 0 50 100
PLANS

PLOT #12
XSC #20
CE-40
CE-14
J. WILSON FLEMING
D.B. 510, PG. 250
PASTURE
EXISTING WETLAND
UNNAMED TRIBUTARY
AS-BUILT CHANNEL
ALIGNMENT
20 TRIB
CE-15
XSC #21
VEG. PLOT #13
XSC #22
XSC #23
VEG. PLOT #5
WOODS
XSC #6
CREST GAGE
25+00
ELLBRA- STA 24+00 SEE SHEET 4
CE-11
CE-10
CE-20
XSC #7
XSC #8
CE-9B
BEGIN MONITORING PROFILE
REACH #3
LIMITS OF BENCHING
CE-9A
AS-BUILT CHANNEL
ALIGNMENT
CE-16
VEG. PLOT #6
VEG. PLOT #7
XSC #9
XSC #10
END MONITORING
PROFILE
REACH #3
CE-17
XSC #11
ELLBRA- STA 38+00 SEE SHEET 6
CE-8
CE-9
PASTURE
WOODS
PASTURE
POTENTIAL
VEGETATION
PROBLEM AREAS
(CATTAILS)

AS-BUILT LEGEND
- BANKFUL
- THALWEG
- WATERS EDGE
- LIMITS OF BENCHING
- ROOT WAD
- STREAM PLUG
- XSC #5 (5 / 5')
- CROSS SECTION
- ROCK CROSS VANE
- ROCK VANE
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8 — VEGATATION PLOT AREA



| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 1 |
| PROJECT NAME ELLINGTON BRANCH STREAM RESTORATION | |
| COUNTY WARREN | DATE 11/2008 |

Ecological Engineering LLP
128 Raleigh Street
Holly Springs, NC 27540

SHEET NAME
PROBLEM AREAS PLAN VIEW

50 25 0 50 100
PLANS

J. WILSON FLEMING
D.B. 510, PG. 250

PASTURE

EXISTING FENCELINE

AS-BUILT CHANNEL ALIGNMENT

LIMITS OF BENCHING

BEGIN MONITORING PROFILE REACH #1

BEGIN MONITORING PROFILE REACH #2

END MONITORING PROFILE REACH #2

END MONITORING PROFILE REACH #1

XSC #1

XSC #2

XSC #3

XSC #4

XSC #5

VEG. PLOT #1

VEG. PLOT #2

VEG. PLOT #3

VEG. PLOT #4

WOODS

POTENTIAL VEGETATION PROBLEM AREA (CATTAILS)

ANNIE N. WILSON
FLOYD EUGENE WILSON
JOHN CRANDALL WILSON
D.B. 350 PG 257
SEE UNRECORDED PLAT
BY PRECISION SURVEYS, INC.
DATED 1-23-80

THAXTER
E. JEFFERSON, JR
CESSEL J. JEFFERSON
D.B. 561, PG.424
P.B. 19, PG.25
TRACT 2

LAWRENCE
D. BULLOCK
D.B. 561, PG. 263
D.B. 622, PG. 308

JERELDINE B. BULLOCK
AND OTHERS
D.B. 500, PG. 305
D.B. 21, PG. 125
TRACT 6

PATRICIA ANNETTE BURCHETT
D.B. 688, PG. 845
P.B. 21, PG. 845
TRACT 4

LUCY B. CHAVIS
D.B. 500, PG. 305
P.B. 21, PG. 125
TRACT 3

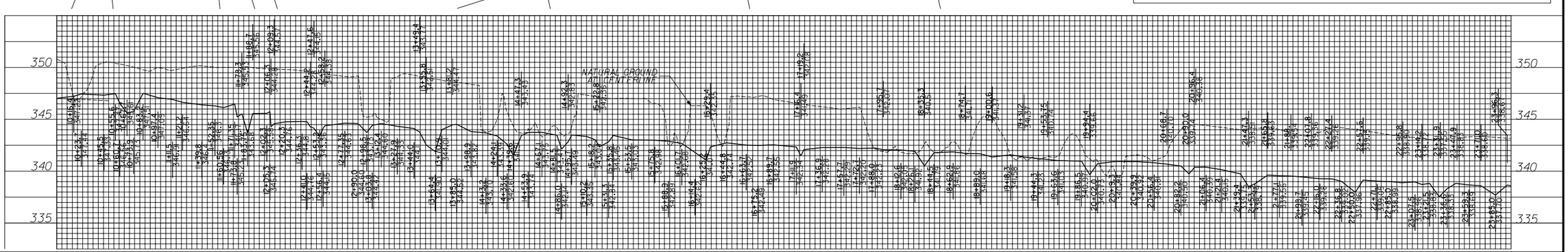
LIZZIE B. JACKSON
D.B. 500, PG. 305
P.B. 21, PG. 125
TRACT 2

EDITH BURCHETT
& OTHERS
D.B. 500, PG. 305
P.B. 21, PG. 125
TRACT 1

WILSON FLEMING
D.B. 245
PG. 299

## AS-BUILT LEGEND

- BANKFUL
- THALWEG
- WATERS EDGE
- LIMITS OF BENCHING
- ROOT WAD
- STREAM PLUG
- XSC #5 / 5 / 5' — CROSS SECTION
- ROCK CROSS VANE
- ROCK VANE
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8 — VEGATATION PLOT AREA



| PROJECT NUMBER | SHEET NUMBER |
|---|---|
| EEP#16-D06045 | 4 |
| PROJECT NAME ELLINGTON BRANCH | STREAM RESTORATION |
| COUNTY WARREN | DATE 11-20-08 |

Ecological Engineering P.L.L.C.
128 Raleigh Street
Holly Springs, NC 27540

SHEET NAME
PROBLEM AREAS PLAN VIEW

50 25 0 50 100
PLANS

**AS-BUILT LEGEND**

- BANKFUL
- THALWEG
- WATERS EDGE
- LIMITS OF BENCHING
- ROOT WAD
- STREAM PLUG
- XSC #5 (5 / 5')
- CROSS SECTION
- ROCK CROSS VANE
- ROCK VANE
- LOG VANE
- CONSTRUCTED RIFFLE
- VEG. PLOT #8
- VEGATATION PLOT AREA

FLEMING FARM ROAD

EXISTING FARM PATH

UNNAMED TRIBUTARY AS-BUILT CHANNEL ALIGNMENT

J. WILSON FLEMING D.B. 510, PG. 250

PASTURE

BEGIN MONITORING PROFILE REACH #5

XSC #16

XSC #17

XSC #18

XSC #19

XSC #20

XSC #21

XSC #22

XSC #23

VEG. PLOT #11

VEG. PLOT #12

VEG. PLOT #13

VEG. PLOT #5

POTENTIAL VEGETATION PROBLEM AREA (CATTAILS)

POTENTIAL VEGETATION PROBLEM AREA (MICROSTEGIUM)

15' TRIB

10' TRIB

20' TRIB

EXISTING WETLAND

WOODS

END MONITORING PROFILE REACH #5

BEGIN MONITORING PROFILE REACH #6

END MONITORING PROFILE REACH #6

AS-BUILT CHANNEL ALIGNMENT

CREST GAGE

10+00

15+00

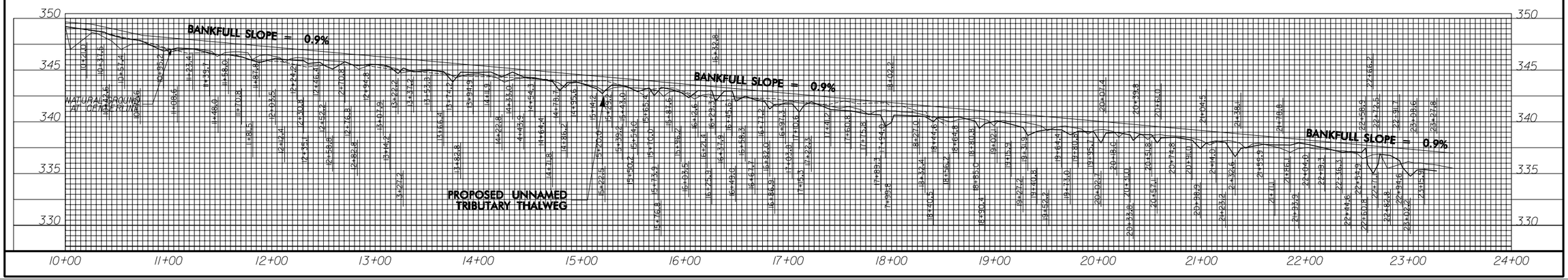
25+00

EXISTING FARM PATH

PASTURE

PASTURE

PASTURE



4. Stem Counts

Stem counts were conducted within 13 strategically placed 10 meter by 10 meter plots. The plots were located based on a representative sample of the entire area of disturbance. They are scattered throughout the project area in order to cover the majority of the habitat variations. The stem count procedure only applies to planted and transplanted woody vegetation. This vegetation is denoted by bio-degradable flagging, which will be replaced every monitoring year.

According to initial planting counts, stem counts within each of the 13 plots ranged from approximately 1,053 to 1,215 individuals per acre. The high number was in anticipation of mortality via the continuing drought and the receipt of additional plantings. Monitoring counts for each plot are presented in Exhibit Tables VIIa and VIIb. As expected, mortality rates were heavy in the spring and summer months of 2008. Species such as redbud (*Cercis canadensis*), paw paw (*Asimina triloba*), hackberry (*Celtis laevigata*), flowering dogwood (*Cornus florida*), persimmon (*Diospyros virginiana*), blackgum (*Nyssa sylvatica*) and white oak (*Quercus alba*) were the most effected. In some cases, none of the above individuals survived within the plots. The drought was the single-most contributing factor to this decline in diversity. Other factors included limited browsing by wildlife and improper installation.

Based on the results of the vegetation assessment, survivability counts ranged from 567 stems per acre in Vegetation Plot 1 to 1,215 stems per acre in Vegetation Plot 3. A complete breakdown of this information is provided in Appendix A-1.Photographs of each plot are presented in Appendix A-2.

**Exhibit Table VIIa. Stem Counts For Each Species Arranged By Plot**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Species | Plots | | | | | | | Initial Totals | Year 1 Totals | Year 2 Totals | Year 3 Totals | Year 4 Totals | Year 5 Totals | Survival % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | | | | |
| *Alnus serrulata* | | | 1 | | | | | 1 | 1 | | | | | 100 |
| *Asimina triloba* | | | | | | | | 14 | 0 | | | | | 0 |
| *Betula nigra* | 6 | 7 | 6 | 1 | | | | 86 | 84 | | | | | 98 |
| *Celtis laevigata* | | | | | | | | 11 | 0 | | | | | 0 |
| *Cercis canadensis* | 3 | | | | | | 1 | 11 | 7 | | | | | 64 |
| *Cornus florida* | | | 5 | | | | | 6 | 0 | | | | | 0 |
| *Diospyros virginiana* | | | 11 | | 1 | 6 | 6 | 37 | 29 | | | | | 78 |
| *Fraxinus pennsylvanica* | | 3 | | | | | 15 | 56 | 56 | | | | | 100 |
| *Nyssa sylvatica* | | | | | | | | 13 | 0 | | | | | 0 |
| *Platanus occidentalis* | 5 | 3 | 5 | 2 | | | 6 | 36 | 32 | | | | | 89 |
| *Quercus alba* | | | | | 5 | 1 | | 11 | 7 | | | | | 64 |
| *Quercus michauxii* | | 5 | 1 | 13 | 6 | 15 | | 51 | 46 | | | | | 91 |
| *Quercus phellos* | | 4 | | | 6 | | | 26 | 25 | | | | | 96 |
| *Salix nigra* | | | 1 | | | | | 1 | 1 | | | | | 100 |

| Exhibit Table VIIb. Stem Counts For Each Species Arranged By Plot<br>Ellington Branch Stream Restoration (Project No. 16-D06045) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **Plots** | | | | | | | **Initial Totals*** | **Year 1 Totals*** | **Year 2 Totals** | **Year 3 Totals** | **Year 4 Totals** | **Year 5 Totals** | **Survival %*** |
| | **8** | **9** | **10** | **11** | **12** | **13** | | | | | | | | |
| *Alnus serrulata* | | | | | | | | 1 | 1 | | | | | 100 |
| *Asimina triloba* | | | | | | | | 14 | 0 | | | | | 0 |
| *Betula nigra* | | 23 | 7 | 21 | 13 | | | 86 | 84 | | | | | 98 |
| *Celtis laevigata* | | | | | | | | 11 | 0 | | | | | 0 |
| *Cercis canadensis* | 2 | 1 | | | | | | 11 | 7 | | | | | 64 |
| *Cornus florida* | | | | | | | | 6 | 0 | | | | | 0 |
| *Diospyros virginiana* | | 5 | | | | | | 37 | 29 | | | | | 78 |
| *Fraxinus pennsylvanica* | 23 | | | | 10 | | | 56 | 56 | | | | | 100 |
| *Nyssa sylvatica* | | | | | | | | 13 | 0 | | | | | 0 |
| *Platanus occidentalis* | 3 | | 8 | | | | | 36 | 32 | | | | | 89 |
| *Quercus alba* | | | | | | 1 | | 11 | 7 | | | | | 64 |
| *Quercus michauxii* | | | | 2 | 1 | 3 | | 51 | 46 | | | | | 91 |
| *Quercus phellos* | 1 | | | 1 | 1 | 11 | | 26 | 25 | | | | | 96 |
| *Salix nigra* | | | | | | | | 1 | 0 | | | | | |

## B. Stream Assessment

1. Procedural Items

Morphological criteria, including dimension and profile were assessed using the recommended procedures in the USACE Draft Stream Mitigation Guidelines (2003) document.

Cross sections were established in the vicinity of every 20 bankfull widths along both Ellington Branch and its UT. This resulted in a total of 15 cross sections along Ellington Branch and eight cross sections along its UT. Average distances between each cross section were approximately 250 and 150 linear feet for Ellington Branch and its UT, respectively. The cross sections were concentrated to riffle or pool locations along each channel. The chart below serves as a legend for each cross section. More detailed information is provided throughout the remainder of the report.

**Ellington Branch**

| Cross Section Number | Morphologic Parameter | Station Number |
|---|---|---|
| 1 | Pool | 10+67 |
| 2 | Riffle | 13+85 |
| 3 | Pool | 16+25 |
| 4 | Riffle | 18+74 |
| 5 | Pool | 21+47 |
| 6 | Riffle | 25+04 |
| 7 | Riffle | 28+23 |
| 8 | Pool | 29+74 |
| 9 | Pool | 31+88 |
| 10 | Riffle | 34+10 |
| 11 | Pool | 36+55 |
| 12 | Riffle | 38+49 |
| 13 | Pool | 40+99 |
| 14 | Riffle | 44+22 |
| 15 | Pool | 46+79 |

**UT to Ellington Branch**

| Cross Section Number | Morphologic Parameter | Station Number |
|---|---|---|
| 16 | Pool | 10+95 |
| 17 | Riffle | 12+35 |
| 18 | Pool | 13+75 |
| 19 | Riffle | 15+39 |
| 20 | Pool | 16+82 |
| 21 | Riffle | 18+64 |
| 22 | Pool | 19+73 |
| 23 | Riffle | 22+36 |

Restoration activities at the Project Site exceeded 3,000 linear feet. According to USACE (2003), profile surveys are to be conducted on only 3,000 linear feet or 30% of the project total, whichever is greater. Ecological Engineering established six total profile segments to be annually reviewed as part of this monitoring assessment. Two of the segments are situated along Ellington Branch upstream of its confluence with the UT, two are downstream and two are along the UT. Lengths vary from approximately 300 to 800 feet in length. A legend is provided for each profile segment in the chart below.

| Segment | Location |
|---|---|
| Profile Reach 1 | Ellington Branch Stations 10+20 to 16+75 (upstream of confluence with UT) |
| Profile Reach 2 | Ellington Branch Stations 18+62 to 23+96 (upstream of confluence with UT) |
| Profile Reach 3 | Ellington Branch Stations 29+33 to 36+85 (downstream of confluence with UT) |
| Profile Reach 4 | Ellington Branch Stations 43+49 to 46+96 (downstream of confluence with UT) |
| Profile Reach 5 | UT to Ellington Branch Stations 12+03 to 16+97 |
| Profile Reach 6 | UT to Ellington Branch Stations 19+02 to 21+93 |

2. Hydrologic Criteria

Bankfull events during the monitoring period are being documented via a crest gage. In order to meet hydrologic success criteria, a minimum of two events must occur during the five-year monitoring period. In addition, the events must occur in separate monitoring years. A crest gage was installed along Ellington Branch at Cross Section #6 immediately after construction was completed in June 2007. The gage was visited monthly during the period leading up to the submittal this document. Based on our findings, one bankfull event occurred on September 5 and 6, 2008 during a two day rain event associated with Tropical Storm Hanna. This event provided more than five inches of rain at the Project Site, according to the property owner. Exhibit Table VIII depicts information regarding the bankfull event.

| Exhibit Table VIII. Verification of Bankfull Events<br>Ellington Branch Stream Restoration (Project No. 16-D06045) | | | | | |
|---|---|---|---|---|---|
| **Date of Data Collection** | **Date(s) of Occurrence** | **Method** | **Calculated Bankfull Elevation (in.)** | **Measured High Water Elevation (in.)** | **Photo # (if available)** |
| 9/9/08 | 9/5/08 – 9/6/08 | Crest gage | 13 inches | 17 inches | Not available |

3. Bank Stability Assessments

EEP requires that detailed Bank Erosion Hazard Index (BEHI) and Near Bank Shear Stress (NBS) be performed in Years 3 and 5, post-construction which correlate to Years 2010 and 2012. The purpose is to describe the proportion of bank footage in the various hazard categories and to produce sediment export rates in tonnage per annum. Exhibit Table IX provides pre-construction BEHI and sediment export rate data. Data from Monitoring Years 3 and 5 will be entered, as appropriate.

**Exhibit Table IX. BEHI and Sediment Export Estimates**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Time Point | Segment/ Reach | Linear Footage | Extreme | | Very High | | High | | Moderate | | Low | | Very Low | | Sediment Export |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ft | % | ft | % | ft | % | ft | % | ft | % | ft | % | Ton/y |
| Pre-construction | Ellington Branch – Upstream of Confluence | 1,500 | | | | | 1,500 | 37 | | | | | | | 44.9 |
| Pre-construction | Ellington Branch – Downstream of Confluence | 2,550 | | | 2,550 | 63 | | | | | | | | | 682.8 |
| | | | | | | | | | | | | | | **Total for Ellington Branch** | **727.7** |
| Pre-construction | Unnamed Tributary of Ellington Branch | 853 | 853 | 100 | | | | | | | | | | | 217.8 |
| | | | | | | | | | | | | | | **Total for the Unnamed Tributary of Ellington Branch** | **217.8** |

| Time Point | Segment/ Reach | Linear Footage | Extreme | | Very High | | High | | Moderate | | Low | | Very Low | | Sediment Export |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ft | % | ft | % | ft | % | ft | % | ft | % | ft | % | Ton/y |
| Year 3 Monitoring | Ellington Branch – Upstream of Confluence | 1,500 | | | | | | | | | | | | | N/A |
| Year 3 Monitoring | Ellington Branch – Downstream of Confluence | 2,550 | | | | | | | | | | | | | N/A |
| | | | | | | | | | | | | | | **Total for Ellington Branch** | **N/A** |
| Year 3 Monitoring | Unnamed Tributary of Ellington Branch | 853 | | | | | | | | | | | | | N/A |
| | | | | | | | | | | | | | | **Total for the Unnamed Tributary of Ellington Branch** | **217.8** |

| Time Point | Segment/ Reach | Linear Footage | Extreme | | Very High | | High | | Moderate | | Low | | Very Low | | Sediment Export |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ft | % | ft | % | ft | % | ft | % | ft | % | ft | % | Ton/y |
| Year 5 Monitoring | Ellington Branch – Upstream of Confluence | 1,500 | | | | | | | | | | | | | N/A |
| Year 5 Monitoring | Ellington Branch – Downstream of Confluence | 2,550 | | | | | | | | | | | | | N/A |
| | | | | | | | | | | | | | | **Total for Ellington Branch** | **N/A** |
| Year 5 Monitoring | Unnamed Tributary of Ellington Branch | 853 | | | | | | | | | | | | | N/A |
| | | | | | | | | | | | | | | **Total for the Unnamed Tributary of Ellington Branch** | **N/A** |

4. Stream Problem Areas

No significant changes to the dimension, pattern, profile or bed material along either channel were observed. Location surveys of the constructed features were conducted to verify the performance of the two stream channels. Both Ellington Branch and its UT are stable. All of the structures are functioning as designed and bank erosion is non-existent. Lack of flow and lack of resulting scouring events during 2008 have contributed to dense vegetation establishment within both stream channels and their adjacent streambanks. Currently, these conditions have contributed to the overall success of the project; however, they may actually become a future deterrent for sediment transport. Ecological Engineering will continue to monitor this situation.

Based on the cross-section surveys, longitudinal profile surveys and visual observations, the channel dimensions and profiles have not significantly changed. Minor adjustments were noted, mainly with regard to the longitudinal profiles. Exhibit Table X is provided for future problem area identification and descriptions, if necessary. No data is currently available for insertion into the table. More overall information regarding issues with either of the stream channels is presented in the following sections. The Table in Appendix B-1 provides information pertaining to the visual assessment. This information is also summarized in Section VI.B.6.

**Exhibit Table X. Stream Problem Areas**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Feature Issue | Station Numbers | Suspected Cause | Photo Number |
|---|---|---|---|
| N/A | N/A | N/A | N/A |

5. Fixed Station Photographs

Photographic documentation was taken at each of the 23 cross sections. This documentation included views across the actual cross section and views facing downstream. The photographs are provided in Appendix B-2 in sequential order.

6. Visual Stability Assessment

Exhibit Table XI provides a semi-qualitative summary of results from the visual inspection conducted over each of the three reaches. It provides a simple performance percentage depicting the state of stability as a proportion of the total amount of the morphological feature category. Based on the overall results, one pool along Reach 1 (Ellington Branch, Station Number 19+00) and two pools along Reach 3 (Unnamed Tributary, Station Numbers 14+00 and 15+00) had filled with sediment. On the contrary though, four pools along Reach 2 (Ellington Branch Station Numbers 30+15, 44+05, 44+55 and 45+50) were formed. Otherwise, no visual evidences of instability were observed along the three reaches associated with the project.

| Exhibit Table XI. Categorical Stream Feature Visual Stability Assessment<br>Ellington Branch Stream Restoration (Project No. 16-D06045) | | | | | | |
|---|---|---|---|---|---|---|
| **Reach 1 – Ellington Branch Upstream of Confluence with Unnamed Tributary (Profile Reaches 1 and 2)** | | | | | | |
| **Feature** | **Initial** | **MY-01** | **MY-02** | **MY-03** | **MY-04** | **MY-05** |
| Riffles | 100% | 100% | | | | |
| Pools | 100% | 95% | | | | |
| Thalweg | 100% | 100% | | | | |
| Meanders | 100% | 100% | | | | |
| Bed General | 100% | 99% | | | | |
| Vanes | 100% | 100% | | | | |
| Rootwads and Boulders | 100% | 100% | | | | |
| **Reach 2 – Ellington Branch Downstream of Confluence with Unnamed Tributary (Profile Reaches 3 and 4)** | | | | | | |
| **Feature** | **Initial** | **MY-01** | **MY-02** | **MY-03** | **MY-04** | **MY-05** |
| Riffles | 100% | 100% | | | | |
| Pools | 100% | 124% | | | | |
| Thalweg | 100% | 100% | | | | |
| Meanders | 100% | 100% | | | | |
| Bed General | 100% | 96% | | | | |
| Vanes | 100% | 100% | | | | |
| Rootwads and Boulders | 100% | 100% | | | | |
| **Reach 3 – Unnamed Tributary (Profile Reaches 5 and 6)** | | | | | | |
| **Feature** | **Initial** | **MY-01** | **MY-02** | **MY-03** | **MY-04** | **MY-05** |
| Riffles | 100% | 100% | | | | |
| Pools | 100% | 90% | | | | |
| Thalweg | 100% | 100% | | | | |
| Meanders | 100% | 100% | | | | |
| Bed General | 100% | 97% | | | | |
| Vanes | | | | | | |
| Rootwads and Boulders | | | | | | |

7. Stream Qualitative Measures

Qualitative summary data including cross-sectional survey, longitudinal profile survey and pebble count information is provided in Exhibit Tables XII and XIII. The associated raw data and plots are provided in Appendices B-3, B-4 and B-5.

## Exhibit Table XII. Baseline Morphology and Hydraulic Summary

**Ellington Branch Stream Restoration (Project No. 16-D06045)**

**Reach 1 – Ellington Branch Upstream of Confluence with Unnamed Tributary**

| Parameter | Pre-Existing Condition | | | Project Reference Stream – UT Ellington | | | Project Reference Stream – Hawtree Creek | | | Design | | | As-Built | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** |
| BF Width (ft) | 7.4 | 11.5 | 9.5 | 4.1 | 4.1 | 4.1 | 7.7 | 9.3 | 8.9 | | | 14.5 | 10.1 | 13.4 | 11.8 |
| Floodprone Width (ft) | 10.5 | 18.6 | 14.6 | 6.5 | 7.9 | 7.2 | 15.8 | 32.5 | 24.2 | | | >50.0 | 33.0 | 50.0 | 42.0 |
| BF Cross-Sect. Area ($ft^2$) | 10.2 | 10.2 | 10.2 | 2.5 | 2.6 | 2.6 | 9.7 | 9.8 | 9.8 | | | 18.3 | 7.0 | 12.1 | 10.0 |
| BF Mean Depth (ft) | 0.9 | 1.4 | 1.1 | 0.6 | 0.6 | 0.6 | 1.0 | 1.3 | 1.1 | | | 1.3 | 0.6 | 1.0 | 0.9 |
| BF Max. Depth (ft) | 1.7 | 1.8 | 1.7 | 1.0 | 1.0 | 1.0 | 1.5 | 1.8 | 1.7 | | | 1.8 | 1.1 | 1.6 | 1.3 |
| Width/Depth Ratio | 5.4 | 12.9 | 8.6 | 6.5 | 6.7 | 6.6 | 6.1 | 10.3 | 8.1 | | | 11.2 | 11.6 | 20.2 | 13.9 |
| Entrenchment Ratio | 1.4 | 1.6 | 1.5 | 1.6 | 1.9 | 1.8 | 1.8 | 3.7 | 2.7 | | | >3.0 | 2.8 | 4.2 | 3.6 |
| Wetted Perimeter (ft) | | | 12.9 | | | 5.3 | | | 11.5 | | | 17.1 | 9.3 | 13.8 | 11.4 |
| Hydraulic Radius (ft) | | | 1.4 | | | 0.5 | | | 0.9 | | | 1.1 | 0.7 | 0.9 | 0.8 |
| **Pattern** | | | | | | | | | | | | | | | |
| Channel Beltwidth (ft) | 19.9 | 90.5 | 42.1 | | | 19.1 | 15.5 | 39.1 | 28.8 | 23.7 | 74.0 | 41.8 | 33.5 | 92.0 | 62.0 |
| Radius of Curvature. (ft) | 8.4 | 70.0 | 26.0 | 1.4 | 7.2 | 3.4 | 4.0 | 10.6 | 7.6 | 24.0 | 50.0 | 30.8 | 18.0 | 47.0 | 30.8 |
| Meander Wavelength (ft) | 21.3 | 87.8 | 41.3 | 2.5 | 10.4 | 5.1 | 10.2 | 23.2 | 15.2 | 68.7 | 164.2 | 104.5 | 74.0 | 150.0 | 102.5 |
| Meander Width Ratio | 2.1 | 9.5 | 4.4 | | | 4.7 | 1.8 | 4.4 | 3.3 | 1.6 | 5.1 | 2.9 | 2.8 | 7.8 | 5.3 |
| **Profile** | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 5.3 | 45.8 | 25.5 | 1.6 | 12.2 | 6.3 | 3.1 | 10.6 | 6.1 | | | 10.0 | | | 10.0 |
| Riffle Slope (ft) | 0.007 | 0.049 | 0.022 | 0.009 | 0.088 | 0.035 | 0.011 | 0.018 | 0.014 | | | 0.015 | 0.012 | 0.039 | 0.028 |
| Pool Length (ft) | 11.6 | 85.7 | 25.4 | | | 3.9 | 4.9 | 27.9 | 15.0 | 13.0 | 45.0 | 26.4 | 13.1 | 39.1 | 23.6 |
| Pool Spacing (ft) | 33.4 | 823.7 | 111.3 | | | 22.6 | 20.9 | 56.3 | 34.6 | 34.0 | 125.0 | 60.1 | 36.8 | 119.1 | 81.7 |
| **Substrate** | | | | | | | | | | | | | | | |
| d50 (mm) | | | 1.2 | | | 1.8 | | | 0.3 | | | 1.2 | | | 0.2 |
| d84 (mm) | | | 10.2 | | | 10.2 | | | 10.9 | | | 10.2 | | | 0.8 |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | |
| Valley Length (ft) | | | 1119 | | | 33 | | | 156 | | | 1586 | | | 1586 |
| Channel Length (ft) | | | 1560 | | | 50 | | | 258 | | | 1943 | | | 1934 |
| Sinuosity | | | 1.4 | | | 1.5 | | | 1.7 | | | 1.3 | | | 1.2 |
| Water Surface Slope (ft/ft) | | | 0.004 | | | 0.013 | | | 0.007 | | | 0.006 | | | 0.006 |
| BF Slope (ft/ft) | | | 0.004 | | | 0.013 | | | 0.007 | | | 0.006 | | | 0.006 |
| Rosgen Classification | | | G5 | | | B4c | | | E5 | | | C5 | | | C5 |

**Exhibit Table XII Continued. Baseline Morphology and Hydraulic Summary Continued**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**
**Reach 2 – Ellington Branch Downstream of Confluence with Unnamed Tributary**

| Parameter | Pre-Existing Condition | | | Project Reference Stream – UT Ellington | | | Project Reference Stream – Hawtree Creek | | | Design | | | As-Built | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** |
| BF Width (ft) | 9.2 | 11.9 | 10.6 | 4.1 | 4.1 | 4.1 | 7.7 | 9.3 | 8.9 | | | 15.5 | 11.6 | 16.6 | 14.9 |
| Floodprone Width (ft) | 27.7 | 193.0 | 110.3 | 6.5 | 7.9 | 7.2 | 15.8 | 32.5 | 24.2 | | | >50.0 | 40.0 | 58.0 | 47.7 |
| BF Cross-Sect. Area ($ft^2$) | 12.4 | 13.8 | 13.1 | 2.5 | 2.6 | 2.6 | 9.7 | 9.8 | 9.8 | | | 21.6 | 11.6 | 16.6 | 14.3 |
| BF Mean Depth (ft) | 1.0 | 1.5 | 1.2 | 0.6 | 0.6 | 0.6 | 1.0 | 1.3 | 1.1 | | | 1.4 | 0.8 | 1.2 | 1.0 |
| BF Max. Depth (ft) | 2.1 | 2.2 | 2.2 | 1.0 | 1.0 | 1.0 | 1.5 | 1.8 | 1.7 | | | 2.0 | 1.6 | 1.9 | 1.7 |
| Width/Depth Ratio | 6.1 | 11.4 | 8.5 | 6.5 | 6.7 | 6.6 | 6.1 | 10.3 | 8.1 | | | 11.1 | 10.6 | 20.1 | 15.5 |
| Entrenchment Ratio | 2.3 | 20.8 | 10.4 | 1.6 | 1.9 | 1.8 | 1.8 | 3.7 | 2.7 | | | >3.2 | 2.7 | 3.9 | 3.2 |
| Wetted Perimeter (ft) | | | 16.64 | | | 5.3 | | | 11.5 | | | 18.3 | 13.0 | 15.5 | 14.6 |
| Hydraulic Radius (ft) | | | 1.3 | | | 0.5 | | | 0.9 | | | 1.2 | 0.8 | 1.1 | 0.93 |
| **Pattern** | | | | | | | | | | | | | | | |
| Channel Beltwidth (ft) | 22.5 | 64.0 | 37.5 | | | 19.1 | 15.5 | 39.1 | 28.8 | 20.7 | 71.1 | 47.3 | 51.0 | 122.0 | 75.8 |
| Radius of Curvature. (ft) | 7.7 | 67.6 | 23.3 | 1.4 | 7.2 | 3.4 | 4.0 | 10.6 | 7.6 | 24.0 | 47.8 | 30.1 | 22.0 | 66.0 | 33.4 |
| Meander Wavelength (ft) | 14.0 | 90.2 | 34.9 | 2.5 | 10.4 | 5.1 | 10.2 | 23.2 | 15.2 | 70.5 | 151.9 | 110.0 | 83.8 | 168.0 | 111.4 |
| Meander Width Ratio | 2.1 | 6.0 | 3.5 | | | 4.7 | 1.8 | 4.4 | 3.3 | 1.3 | 4.6 | 3.1 | 3.4 | 8.2 | 5.1 |
| **Profile** | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 4.5 | 47.9 | 25.5 | 1.6 | 12.2 | 6.3 | 3.1 | 10.6 | 6.1 | | | 10.0 | 10.0 | 10.0 | 10.0 |
| Riffle Slope (ft) | 0.007 | 0.052 | 0.022 | 0.009 | 0.088 | 0.035 | 0.011 | 0.018 | 0.014 | | | 0.015 | 0.016 | 0.035 | 0.024 |
| Pool Length (ft) | 11.6 | 85.7 | 25.4 | | | 3.9 | 4.9 | 27.9 | 15.0 | 9.0 | 50.0 | 23.1 | 14.3 | 32.2 | 24.1 |
| Pool Spacing (ft) | 33.4 | 823.7 | 111.3 | | | 22.6 | 20.9 | 56.3 | 34.6 | 40.0 | 103.0 | 72.9 | 38.3 | 147.4 | 75.6 |
| **Substrate** | | | | | | | | | | | | | | | |
| d50 (mm) | | | 0.41 | | | 1.8 | | | 0.3 | | | 0.4 | | | 0.2 |
| d84 (mm) | | | 4.0 | | | 10.2 | | | 10.9 | | | 10.0 | | | 4.5 |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | |
| Valley Length (ft) | | | 1846 | | | 33 | | | 156 | | | 1370 | | | 1370 |
| Channel Length (ft) | | | 2476 | | | 50 | | | 258 | | | 1810 | | | 1801 |
| Sinuosity | | | 1.3 | | | 1.5 | | | 1.7 | | | 1.3 | | | 1.3 |
| Water Surface Slope (ft/ft) | | | 0.006 | | | 0.013 | | | 0.007 | | | 0.006 | | | 0.006 |
| BF Slope (ft/ft) | | | 0.006 | | | 0.013 | | | 0.007 | | | 0.006 | | | 0.006 |
| Rosgen Classification | | | E5 | | | B4c | | | E5 | | | C5 | | | C5 |

## Exhibit Table XII. Baseline Morphology and Hydraulic Summary Continued

**Ellington Branch Stream Restoration (Project No. 16-D06045)**
**Reach 3 – Unnamed Tributary to Ellington Branch**

| Parameter | Pre-Existing Condition | | | Project Reference Stream – UT Ellington | | | Project Reference Stream – Hawtree Creek | | | Design | | | As-Built | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** | **Min.** | **Max.** | **Med.** |
| BF Width (ft) | 8.3 | 14.5 | 11.4 | 4.1 | 4.1 | 4.1 | 7.7 | 9.3 | 8.9 | | | 8.0 | 6.9 | 9.3 | 7.7 |
| Floodprone Width (ft) | 15.8 | 34.0 | 24.9 | 6.5 | 7.9 | 7.2 | 15.8 | 32.5 | 24.2 | | | >30.0 | 22.0 | 29.0 | 27.0 |
| BF Cross-Sect. Area ($ft^2$) | 4.7 | 6.4 | 5.6 | 2.5 | 2.6 | 2.6 | 9.7 | 9.8 | 9.8 | | | 4.5 | 4.1 | 6.0 | 4.9 |
| BF Mean Depth (ft) | 0.4 | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | 1.0 | 1.3 | 1.1 | | | 0.6 | 0.6 | 0.7 | 0.7 |
| BF Max. Depth (ft) | 0.7 | 1.1 | 0.9 | 1.0 | 1.0 | 1.0 | 1.5 | 1.8 | 1.7 | | | 0.8 | 0.9 | 1.0 | 1.0 |
| Width/Depth Ratio | 14.7 | 32.9 | 23.8 | 6.5 | 6.7 | 6.6 | 6.1 | 10.3 | 8.1 | | | 13.3 | 10.5 | 14.4 | 11.8 |
| Entrenchment Ratio | 1.4 | 3.0 | 2.2 | 1.6 | 1.9 | 1.8 | 1.8 | 3.7 | 2.7 | | | >3.7 | 2.9 | 3.8 | 3.5 |
| Wetted Perimeter (ft) | | | 12.4 | | | 5.3 | | | 11.5 | | | 9.2 | 6.5 | 8.4 | 7.6 |
| Hydraulic Radius (ft) | | | 0.5 | | | 0.5 | | | 0.9 | | | 0.5 | 0.4 | 0.6 | 0.53 |
| **Pattern** | | | | | | | | | | | | | | | |
| Channel Beltwidth (ft) | 19.8 | 67.0 | 40.0 | | | 19.1 | 15.5 | 39.1 | 28.8 | 11.4 | 42.5 | 23.3 | 36.7 | 60.0 | 47.7 |
| Radius of Curvature (ft) | 11.1 | 58.4 | 33.5 | 1.4 | 7.2 | 3.4 | 4.0 | 10.6 | 7.6 | 13.0 | 25.0 | 17.3 | 13.3 | 28.3 | 18.2 |
| Meander Wavelength (ft) | 23.7 | 87.0 | 44.1 | 2.5 | 10.4 | 5.1 | 10.2 | 23.2 | 15.2 | 29.7 | 97.8 | 61.7 | 44.0 | 95.0 | 56.0 |
| Meander Width Ratio | 1.7 | 5.9 | 3.5 | | | 4.7 | 1.8 | 4.4 | 3.3 | 1.4 | 5.3 | 2.9 | 4.8 | 7.8 | 6.2 |
| **Profile** | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 13.8 | 58.0 | 27.4 | 1.6 | 12.2 | 6.3 | 3.1 | 10.6 | 6.1 | | | 5.0 | 5.0 | 5.0 | 5.0 |
| Riffle Slope (ft) | 0.005 | 0.029 | 0.019 | 0.009 | 0.088 | 0.035 | 0.011 | 0.018 | 0.014 | | | 0.02 | 0.012 | 0.039 | 0.025 |
| Pool Length (ft) | | | 17.2 | | | 3.9 | 4.9 | 27.9 | 15.0 | 10.0 | 21.0 | 14.0 | 9.2 | 36.0 | 15.7 |
| Pool Spacing (ft) | | | | | | 22.6 | 20.9 | 56.3 | 34.6 | 27.0 | 89.0 | 51.0 | 19.7 | 86.3 | 44.2 |
| **Substrate** | | | | | | | | | | | | | | | |
| d50 (mm) | | | 0.4 | | | 1.8 | | | 0.3 | | | 0.4 | | | 0.3 |
| d84 (mm) | | | 11.8 | | | 10.2 | | | 10.9 | | | 11.8 | | | 0.6 |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | |
| Valley Length (ft) | | | 702 | | | 33 | | | 156 | | | 1074 | | | 1074 |
| Channel Length (ft) | | | 854 | | | 50 | | | 258 | | | 1343 | | | 1328 |
| Sinuosity | | | 1.2 | | | 1.5 | | | 1.7 | | | 1.3 | | | 1.3 |
| Water Surface Slope (ft/ft) | | | 0.008 | | | 0.013 | | | 0.007 | | | 0.009 | | | 0.008 |
| BF Slope (ft/ft) | | | 0.008 | | | 0.013 | | | 0.007 | | | 0.009 | | | 0.008 |
| Rosgen Classification | | | C5 | | | B4c | | | E5 | | | C5 | | | C5 |

## Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary

**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| | Cross Section 1 Pool (Ellington Branch) | | | | | Cross Section 2 Riffle (Ellington Branch) | | | | | Cross Section 3 Pool (Ellington Branch) | | | | | Cross Section 4 Riffle (Ellington Branch) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** |
| BF Width (ft) | 12.9 | | | | | 8.9 | | | | | 15.5 | | | | | 10.0 | | | | |
| Floodprone Width (ft) | | | | | | 33.0 | | | | | | | | | | 50.0 | | | | |
| BF Cross-Sect. Area ($ft^2$) | 21.6 | | | | | 6.4 | | | | | 24.9 | | | | | 7.7 | | | | |
| BF Mean Depth (ft) | 1.7 | | | | | 0.7 | | | | | 1.6 | | | | | 0.8 | | | | |
| BF Max. Depth (ft) | 3.3 | | | | | 1.0 | | | | | 3.2 | | | | | 1.2 | | | | |
| Width/Depth Ratio | | | | | | 12.4 | | | | | | | | | | 12.9 | | | | |
| Entrenchment Ratio | | | | | | 3.7 | | | | | | | | | | 5.0 | | | | |
| Wetted Perimeter (ft) | 15.8 | | | | | 9.3 | | | | | 16.9 | | | | | 10.4 | | | | |
| Hydraulic Radius (ft) | 1.4 | | | | | 0.7 | | | | | 1.5 | | | | | 0.7 | | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | 0.17 | | | | | 0.3 | | | | | 0.3 | | | | | 0.3 | | | | |
| d84 (mm) | 0.25 | | | | | 3.6 | | | | | 1.2 | | | | | 0.7 | | | | |

| | Cross Section 5 Pool (Ellington Branch) | | | | | Cross Section 6 Riffle (Ellington Branch) | | | | | Cross Section 7 Riffle (Ellington Branch) | | | | | Cross Section 8 Pool (Ellington Branch) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** |
| BF Width (ft) | 22.2 | | | | | 11.6 | | | | | 13.4 | | | | | 16.6 | | | | |
| Floodprone Width (ft) | | | | | | 38.0 | | | | | 46.0 | | | | | | | | | |
| BF Cross-Sect. Area ($ft^2$) | 18.0 | | | | | 11.0 | | | | | 12.6 | | | | | 19.3 | | | | |
| BF Mean Depth (ft) | 0.8 | | | | | 0.9 | | | | | 0.9 | | | | | 1.2 | | | | |
| BF Max. Depth (ft) | 2.3 | | | | | 1.4 | | | | | 1.5 | | | | | 2.5 | | | | |
| Width/Depth Ratio | | | | | | 12.3 | | | | | 14.2 | | | | | | | | | |
| Entrenchment Ratio | | | | | | 3.3 | | | | | 3.4 | | | | | | | | | |
| Wetted Perimeter (ft) | 23.6 | | | | | 12.2 | | | | | 13.8 | | | | | 18.1 | | | | |
| Hydraulic Radius (ft) | 0.8 | | | | | 0.9 | | | | | 0.9 | | | | | 1.1 | | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | 0.2 | | | | | 0.1 | | | | | 2.6 | | | | | 0.2 | | | | |
| d84 (mm) | 0.6 | | | | | 0.2 | | | | | 6.8 | | | | | 0.3 | | | | |

## Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary Continued

**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Parameter | Cross Section 9 Pool (Ellington Branch) | | | | | Cross Section 10 Riffle (Ellington Branch) | | | | | Cross Section 11 Pool (Ellington Branch) | | | | | Cross Section 12 Riffle (Ellington Branch) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** |
| BF Width (ft) | 15.2 | | | | | 14.9 | | | | | 25.5 | | | | | 12.0 | | | | |
| Floodprone Width (ft) | | | | | | 45.0 | | | | | | | | | | 58.0 | | | | |
| BF Cross-Sect. Area ($ft^2$) | 23.1 | | | | | 12.1 | | | | | 28.3 | | | | | 13.9 | | | | |
| BF Mean Depth (ft) | 1.5 | | | | | 0.8 | | | | | 1.1 | | | | | 1.2 | | | | |
| BF Max. Depth (ft) | 2.8 | | | | | 1.7 | | | | | 3.2 | | | | | 2.0 | | | | |
| Width/Depth Ratio | | | | | | 18.2 | | | | | | | | | | 10.4 | | | | |
| Entrenchment Ratio | | | | | | 3.0 | | | | | | | | | | 4.8 | | | | |
| Wetted Perimeter (ft) | 16.6 | | | | | 15.5 | | | | | 27.8 | | | | | 13.0 | | | | |
| Hydraulic Radius (ft) | 1.4 | | | | | 0.8 | | | | | 1.0 | | | | | 1.1 | | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | 0.2 | | | | | 0.1 | | | | | 0.2 | | | | | | | | | |
| d84 (mm) | 0.4 | | | | | 2.0 | | | | | 0.3 | | | | | | | | | |

| Parameter | Cross Section 13 Pool (Ellington Branch) | | | | | Cross Section 14 Riffle (Ellington Branch) | | | | | Cross Section 15 Pool (Ellington Branch) | | | | | Cross Section 16 Pool (Unnamed Tributary) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** |
| BF Width (ft) | 23.6 | | | | | 14.1 | | | | | 18.9 | | | | | 13.7 | | | | |
| Floodprone Width (ft) | | | | | | 40.0 | | | | | | | | | | | | | | |
| BF Cross-Sect. Area ($ft^2$) | 26.5 | | | | | 13.2 | | | | | 27.8 | | | | | 11.0 | | | | |
| BF Mean Depth (ft) | 1.1 | | | | | 0.9 | | | | | 1.5 | | | | | 0.8 | | | | |
| BF Max. Depth (ft) | 2.8 | | | | | 2.2 | | | | | 3.7 | | | | | 1.8 | | | | |
| Width/Depth Ratio | | | | | | 15.1 | | | | | | | | | | | | | | |
| Entrenchment Ratio | | | | | | 2.8 | | | | | | | | | | | | | | |
| Wetted Perimeter (ft) | 24.6 | | | | | 15.2 | | | | | 20.8 | | | | | 14.6 | | | | |
| Hydraulic Radius (ft) | 1.1 | | | | | 0.9 | | | | | 1.3 | | | | | 0.8 | | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | 0.4 | | | | | 0.6 | | | | | 0.2 | | | | | 0.6 | | | | |
| d84 (mm) | 1.1 | | | | | 1.9 | | | | | 0.3 | | | | | 1.8 | | | | |

## Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary Continued

**Ellington Branch Stream Restoration (Project No. 16-D06045)**

| Parameter | Cross Section 17 Riffle (Unnamed Tributary) | | | | | Cross Section 18 Pool (Unnamed Tributary) | | | | | Cross Section 19 Riffle (Unnamed Tributary) | | | | | Cross Section 20 Pool (Unnamed Tributary) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** |
| BF Width (ft) | 6.2 | | | | | 9.4 | | | | | 6.8 | | | | | 9.2 | | | | |
| Floodprone Width (ft) | 22.0 | | | | | | | | | | 29.0 | | | | | | | | | |
| BF Cross-Sect. Area ($ft^2$) | 2.7 | | | | | 7.2 | | | | | 4.0 | | | | | 7.2 | | | | |
| BF Mean Depth (ft) | 0.4 | | | | | 0.8 | | | | | 0.6 | | | | | 0.8 | | | | |
| BF Max. Depth (ft) | 0.8 | | | | | 1.8 | | | | | 0.8 | | | | | 2.1 | | | | |
| Width/Depth Ratio | 14.1 | | | | | | | | | | 11.5 | | | | | | | | | |
| Entrenchment Ratio | 3.6 | | | | | | | | | | 4.3 | | | | | | | | | |
| Wetted Perimeter (ft) | 6.5 | | | | | 10.8 | | | | | 7.1 | | | | | 10.6 | | | | |
| Hydraulic Radius (ft) | 0.4 | | | | | 0.7 | | | | | 0.6 | | | | | 0.7 | | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | 0.3 | | | | | 0.3 | | | | | 0.2 | | | | | 0.2 | | | | |
| d84 (mm) | 0.6 | | | | | 0.5 | | | | | 0.4 | | | | | 0.4 | | | | |

| Parameter | Cross Section 21 Riffle (Unnamed Tributary) | | | | | Cross Section 22 Pool (Unnamed Tributary) | | | | | Cross Section 23 Riffle (Unnamed Tributary) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** | **MY1** | **MY2** | **MY3** | **MY4** | **MY5** |
| BF Width (ft) | 7.9 | | | | | 14.5 | | | | | 8.0 | | | | | | | | | |
| Floodprone Width (ft) | 29.0 | | | | | | | | | | 28.0 | | | | | | | | | |
| BF Cross-Sect. Area ($ft^2$) | 4.1 | | | | | 10.3 | | | | | 4.9 | | | | | | | | | |
| BF Mean Depth (ft) | 0.5 | | | | | 0.7 | | | | | 0.6 | | | | | | | | | |
| BF Max. Depth (ft) | 0.9 | | | | | 1.5 | | | | | 1.2 | | | | | | | | | |
| Width/Depth Ratio | 15.2 | | | | | | | | | | 12.9 | | | | | | | | | |
| Entrenchment Ratio | 3.7 | | | | | | | | | | 3.5 | | | | | | | | | |
| Wetted Perimeter (ft) | 8.3 | | | | | 14.9 | | | | | 8.4 | | | | | | | | | |
| Hydraulic Radius (ft) | 0.5 | | | | | 0.7 | | | | | 0.6 | | | | | | | | | |
| **Substrate** | | | | | | | | | | | | | | | | | | | | |
| d50 (mm) | 0.3 | | | | | 0.3 | | | | | 0.3 | | | | | | | | | |
| d84 (mm) | 1.5 | | | | | 0.6 | | | | | 0.4 | | | | | | | | | |

**Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary Continued**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**
**Reach 1 – Ellington Branch Upstream of Confluence with Unnamed Tributary (Profile Reaches 1 and 2)**

| Parameter | MY 1 (2008) | | | MY 2 (2009) | | | MY 3 (2010) | | | MY 4 (2011) | | | MY 5 (2012) | | | MY + (2012) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pattern** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** |
| Channel Beltwidth (ft) | 33.5 | 92.0 | 62.0 | | | | | | | | | | | | | | | |
| Radius of Curvature (ft) | 18.0 | 47.0 | 30.8 | | | | | | | | | | | | | | | |
| Meander Wavelength (ft) | 74.0 | 150.0 | 102.5 | | | | | | | | | | | | | | | |
| Meander Width Ratio | 2.8 | 7.8 | 5.3 | | | | | | | | | | | | | | | |
| **Profile** | | | | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 9.5 | 20.0 | 15.8 | | | | | | | | | | | | | | | |
| Riffle Slope (ft/ft) | 0.004 | 0.028 | 0.01 | | | | | | | | | | | | | | | |
| Pool Length (ft) | 11.0 | 67.1 | 23.2 | | | | | | | | | | | | | | | |
| Pool Slope (ft/ft) | 0.000 | 0.006 | 0.001 | | | | | | | | | | | | | | | |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | 1586 | | | | | | | | | | | | | | | | | |
| Channel Length (ft) | 1934 | | | | | | | | | | | | | | | | | |
| Sinuosity | 1.22 | | | | | | | | | | | | | | | | | |
| Water Surface Slope (ft/ft) | 0.007 | | | | | | | | | | | | | | | | | |
| BF Slope (ft/ft) | 0.007 | | | | | | | | | | | | | | | | | |
| Rosgen Classification | C5 | | | | | | | | | | | | | | | | | |

**Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary Continued**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**
**Reach 2 – Ellington Branch Downstream of Confluence with Unnamed Tributary (Profile Reaches 3 and 4)**

| Parameter | MY 1 (2008) | | | MY 2 (2009) | | | MY 3 (2010) | | | MY 4 (2011) | | | MY 5 (2012) | | | MY + (2012) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pattern** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** |
| Channel Beltwidth (ft) | 51.0 | 122.0 | 75.8 | | | | | | | | | | | | | | | |
| Radius of Curvature (ft) | 22.0 | 66.0 | 33.4 | | | | | | | | | | | | | | | |
| Meander Wavelength (ft) | 83.8 | 168.0 | 111.4 | | | | | | | | | | | | | | | |
| Meander Width Ratio | 3.4 | 8.2 | 5.1 | | | | | | | | | | | | | | | |
| **Profile** | | | | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 9.1 | 23.6 | 14.5 | | | | | | | | | | | | | | | |
| Riffle Slope (ft/ft) | 0.003 | 0.028 | 0.011 | | | | | | | | | | | | | | | |
| Pool Length (ft) | 11.1 | 53.3 | 27.3 | | | | | | | | | | | | | | | |
| Pool Slope (ft/ft) | 0.000 | 0.003 | 0.001 | | | | | | | | | | | | | | | |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | 1370 | | | | | | | | | | | | | | | | | |
| Channel Length (ft) | 1801 | | | | | | | | | | | | | | | | | |
| Sinuosity | 1.31 | | | | | | | | | | | | | | | | | |
| Water Surface Slope (ft/ft) | 0.006 | | | | | | | | | | | | | | | | | |
| BF Slope (ft/ft) | 0.006 | | | | | | | | | | | | | | | | | |
| Rosgen Classification | C5 | | | | | | | | | | | | | | | | | |

**Exhibit Table XIII. Morphology and Hydraulic Monitoring Summary Continued**
**Ellington Branch Stream Restoration (Project No. 16-D06045)**
**Reach 3 – Unnamed Tributary to Ellington Branch (Profile Reaches 5 and 6)**

| Parameter | MY 1 (2008) | | | MY 2 (2009) | | | MY 3 (2010) | | | MY 4 (2011) | | | MY 5 (2012) | | | MY + (2012) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pattern** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** | **Min** | **Max** | **Med** |
| Channel Beltwidth (ft) | 36.7 | 60.0 | 47.7 | | | | | | | | | | | | | | | |
| Radius of Curvature (ft) | 13.3 | 28.3 | 18.2 | | | | | | | | | | | | | | | |
| Meander Wavelength (ft) | 44.0 | 95.0 | 56.0 | | | | | | | | | | | | | | | |
| Meander Width Ratio | 4.8 | 7.8 | 6.2 | | | | | | | | | | | | | | | |
| **Profile** | | | | | | | | | | | | | | | | | | |
| Riffle Length (ft) | 4.4 | 13.6 | 10.7 | | | | | | | | | | | | | | | |
| Riffle Slope (ft/ft) | 0.005 | 0.036 | 0.019 | | | | | | | | | | | | | | | |
| Pool Length (ft) | 7.5 | 24.9 | 15.4 | | | | | | | | | | | | | | | |
| Pool Slope (ft/ft) | 0.000 | 0.004 | 0.001 | | | | | | | | | | | | | | | |
| **Additional Reach Parameters** | | | | | | | | | | | | | | | | | | |
| Valley Length (ft) | 1074 | | | | | | | | | | | | | | | | | |
| Channel Length (ft) | 1328 | | | | | | | | | | | | | | | | | |
| Sinuosity | 1.24 | | | | | | | | | | | | | | | | | |
| Water Surface Slope (ft/ft) | 0.008 | | | | | | | | | | | | | | | | | |
| BF Slope (ft/ft) | 0.008 | | | | | | | | | | | | | | | | | |
| Rosgen Classification | C5 | | | | | | | | | | | | | | | | | |

## SECTION VII. Methodology Section

This document employs methodologies according to the post-construction monitoring plan and standard regulatory guidance and procedures documents, including Stream Mitigation Guidelines (USACE, 2003), Corps of Engineers Wetland Delineation Manual (USACE, 1987) and Applied River Morphology (Rosgen, D.L., 1996). No other specifications were utilized in this monitoring assessment. References are provided below.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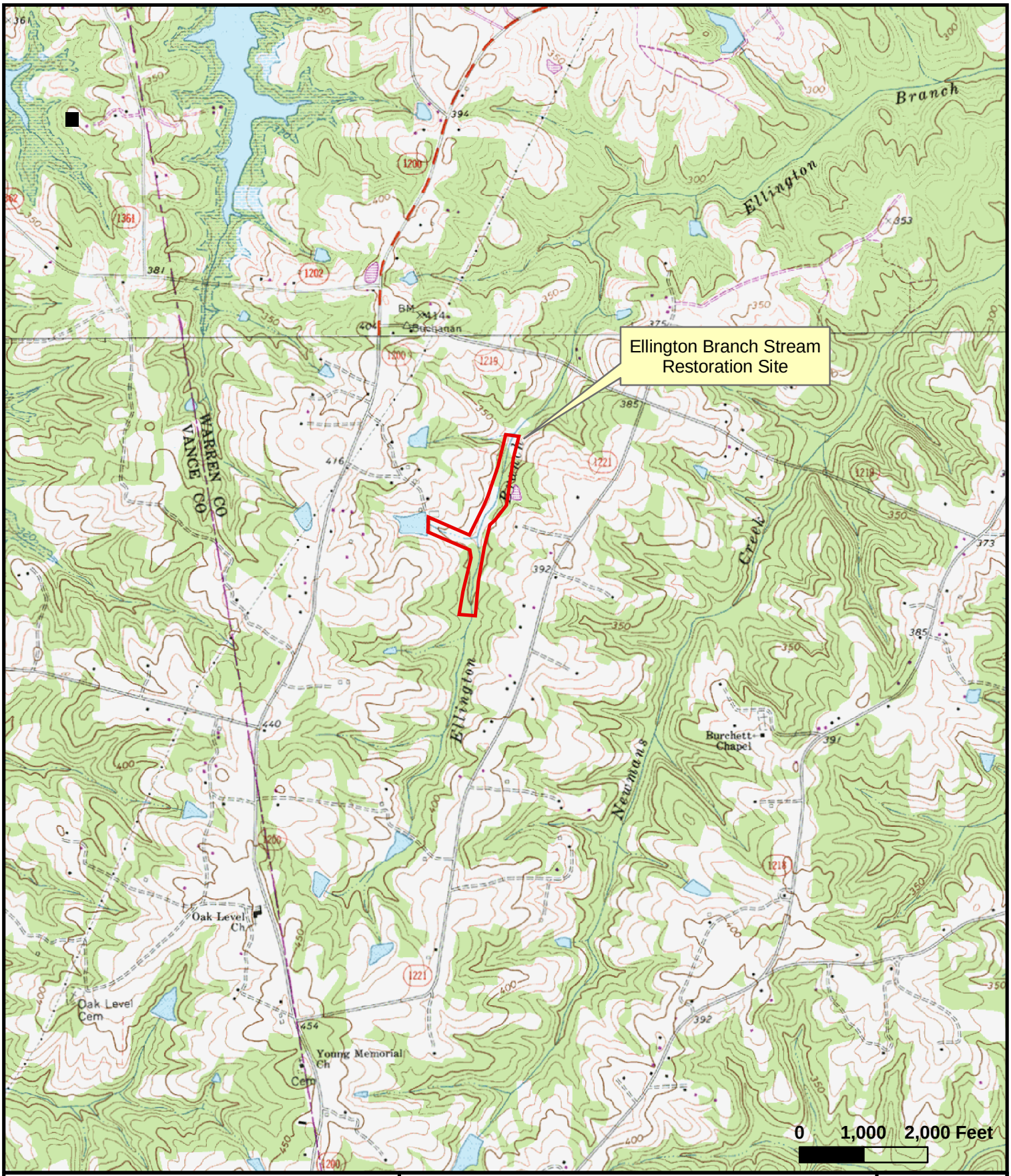



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# Ellington Branch Stream Restoration
## EEP # 16-D06045
## Vicinity Map
## Warren County, NC

**October 16, 2006**

Source: USGS Quadrangle Maps (John H Kerr Dam and Middleburg)

**FIGURE 1**

## APPENDIX A-1: Vegetation Raw Data

| COMMON NAME | SCIENTIFIC NAME | STEM COUNTS | | | | | | | | | | | | | Initial Totals | Year 1 Totals | Year 2 Totals | Year 3 Totals | Year 4 Totals | Year 5 Totals | Surviv. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | VP #1 | VP #2 | VP #3 | VP #4 | VP #5 | VP #6 | VP #7 | VP #8 | VP #9 | VP #10 | VP #11 | VP #12 | VP #13 | | | | | | | |
| Tag alder | *Alnus serrulata* | | | 1 | | | | | | | | | | | 1 | 1 | | | | | 100 |
| Paw Paw | *Asimina triloba* | | | | | | | | | | | | | | 14 | 0 | | | | | 0 |
| River birch | *Betula nigra* | 6 | 7 | 6 | 1 | | | | | 23 | 7 | 21 | 13 | | 86 | 84 | | | | | 98 |
| Sugarberry | *Celtis laeviagata* | | | | | | | | | | | | | | 11 | 0 | | | | | 0 |
| Red bud | *Cercis canadensis* | 3 | | | | | | 1 | 2 | 1 | | | | | 11 | 7 | | | | | 64 |
| Flowering dogwood | *Cornus florida* | | | | | | | | | | | | | | 6 | 0 | | | | | 0 |
| Persimmon | *Diospyros virginiana* | | | 11 | | 1 | 6 | 6 | | 5 | | | | | 37 | 29 | | | | | 78 |
| Green ash | *Fraxinus pennsylvanica* | | 3 | 5 | | | | 15 | 23 | | | | 10 | | 56 | 56 | | | | | 100 |
| Blackgum | *Nyssa sylvatica* | | | | | | | | | | | | | | 13 | 0 | | | | | 0 |
| Sycamore | *Platanus occidentalis* | 5 | 3 | 5 | 2 | | | 6 | 3 | | 8 | | | | 36 | 32 | | | | | 89 |
| White oak | *Quercus alba* | | | | | 5 | 1 | | | | | | | 1 | 11 | 7 | | | | | 64 |
| Swamp chestnut oak | *Quercus michauxii* | | 5 | 1 | 13 | 6 | 15 | | | | | 2 | 1 | 3 | 51 | 46 | | | | | 90 |
| Willow oak | *Quercus phellos* | | 4 | | | 6 | | 1 | 1 | | | 1 | 1 | 11 | 26 | 25 | | | | | 96 |
| Black willow | *Salix nigra* | | | 1 | | | | | | | | | | | 1 | 1 | | | | | 100 |
| | | | | | | | | | | | | | | Totals | 360 | 288 | 0 | 0 | 0 | 0 | |
| Total Number of Individuals Planted | | 26 | 26 | 30 | 26 | 26 | 26 | 30 | 30 | 30 | 26 | 28 | 30 | 26 | | | | | | | |
| Plot Size (square meters) | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | | | | | | |
| Total Number of Individuals Observed (2008) | | 14 | 22 | 30 | 16 | 18 | 22 | 29 | 29 | 29 | 15 | 24 | 25 | 15 | | | | | | | |
| Total Number of Individuals Observed (2009) | | | | | | | | | | | | | | | | | | | | | |
| Total Number of Individuals Observed (2010) | | | | | | | | | | | | | | | | | | | | | |
| Total Number of Individuals Observed (2011) | | | | | | | | | | | | | | | | | | | | | |
| Total Number of Individuals Observed (2012) | | | | | | | | | | | | | | | | | | | | | |
| Plot Size (square meters) | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | | | | | | |
| Stems/Acre (Initial) | | 1053 | 1053 | 1215 | 1053 | 1053 | 1053 | 1215 | 1215 | 1215 | 1053 | 1134 | 1215 | 1053 | | | | | | | |
| Stems/Acre (2008) | | 567 | 891 | 1215 | 648 | 729 | 891 | 1174 | 1174 | 1174 | 607 | 972 | 1012 | 607 | | | | | | | |
| Stems/Acre (2009) | | | | | | | | | | | | | | | | | | | | | |
| Stems/Acre (2010) | | | | | | | | | | | | | | | | | | | | | |
| Stems/Acre (2011) | | | | | | | | | | | | | | | | | | | | | |
| Stems/Acre (2012) | | | | | | | | | | | | | | | | | | | | | |

**Notes:**

| | |
|---|---|
| Year 1 Monitoring | 2008 |
| Year 2 Monitoring | 2009 |
| Year 3 Monitoring | 2010 |
| Year 4 Monitoring | 2011 |
| Year 5 Monitoring | 2012 |

# APPENDIX A-2: Vegetation Monitoring Plot Photograph Summary

| Photograph Number and Location | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs | Year 2010 Monitoring Photographs |
|---|---|---|---|
| Photo # VP-1 Facing north at Vegetation Plot #1 |  | | |
| Photo # VP-2 Facing north at Vegetation Plot #2 |  | | |
| Photo # VP-3 Facing north at Vegetation Plot #3 |  | | |

# APPENDIX A-2: Vegetation Monitoring Plot Photograph Summary Continued

| Photograph Number and Location | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs | Year 2010 Monitoring Photographs |
|---|---|---|---|
| Photo # VP-4 Facing north at Vegetation Plot #4 |  | | |
| Photo # VP-5 Facing north at Vegetation Plot #5 |  | | |
| Photo # VP-6 Facing north at Vegetation Plot #6 |  | | |

# APPENDIX A-2: Vegetation Monitoring Plot Photograph Summary Continued

| Photograph Number and Location | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs | Year 2010 Monitoring Photographs |
|---|---|---|---|
| Photo # VP-7<br>Facing north at<br>Vegetation Plot #7 |  | | |
| Photo # VP-8<br>Facing north at<br>Vegetation Plot #8 |  | | |
| Photo # VP-9<br>Facing north at<br>Vegetation Plot #9 |  | | |

# APPENDIX A-2: Vegetation Monitoring Plot Photograph Summary Continued

| Photograph Number and Location | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs | Year 2010 Monitoring Photographs |
|---|---|---|---|
| Photo # VP-10<br>Facing north at<br>Vegetation Plot #10 |  | | |
| Photo # VP-11<br>Facing north at<br>Vegetation Plot #11 |  | | |
| Photo # VP-12<br>Facing north at<br>Vegetation Plot #12 |  | | |

# APPENDIX A-2: Vegetation Monitoring Plot Photograph Summary Continued

| Photograph Number and Location | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs | Year 2010 Monitoring Photographs |
|---|---|---|---|
| Photo # VP-13<br>Facing north at<br>Vegetation Plot #13 |  | | |

# APPENDIX B-1: Stream Visual Assessment Table

| 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[1] | % Perform. in Stable Condition[2] | Feature Perform. Mean or Total[3] |
|---|---|---|---|---|---|---|
| A. Riffles | 1. Present?[4] | 75 | 81 | 65 | 93 | |
| | 2. Armor stable (e.g. no displacement)? | 75 | 81 | N/A | 93 | |
| | 3. Facet grade appears stable | 75 | 81 | 65 | 93 | |
| | 4. Minimal evidence of embedding/fining? | 75 | 81 | 65 | 93 | |
| | 5. Length appropriate? | 73 | 81 | 75 | 90 | **92%** |
| | | | | | | |
| B. Pools | 1. Present? (e.g. not subject to severe aggradation or migration?)[4] | 73 | 77 | 60 | 95 | |
| | 2. Sufficiently deep (Dmax:Dmean >1.6?) | 70 | 77 | 75 | 91 | |
| | 3. Length Appropriate? | 70 | 77 | 75 | 91 | **92%** |
| | | | | | | |
| C. Thalweg | 1. Upstream of meander bend (run/inflection) centering?[5] | N/A | N/A | N/A | 100 | |
| | 2. Downstream of meander (glide/inflection) centering?[5] | N/A | N/A | N/A | 100 | **100%** |
| | | | | | | |
| D. Meanders | 1. Outer bend in state of limited/controlled erosion? | 97 | 97 | N/A | 100 | |
| | 2. Of those eroding, # w/concomitant point bar formation? | 97 | 97 | N/A | 100 | |
| | 3. Apparent Rc within spec? | 97 | 97 | N/A | 100 | |
| | 4. Sufficient floodplain access and relief?[6] | 97 | 97 | N/A | 100 | **100%** |
| | | | | | | |
| E. Bed General | 1. General channel bed aggradation areas (bar formation) | N/A | N/A | N/A | 100 | |
| | 2. Channel bed degradation – areas of increasing down-cutting or head-cutting? | N/A | N/a | N/A | 100 | **100%** |
| | | | | | | |
| F. Vanes | 1. Free of back or arm scour? | 5 | 5 | N/A | 100 | |
| | 2. Height appropriate? | 5 | 5 | N/A | 100 | |
| | 3. Angle and geometry appear appropriate? | 5 | 5 | N/A | 100 | |
| | 4. Free of piping or other structural failures | 5 | 5 | N/A | 100 | **100%** |
| | | | | | | |
| G. Rootwads/ Boulders | 1. Free of scour? | 24 | 24 | N/A | 100 | |
| | 2. Footing stable? | 24 | 24 | N/A | 100 | **100%** |

**Footnotes:**

1. Metrics that are spatial estimates should be entered as:
   The number of locales over the reach for which the failing condition is observed / followed by the total linear distance (feet) or area for which the failing or unstable condition is observed.
2. In the case of categorical metrics for which a feature count is involved, this is simply calculated as the number of functional features that are in a state of stability as a percentage of the total. In the case of those metrics based on footage or aerial extent, it is the amount in a state of failure or instability expressed as a proportion of the total amount of that feature. The resulting proportion is then subtracted from 1 and then multiplied by 100 to give a percentage that represents the proportion of that feature category in a state of apparent stability.
3. The mean of the metrics for a given feature category.
4. Was the feature actually present as compared to the As-built or has the feature been completely obscured (aggraded) or removed (degraded).
5. Is the thalweg centering up on the channel in between the meander bends?
6. Is the meander bend in a state of constriction?

# APPENDIX B-2: Monitoring Photograph Summary

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #1 Facing north (downstream) at Cross Section #1 along Ellington Branch |  |  | |
| Photo #2 Facing west across Cross Section #1 along Ellington Branch |  |  | |
| Photo #3 Facing north (downstream) at Cross Section #2 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #4 Facing west across Cross Section #2 along Ellington Branch |  |  | |
| Photo #5 Facing north (downstream) at Cross Section #3 along Ellington Branch | *No photograph available* |  | |
| Photo #6 Facing west across Cross Section #3 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #7 Facing north (downstream) at Cross Section #4 along Ellington Branch |  |  | |
| Photo #8 Facing west across Cross Section #4 along Ellington Branch |  |  | |
| Photo #9 Facing north (downstream) at Cross Section #5 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #10 Facing west across Cross Section #5 along Ellington Branch |  |  | |
| Photo #11 Facing north (downstream) at Cross Section #6 along Ellington Branch |  |  | |
| Photo #12 Facing west across Cross Section #6 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #13 Facing north (downstream) at Cross Section #7 along Ellington Branch |  |  | |
| Photo #14 Facing west across Cross Section #7 along Ellington Branch |  |  | |
| Photo #15 Facing north (downstream) at Cross Section #8 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #16 Facing west across Cross Section #8 along Ellington Branch |  |  | |
| Photo #17 Facing north (downstream) at Cross Section #9 along Ellington Branch |  |  | |
| Photo #18 Facing west across Cross Section #9 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #19 Facing north (downstream) at Cross Section #10 along Ellington Branch |  |  | |
| Photo #20 Facing west across Cross Section #10 along Ellington Branch |  |  | |
| Photo #21 Facing north (downstream) at Cross Section #11 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #22 Facing west across Cross Section #11 along Ellington Branch |  |  | |
| Photo #23 Facing north (downstream) at Cross Section #12 along Ellington Branch |  |  | |
| Photo #24 Facing west across Cross Section #12 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #25 Facing north (downstream) at Cross Section #13 along Ellington Branch |  |  | |
| Photo #26 Facing west across Cross Section #13 along Ellington Branch |  |  | |
| Photo #27 Facing north (downstream) at Cross Section #14 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #28 Facing west across Cross Section #14 along Ellington Branch |  |  | |
| Photo #29 Facing north (downstream) at Cross Section #15 along Ellington Branch |  |  | |
| Photo #30 Facing west across Cross Section #15 along Ellington Branch |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #31 Facing east (downstream) at Cross Section #16 along the Unnamed Tributary |  |  | |
| Photo #32 Facing north across Cross Section #16 along the Unnamed Tributary |  |  | |
| Photo #33 Facing east (downstream) at Cross Section #17 along the Unnamed Tributary |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #34 Facing north across Cross Section #17 along the Unnamed Tributary |  |  | |
| Photo #35 Facing east (downstream) at Cross Section #18 along the Unnamed Tributary |  |  | |
| Photo #36 Facing north across Cross Section #18 along the Unnamed Tributary |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #37 Facing east (downstream) at Cross Section #19 along the Unnamed Tributary |  |  | |
| Photo #38 Facing north across Cross Section #19 along the Unnamed Tributary |  |  | |
| Photo #39 Facing east (downstream) at Cross Section #20 along the Unnamed Tributary |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #40 Facing north across Cross Section #20 along the Unnamed Tributary |  |  | |
| Photo #41 Facing north (downstream) at Cross Section #21 along the Unnamed Tributary |  |  | |
| Photo #42 Facing west across Cross Section #21 along the Unnamed Tributary |  |  | |

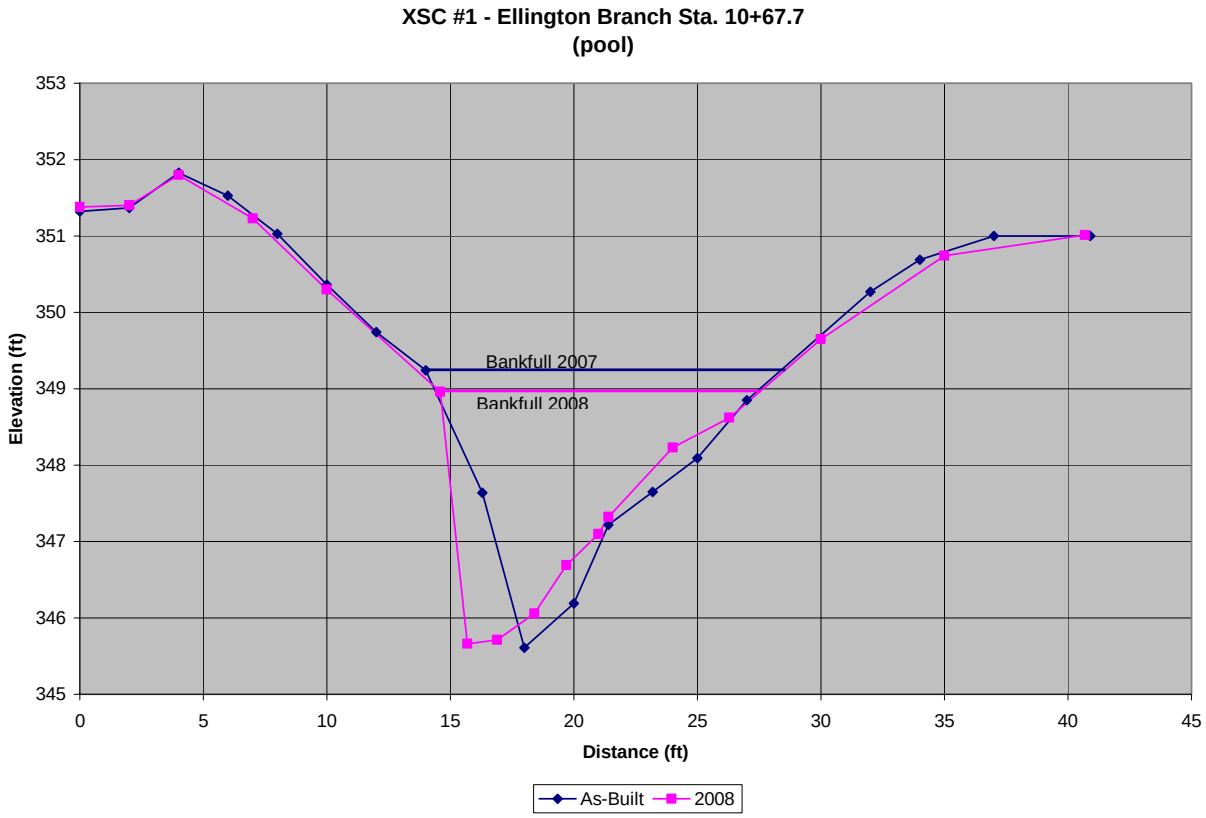
# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #43 Facing north (downstream) at Cross Section #22 along the Unnamed Tributary |  |  | |
| Photo #44 Facing west across Cross Section #22 along the Unnamed Tributary |  |  | |
| Photo #45 Facing north (downstream) at Cross Section #23 along the Unnamed Tributary |  |  | |

# APPENDIX B-2: Monitoring Photograph Summary Continued

| Photograph Number and Location | As-Built Photographs taken January 2008 | Year 2008 Monitoring Photographs taken September 2008 | Year 2009 Monitoring Photographs |
|---|---|---|---|
| Photo #46 Facing west across Cross Section #23 along the Unnamed Tributary |  |  | |

# APPENDIX B-3:
## Cross Section Plots and Raw Data Tables – Ellington Branch

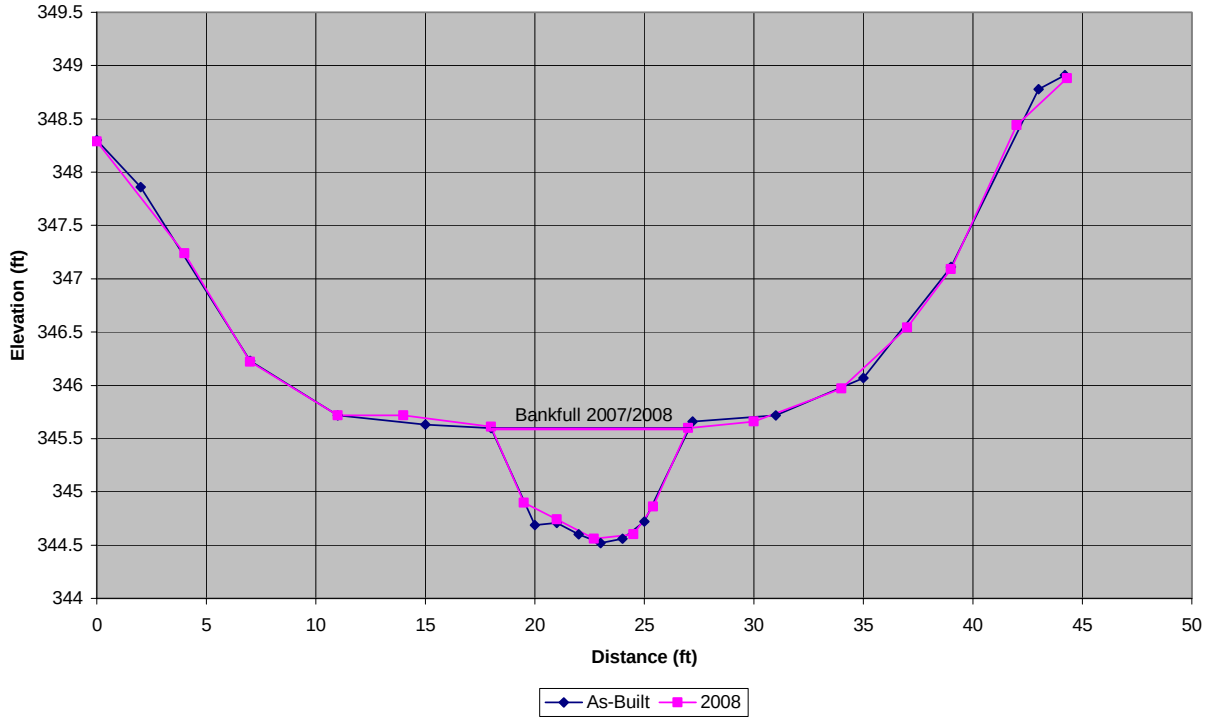



**XSC #1**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 351.32 | | 0 | 351.38 | |
| 2 | 351.37 | | 2 | 351.4 | |
| 4 | 351.83 | | 4 | 351.8 | |
| 6 | 351.53 | | 7 | 351.23 | |
| 8 | 351.03 | | 10 | 350.3 | |
| 10 | 350.36 | | 14.6 | 348.96 | 348.96 |
| 12 | 349.74 | | 15.7 | 345.66 | 348.96 |
| 14 | 349.24 | 349.24 | 16.9 | 345.71 | 348.96 |
| 16.3 | 347.64 | 349.24 | 18.4 | 346.06 | 348.96 |
| 18 | 345.61 | 349.24 | 19.7 | 346.69 | 348.96 |
| 20 | 346.19 | 349.24 | 21 | 347.1 | 348.96 |
| 21.4 | 347.22 | 349.24 | 21.4 | 347.32 | 348.96 |
| 23.2 | 347.65 | 349.24 | 24 | 348.23 | 348.96 |
| 25 | 348.09 | 349.24 | 26.3 | 348.62 | 348.96 |
| 27 | 348.85 | 349.24 | 30 | 349.65 | |
| 32 | 350.27 | 349.24 | 35 | 350.74 | |
| 34 | 350.69 | | 40.7 | 351.01 | |
| 37 | 351 | | | | |
| 40.9 | 351 | | | | |

**Facing downstream along Cross Section #1 (2008)**

**XSC #2 - Ellington Branch Sta. 13+85**
**(riffle)**

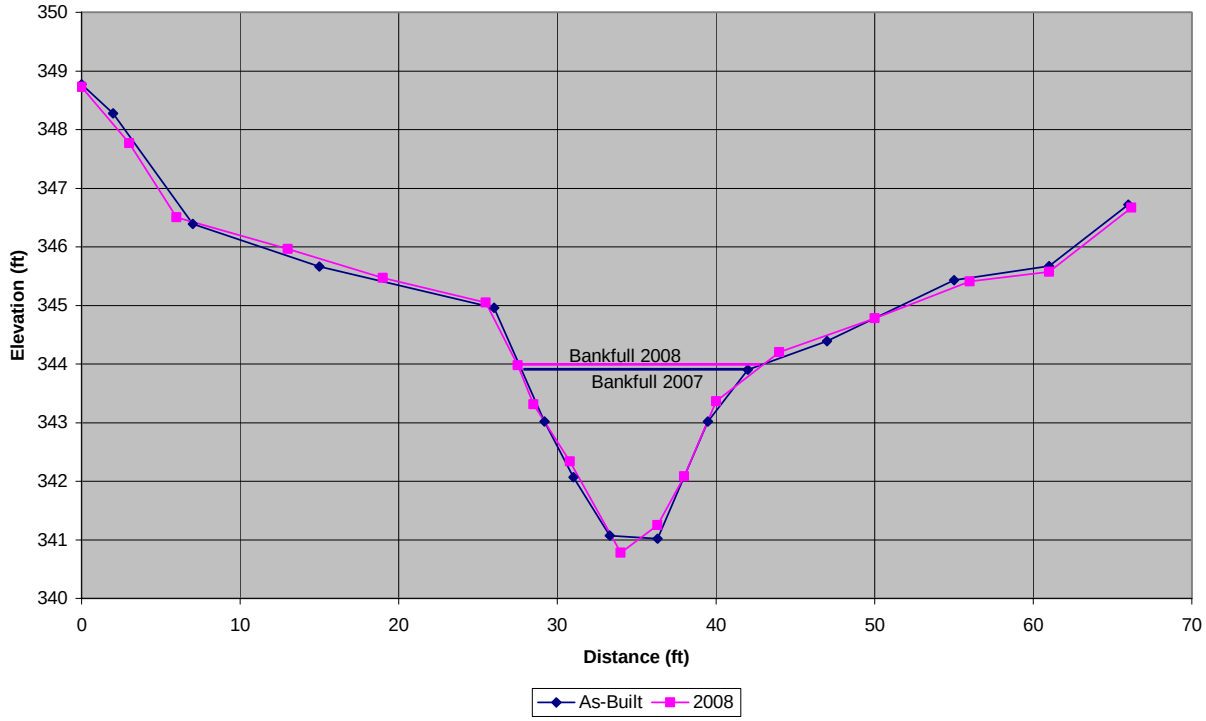



**XSC #2 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 348.3 | | 0 | 348.29 | |
| 2 | 347.86 | | 4 | 347.24 | |
| 7 | 346.23 | | 7 | 346.22 | |
| 11 | 345.72 | | 11 | 345.72 | |
| 15 | 345.63 | | 14 | 345.72 | |
| 18 | 345.6 | 345.63 | 18 | 345.61 | 345.61 |
| 20 | 344.69 | 345.63 | 19.5 | 344.9 | 345.61 |
| 21 | 344.71 | 345.63 | 21 | 344.74 | 345.61 |
| 22 | 344.6 | 345.63 | 22.7 | 344.56 | 345.61 |
| 23 | 344.52 | 345.63 | 24.5 | 344.6 | 345.61 |
| 24 | 344.56 | 345.63 | 25.4 | 344.86 | 345.61 |
| 25 | 344.72 | 345.63 | 27 | 345.6 | 345.61 |
| 27.2 | 345.66 | 345.63 | 30 | 345.66 | |
| 31 | 345.72 | | 34 | 345.97 | |
| 35 | 346.07 | | 37 | 346.54 | |
| 39 | 347.11 | | 39 | 347.09 | |
| 43 | 348.78 | | 42 | 348.44 | |
| 44.2 | 348.91 | | 44.3 | 348.88 | |

**Facing downstream at Cross Section #2 (2008)**

**XSC #3 - Ellington Branch Sta. 16+25.2**
**(pool)**

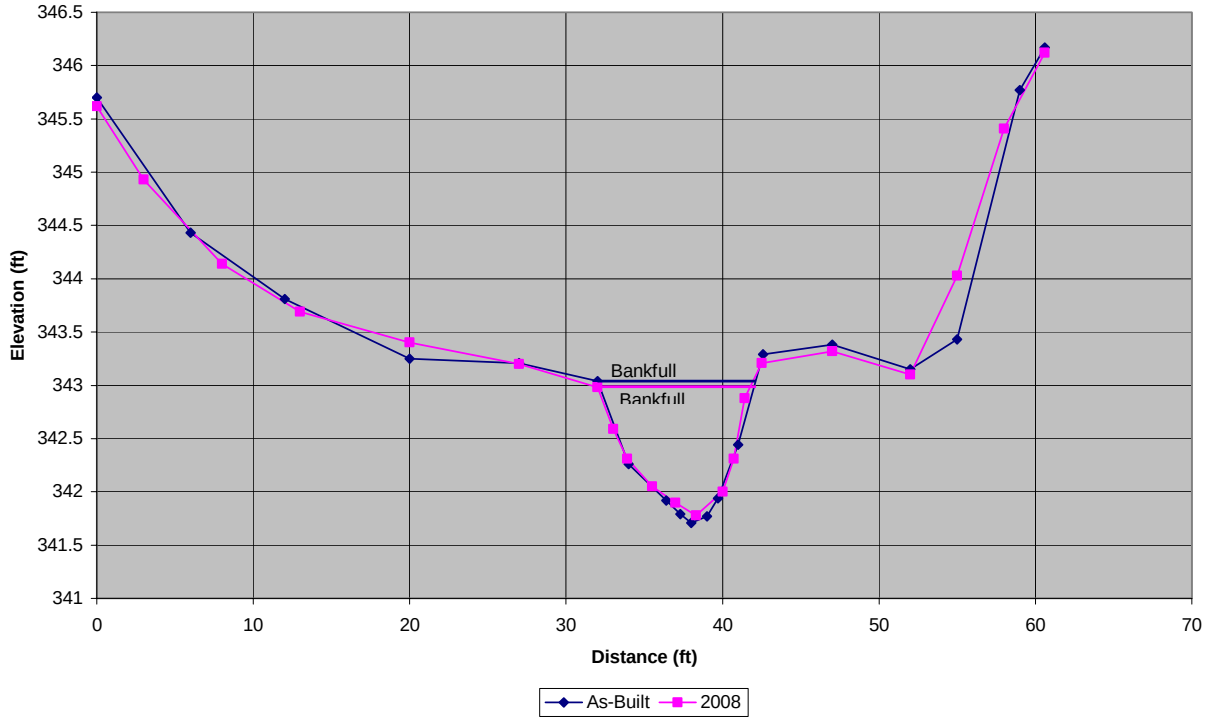



**XSC #3 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 348.77 | | 0 | 348.73 | |
| 2 | 348.28 | | 3 | 347.77 | |
| 7 | 346.39 | | 6 | 346.5 | |
| 15 | 345.66 | | 13 | 345.96 | |
| 26 | 344.96 | 343.9 | 19 | 345.47 | |
| 29.2 | 343.02 | 343.9 | 25.5 | 345.05 | |
| 31 | 342.07 | 343.9 | 27.5 | 343.98 | 343.98 |
| 33.3 | 341.07 | 343.9 | 28.5 | 343.31 | 343.98 |
| 36.3 | 341.02 | 343.9 | 30.8 | 342.34 | 343.98 |
| 39.5 | 343.02 | 343.9 | 34 | 340.78 | 343.98 |
| 42 | 343.9 | 343.9 | 36.3 | 341.25 | 343.98 |
| 47 | 344.39 | | 38 | 342.08 | 343.98 |
| 55 | 345.43 | | 40 | 343.36 | 343.98 |
| 61 | 345.67 | | 44 | 344.2 | |
| 66 | 346.72 | | 50 | 344.78 | |
| | | | 56 | 345.41 | |
| | | | 61 | 345.57 | |
| | | | 66.2 | 346.67 | |

**Facing downstream at Cross Section #3 (2008)**

**XSC #4 - Ellington Branch Sta. 18+74.7**
**(riffle)**

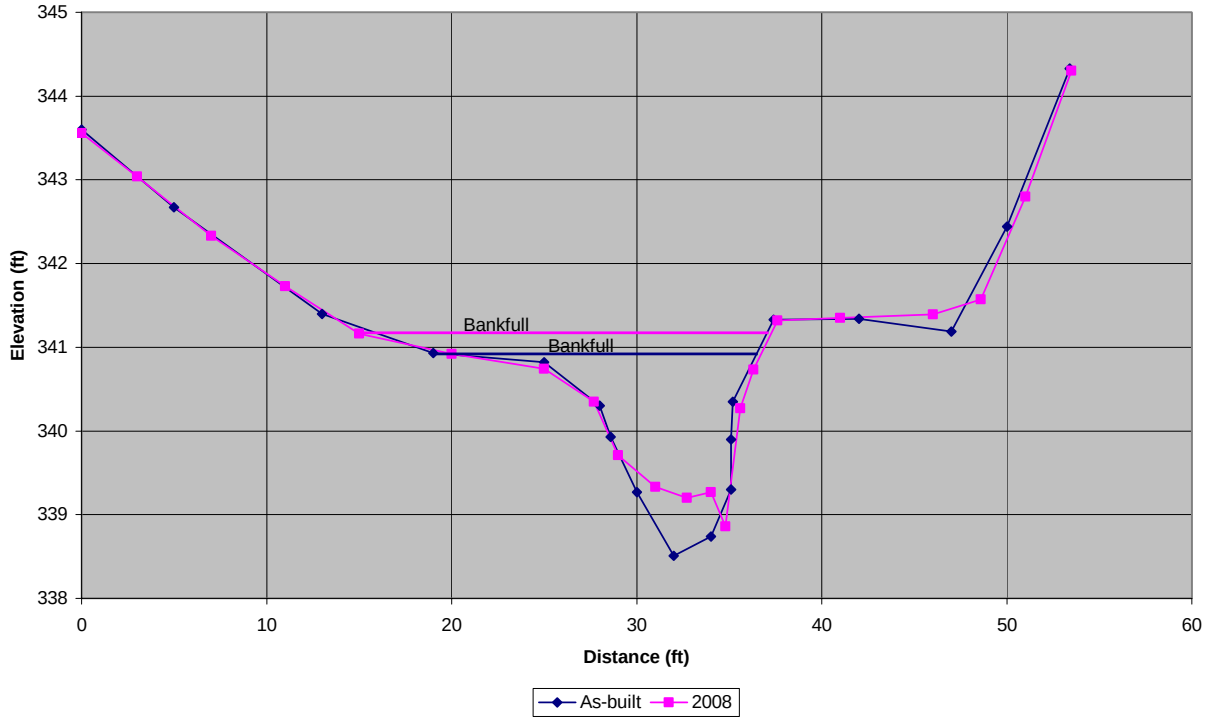



**XSC #4 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 345.7 | | 0 | 345.62 | |
| 6 | 344.43 | | 3 | 344.93 | |
| 12 | 343.81 | | 8 | 344.14 | |
| 20 | 343.25 | | 13 | 343.69 | |
| 27 | 343.21 | | 20 | 343.4 | |
| 32 | 343.04 | 343.04 | 27 | 343.2 | |
| 34 | 342.26 | 343.04 | 32 | 342.98 | 342.98 |
| 36.4 | 341.92 | 343.04 | 33 | 342.59 | 342.98 |
| 37.3 | 341.79 | 343.04 | 33.9 | 342.31 | 342.98 |
| 38 | 341.71 | 343.04 | 35.5 | 342.05 | 342.98 |
| 39 | 341.77 | 343.04 | 37 | 341.9 | 342.98 |
| 39.7 | 341.94 | 343.04 | 38.3 | 341.78 | 342.98 |
| 41 | 342.44 | 343.04 | 40 | 342 | 342.98 |
| 42.6 | 343.29 | 343.04 | 40.7 | 342.31 | 342.98 |
| 47 | 343.38 | | 41.4 | 342.88 | 342.98 |
| 52 | 343.15 | | 42.5 | 343.21 | |
| 55 | 343.43 | | 47 | 343.32 | |
| 59 | 345.77 | | 52 | 343.1 | |
| 60.6 | 346.17 | | 55 | 344.03 | |
| | | | 58 | 345.41 | |
| | | | 60.6 | 346.12 | |

**Facing downstream at Cross Section #4 (2008)**

**XSC #5 - Ellington Branch Sta. 21+47.3**
**(pool)**

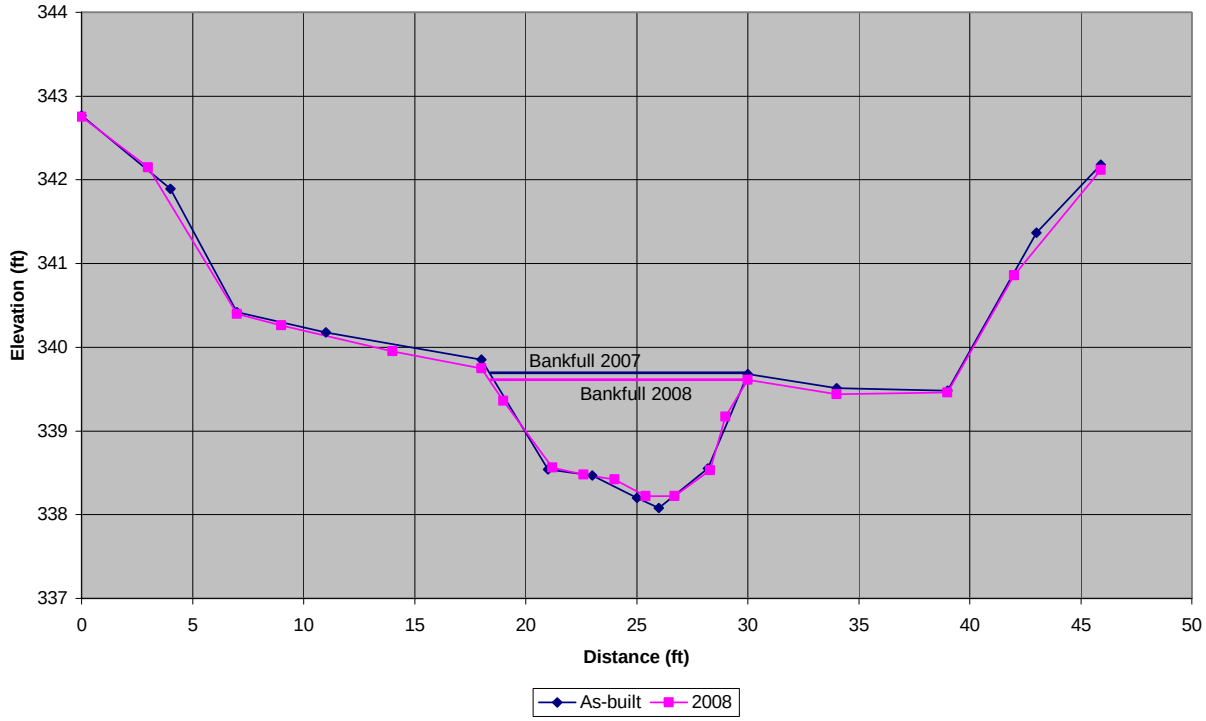



**XSC #5 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 343.6 | | 0 | 343.56 | |
| 5 | 342.67 | | 3 | 343.04 | |
| 13 | 341.4 | | 7 | 342.33 | |
| 19 | 340.93 | 340.93 | 11 | 341.73 | |
| 25 | 340.82 | 340.93 | 15 | 341.16 | 341.16 |
| 28 | 340.3 | 340.93 | 20 | 340.92 | 341.16 |
| 28.6 | 339.93 | 340.93 | 25 | 340.74 | 341.16 |
| 30 | 339.27 | 340.93 | 27.7 | 340.35 | 341.16 |
| 32 | 338.51 | 340.93 | 29 | 339.71 | 341.16 |
| 34 | 338.74 | 340.93 | 31 | 339.33 | 341.16 |
| 35.1 | 339.3 | 340.93 | 32.7 | 339.2 | 341.16 |
| 35.1 | 339.9 | 340.93 | 34 | 339.27 | 341.16 |
| 35.2 | 340.35 | 340.93 | 34.8 | 338.86 | 341.16 |
| 37.4 | 341.33 | 340.93 | 35.6 | 340.27 | 341.16 |
| 42 | 341.34 | | 36.3 | 340.73 | 341.16 |
| 47 | 341.19 | | 37.6 | 341.32 | |
| 50 | 342.44 | | 41 | 341.35 | |
| 53.4 | 344.33 | | 46 | 341.39 | |
| | | | 48.6 | 341.57 | |
| | | | 51 | 342.8 | |
| | | | 53.5 | 344.3 | |

**Facing downstream at Cross Section #5 (2008)**

**XSC #6 - Ellington Branch Sta. 25+04.9**
**(riffle)**

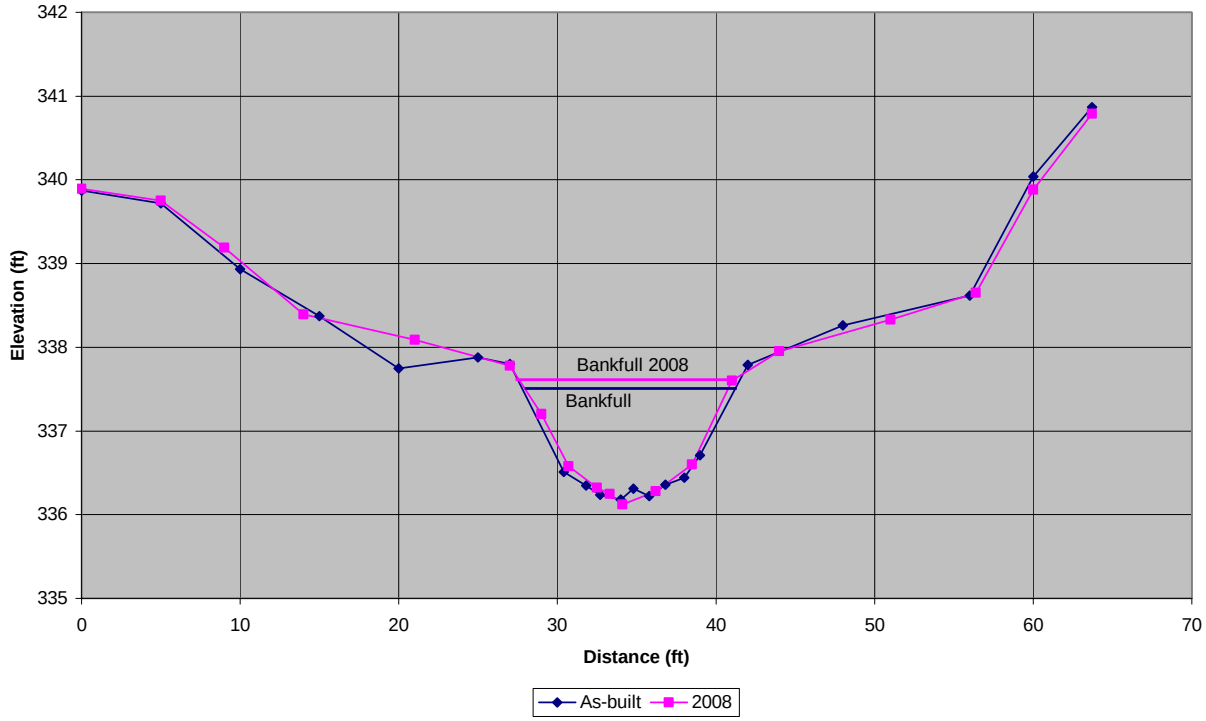



**XSC #6 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 342.77 | | 0 | 342.75 | |
| 4 | 341.89 | | 3 | 342.15 | |
| 7 | 340.42 | | 7 | 340.4 | |
| 11 | 340.18 | | 9 | 340.26 | |
| 18 | 339.85 | 339.68 | 14 | 339.95 | |
| 21 | 338.54 | 339.68 | 18 | 339.75 | |
| 23 | 338.47 | 339.68 | 19 | 339.36 | 339.61 |
| 25 | 338.2 | 339.68 | 21.2 | 338.56 | 339.61 |
| 26 | 338.08 | 339.68 | 22.6 | 338.48 | 339.61 |
| 28.2 | 338.55 | 339.68 | 24 | 338.42 | 339.61 |
| 30 | 339.68 | 339.68 | 25.4 | 338.22 | 339.61 |
| 34 | 339.51 | | 26.7 | 338.22 | 339.61 |
| 39 | 339.48 | | 28.3 | 338.53 | 339.61 |
| 43 | 341.37 | | 29 | 339.17 | 339.61 |
| 45.9 | 342.18 | | 30 | 339.61 | 339.61 |
| | | | 34 | 339.44 | |
| | | | 39 | 339.46 | |
| | | | 42 | 340.86 | |
| | | | 45.9 | 342.12 | |

**Facing downstream at Cross Section #6 (2008)**

**XSC #7 - Ellington Branch Sta. 28+23.2**
**(riffle)**

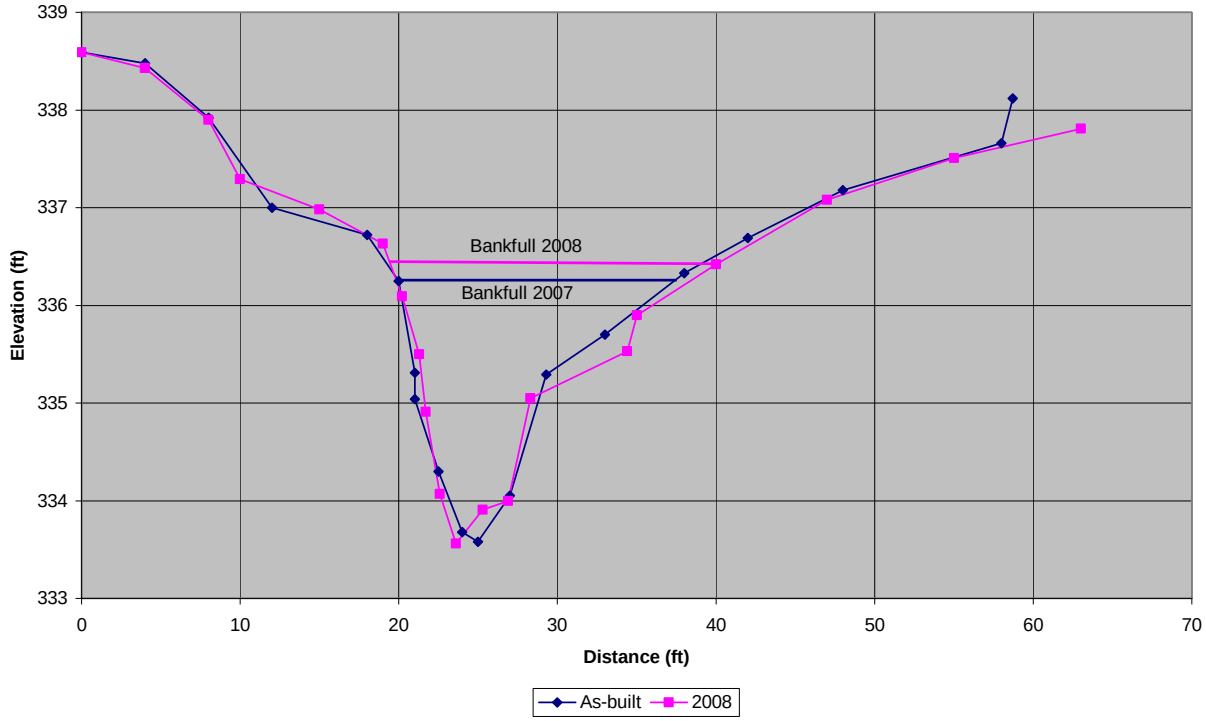



**XSC #7 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 339.87 | | 0 | 339.89 | |
| 5 | 339.72 | | 5 | 339.75 | |
| 10 | 338.93 | | 9 | 339.19 | |
| 15 | 338.37 | | 14 | 338.39 | |
| 20 | 337.75 | | 21 | 338.09 | |
| 25 | 337.88 | | 27 | 337.78 | |
| 27 | 337.8 | 337.5 | 29 | 337.2 | 337.6 |
| 30.4 | 336.51 | 337.5 | 30.7 | 336.58 | 337.6 |
| 31.8 | 336.35 | 337.5 | 32.5 | 336.32 | 337.6 |
| 32.7 | 336.24 | 337.5 | 33.3 | 336.25 | 337.6 |
| 34 | 336.18 | 337.5 | 34.1 | 336.12 | 337.6 |
| 34.8 | 336.31 | 337.5 | 36.2 | 336.28 | 337.6 |
| 35.8 | 336.22 | 337.5 | 38.5 | 336.6 | 337.6 |
| 36.8 | 336.36 | 337.5 | 41 | 337.6 | 337.6 |
| 38 | 336.44 | 337.5 | 44 | 337.95 | |
| 39 | 336.71 | 337.5 | 51 | 338.33 | |
| 42 | 337.79 | 337.5 | 56.4 | 338.65 | |
| 48 | 338.26 | | 60 | 339.88 | |
| 56 | 338.62 | | 63.7 | 340.79 | |
| 60 | 340.04 | | | | |
| 63.7 | 340.87 | | | | |

**Facing downstream at Cross Section #7 (2008)**

**XSC #8 - Ellington Branch Sta. 29+74.7**
**(pool)**

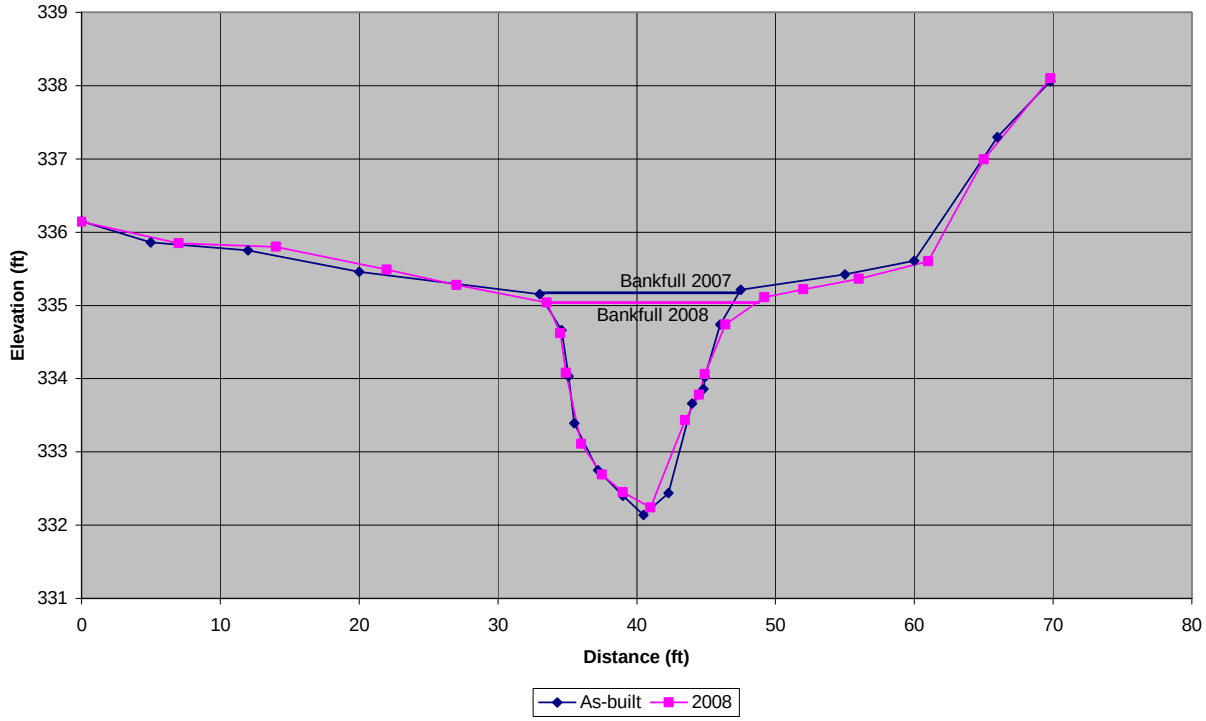



**XSC #8 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 338.59 | | 0 | 338.59 | |
| 4 | 338.48 | | 4 | 338.43 | |
| 8 | 337.92 | | 8 | 337.9 | |
| 12 | 337 | | 10 | 337.29 | |
| 18 | 336.72 | | 15 | 336.98 | |
| 20 | 336.25 | 336.25 | 19 | 336.63 | |
| 21 | 335.31 | 336.25 | 20.2 | 336.09 | 336.42 |
| 21 | 335.04 | 336.25 | 21.3 | 335.5 | 336.42 |
| 22.5 | 334.3 | 336.25 | 21.7 | 334.91 | 336.42 |
| 24 | 333.68 | 336.25 | 22.6 | 334.07 | 336.42 |
| 25 | 333.58 | 336.25 | 23.6 | 333.56 | 336.42 |
| 27 | 334.05 | 336.25 | 25.3 | 333.91 | 336.42 |
| 29.3 | 335.29 | 336.25 | 26.9 | 334 | 336.42 |
| 33 | 335.7 | 336.25 | 28.3 | 335.05 | 336.42 |
| 38 | 336.33 | 336.25 | 34.4 | 335.53 | 336.42 |
| 42 | 336.69 | | 35 | 335.9 | 336.42 |
| 48 | 337.18 | | 40 | 336.42 | 336.42 |
| 58 | 337.66 | | 47 | 337.08 | |
| 58.7 | 338.12 | | 55 | 337.51 | |
| | | | 63 | 337.81 | |
| | | | 68.8 | 338.15 | |

**Facing downstream at Cross Section #8 (2008)**

**XSC #9 - Ellington Branch Sta. 31+88.3**
**(pool)**

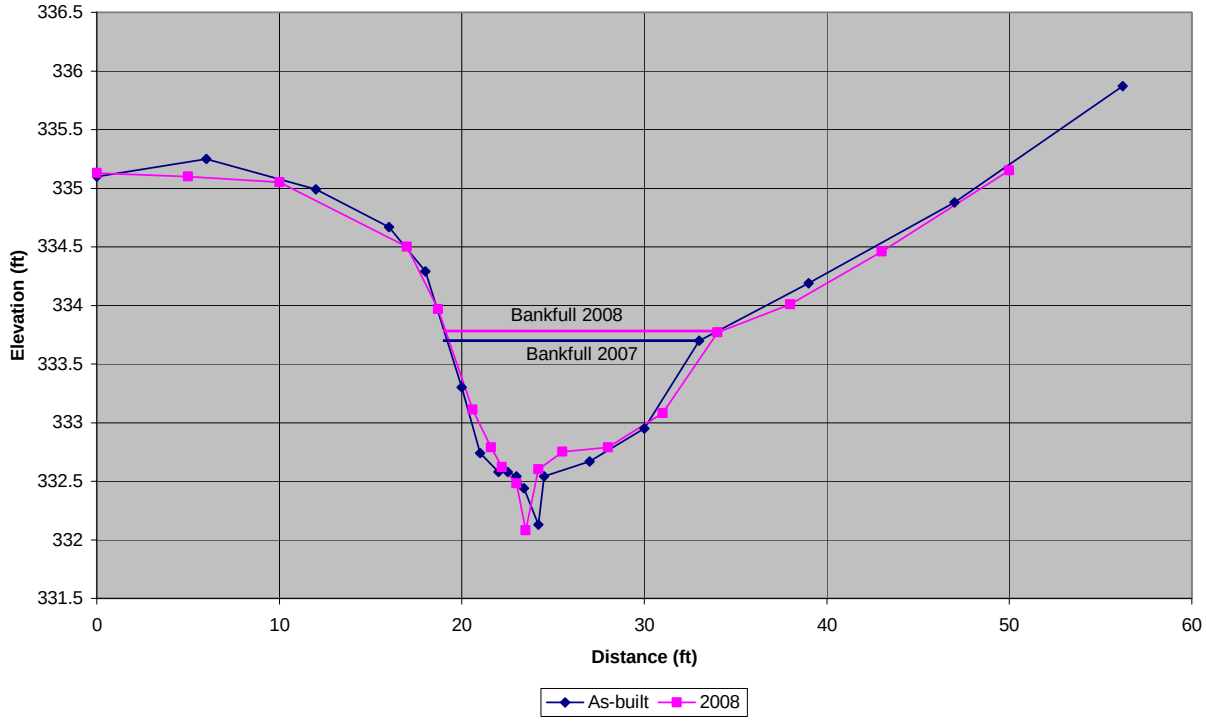



**XSC #9 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 336.15 | | 0 | 336.14 | |
| 5 | 335.86 | | 7 | 335.85 | |
| 12 | 335.75 | | 14 | 335.8 | |
| 20 | 335.46 | | 22 | 335.49 | |
| 33 | 335.15 | 335.15 | 27 | 335.28 | |
| 34.6 | 334.66 | 335.15 | 33.5 | 335.04 | 335.04 |
| 35.1 | 334.03 | 335.15 | 34.5 | 334.62 | 335.04 |
| 35.5 | 333.39 | 335.15 | 34.9 | 334.08 | 335.04 |
| 37.2 | 332.75 | 335.15 | 36 | 333.11 | 335.04 |
| 39 | 332.4 | 335.15 | 37.5 | 332.69 | 335.04 |
| 40.5 | 332.14 | 335.15 | 39 | 332.45 | 335.04 |
| 42.3 | 332.44 | 335.15 | 41 | 332.24 | 335.04 |
| 44 | 333.66 | 335.15 | 43.5 | 333.43 | 335.04 |
| 44.8 | 333.86 | 335.15 | 44.5 | 333.78 | 335.04 |
| 44.9 | 334.02 | 335.15 | 44.9 | 334.06 | 335.04 |
| 46 | 334.74 | 335.15 | 46.4 | 334.74 | 335.04 |
| 47.5 | 335.21 | 335.15 | 49.2 | 335.11 | |
| 55 | 335.42 | | 52 | 335.22 | |
| 60 | 335.61 | | 56 | 335.36 | |
| 66 | 337.3 | | 61 | 335.6 | |
| 69.8 | 338.06 | | 65 | 336.99 | |
| | | | 69.8 | 338.1 | |

**Facing downstream at Cross Section #9 (2008)**

**XSC #10 - Ellington Branch Sta. 34+10.4**
**(riffle)**

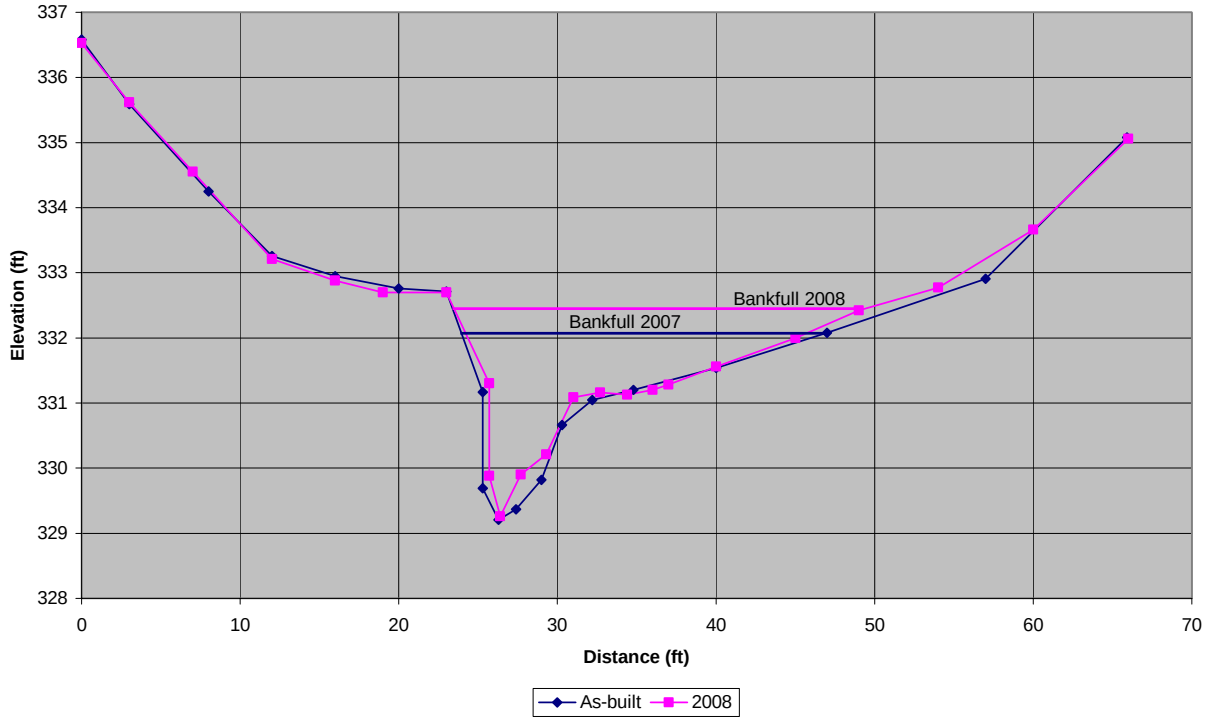



**XSC #10 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 335.1 | | 0 | 335.13 | |
| 6 | 335.25 | | 5 | 335.1 | |
| 12 | 334.99 | | 10 | 335.05 | |
| 16 | 334.67 | | 17 | 334.5 | |
| 18 | 334.29 | 333.7 | 18.7 | 333.97 | |
| 20 | 333.3 | 333.7 | 20.6 | 333.11 | 333.77 |
| 21 | 332.74 | 333.7 | 21.6 | 332.79 | 333.77 |
| 22 | 332.58 | 333.7 | 22.2 | 332.62 | 333.77 |
| 22.5 | 332.58 | 333.7 | 23 | 332.48 | 333.77 |
| 23 | 332.54 | 333.7 | 23.5 | 332.08 | 333.77 |
| 23.4 | 332.44 | 333.7 | 24.2 | 332.6 | 333.77 |
| 24.2 | 332.13 | 333.7 | 25.5 | 332.75 | 333.77 |
| 24.5 | 332.54 | 333.7 | 28 | 332.79 | 333.77 |
| 27 | 332.67 | 333.7 | 31 | 333.08 | 333.77 |
| 30 | 332.95 | 333.7 | 34 | 333.77 | 333.77 |
| 33 | 333.7 | 333.7 | 38 | 334.01 | |
| 39 | 334.19 | | 43 | 334.46 | |
| 47 | 334.88 | | 50 | 335.15 | |
| 56.2 | 335.87 | | | | |

**Facing downstream at Cross Section #10 (2008)**

**XSC #11 - Ellington Branch Sta. 36+55.6**
**(pool)**

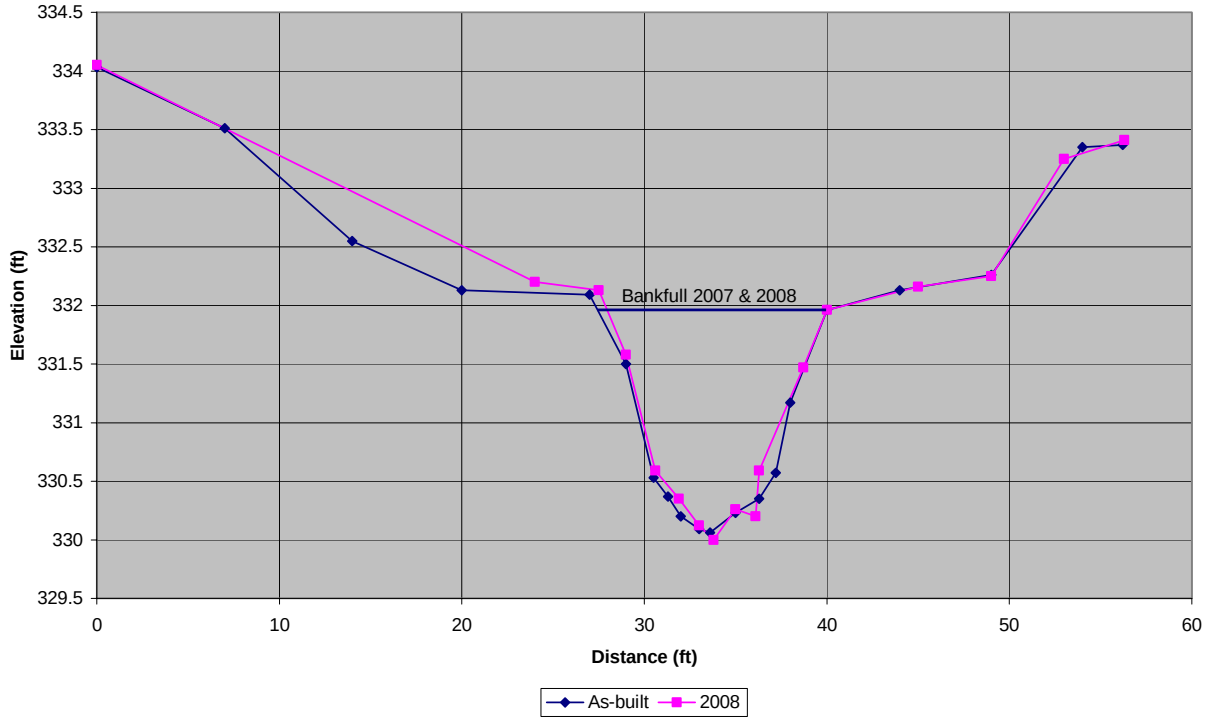



**XSC #11 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 336.58 | | 0 | 336.53 | |
| 3 | 335.59 | | 3 | 335.62 | |
| 8 | 334.25 | | 7 | 334.55 | |
| 12 | 333.26 | | 12 | 333.21 | |
| 16 | 332.95 | | 16 | 332.88 | |
| 20 | 332.76 | | 19 | 332.7 | |
| 23 | 332.71 | 332.08 | 23 | 332.7 | |
| 25.3 | 331.17 | 332.08 | 25.7 | 331.3 | 332.42 |
| 25.3 | 329.69 | 332.08 | 25.7 | 329.88 | 332.42 |
| 26.3 | 329.21 | 332.08 | 26.4 | 329.26 | 332.42 |
| 27.4 | 329.37 | 332.08 | 27.7 | 329.9 | 332.42 |
| 29 | 329.82 | 332.08 | 29.3 | 330.21 | 332.42 |
| 30.3 | 330.66 | 332.08 | 31 | 331.09 | 332.42 |
| 32.2 | 331.05 | 332.08 | 32.7 | 331.16 | 332.42 |
| 34.8 | 331.2 | 332.08 | 34.4 | 331.13 | 332.42 |
| 40 | 331.54 | 332.08 | 36 | 331.2 | 332.42 |
| 47 | 332.08 | 332.08 | 37 | 331.28 | 332.42 |
| 57 | 332.91 | | 40 | 331.56 | 332.42 |
| 65.9 | 335.08 | | 45 | 332 | 332.42 |
| | | | 49 | 332.42 | 332.42 |
| | | | 54 | 332.77 | |
| | | | 60 | 333.66 | |
| | | | 66 | 335.06 | |

**Facing downstream at Cross Section #11 (2008)**

**XSC #12 - Ellington Branch Sta. 38+49.7**
**(riffle)**

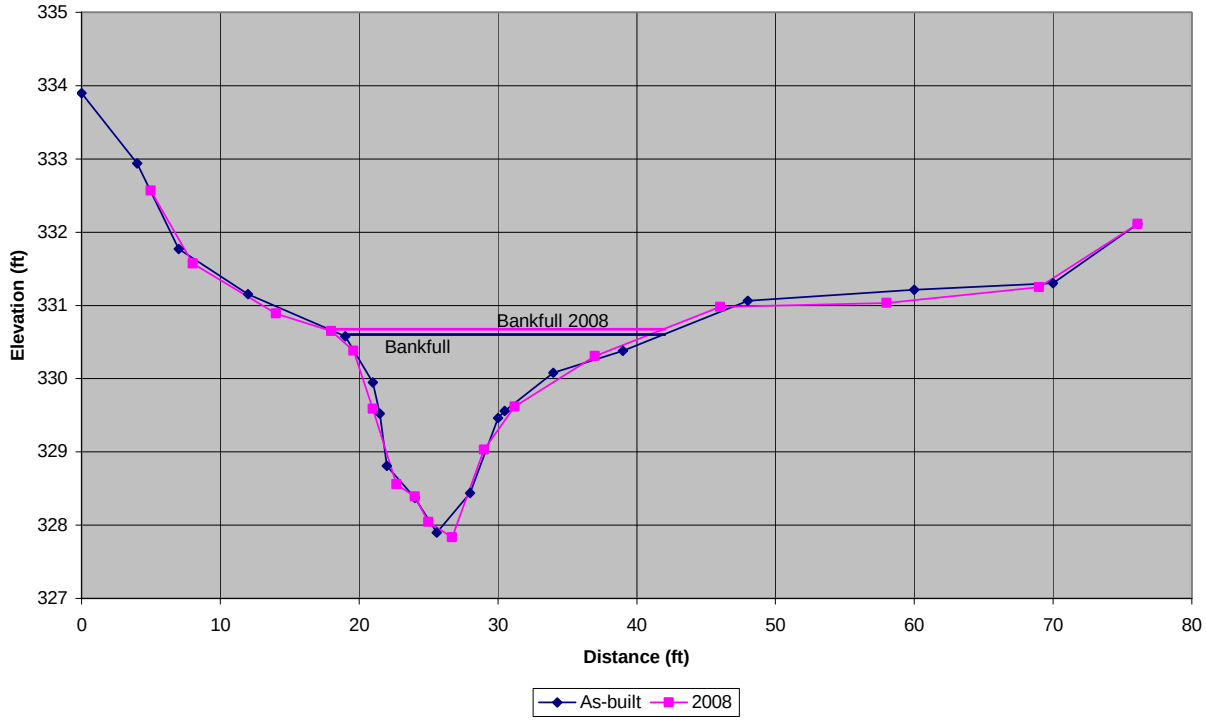



**XSC #12 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 334.03 | | 0 | 334.05 | |
| 7 | 333.51 | | 24 | 332.2 | |
| 14 | 332.55 | | 27.5 | 332.13 | |
| 20 | 332.13 | | 29 | 331.58 | 331.96 |
| 27 | 332.09 | 331.96 | 30.6 | 330.59 | 331.96 |
| 29 | 331.5 | 331.96 | 31.9 | 330.35 | 331.96 |
| 30.5 | 330.53 | 331.96 | 33 | 330.12 | 331.96 |
| 31.3 | 330.37 | 331.96 | 33.8 | 330 | 331.96 |
| 32 | 330.2 | 331.96 | 35 | 330.26 | 331.96 |
| 33 | 330.09 | 331.96 | 36.1 | 330.2 | 331.96 |
| 33.6 | 330.06 | 331.96 | 36.3 | 330.59 | 331.96 |
| 35 | 330.23 | 331.96 | 38.7 | 331.47 | 331.96 |
| 36.3 | 330.35 | 331.96 | 40 | 331.96 | 331.96 |
| 37.2 | 330.57 | 331.96 | 45 | 332.16 | |
| 38 | 331.17 | 331.96 | 49 | 332.25 | |
| 40 | 331.96 | 331.96 | 53 | 333.25 | |
| 44 | 332.13 | | 56.3 | 333.41 | |
| 49 | 332.26 | | | | |
| 54 | 333.35 | | | | |
| 56.2 | 333.37 | | | | |

**Facing downstream at Cross Section #12 (2008)**

**XSC #13 - Ellington Branch Sta. 40+99.5**
**(pool)**

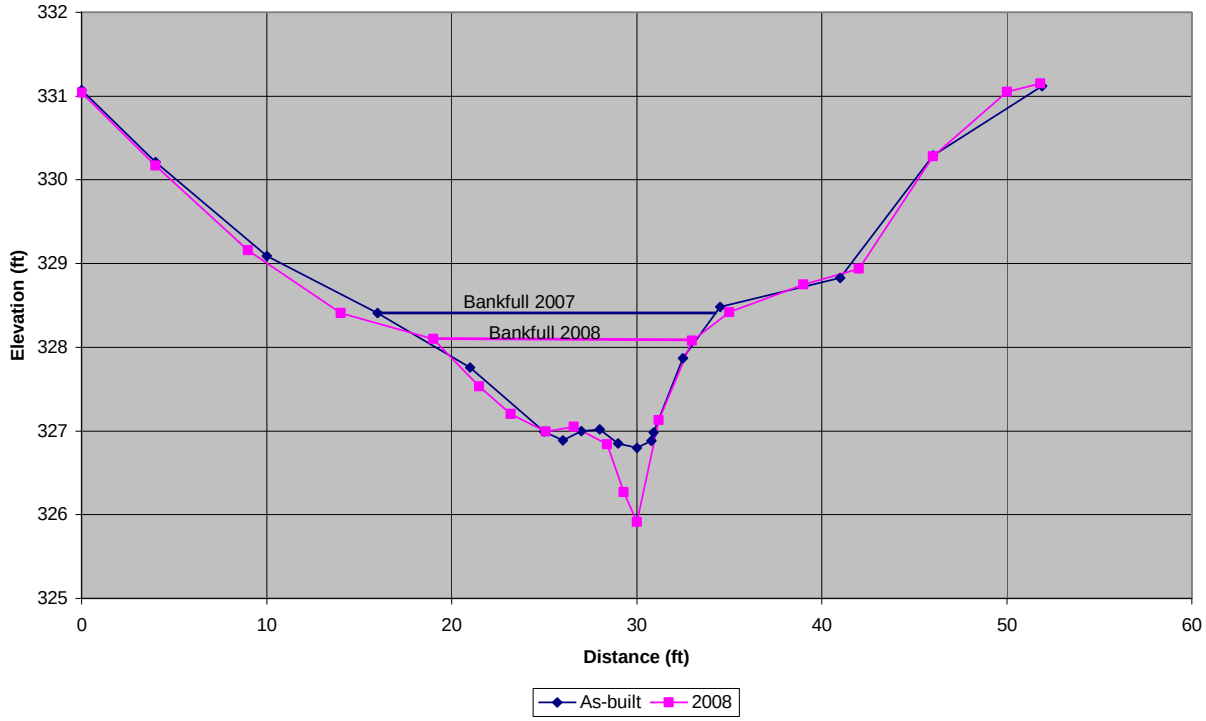



**XSC #13 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 333.9 | | | | |
| 4 | 332.94 | | 5 | 332.57 | |
| 7 | 331.77 | | 8 | 331.57 | |
| 12 | 331.15 | | 14 | 330.89 | |
| 19 | 330.58 | 330.58 | 18 | 330.65 | 330.65 |
| 21 | 329.95 | 330.58 | 19.6 | 330.38 | 330.65 |
| 21.5 | 329.52 | 330.58 | 21 | 329.59 | 330.65 |
| 22 | 328.81 | 330.58 | 22.7 | 328.56 | 330.65 |
| 24 | 328.37 | 330.58 | 24 | 328.39 | 330.65 |
| 25.6 | 327.9 | 330.58 | 25 | 328.04 | 330.65 |
| 28 | 328.44 | 330.58 | 26.7 | 327.83 | 330.65 |
| 30 | 329.46 | 330.58 | 29 | 329.03 | 330.65 |
| 30.5 | 329.56 | 330.58 | 31.2 | 329.62 | 330.65 |
| 34 | 330.08 | 330.58 | 37 | 330.31 | 330.65 |
| 39 | 330.38 | 330.58 | 46 | 330.98 | |
| 48 | 331.06 | 330.58 | 58 | 331.03 | |
| 60 | 331.21 | | 69 | 331.25 | |
| 70 | 331.3 | | 76.1 | 332.11 | |
| 76.1 | 332.11 | | | | |

**Facing downstream at Cross Section #13 (2008)**

**XSC #14 - Ellington Branch Sta. 44+22.4**
**(riffle)**

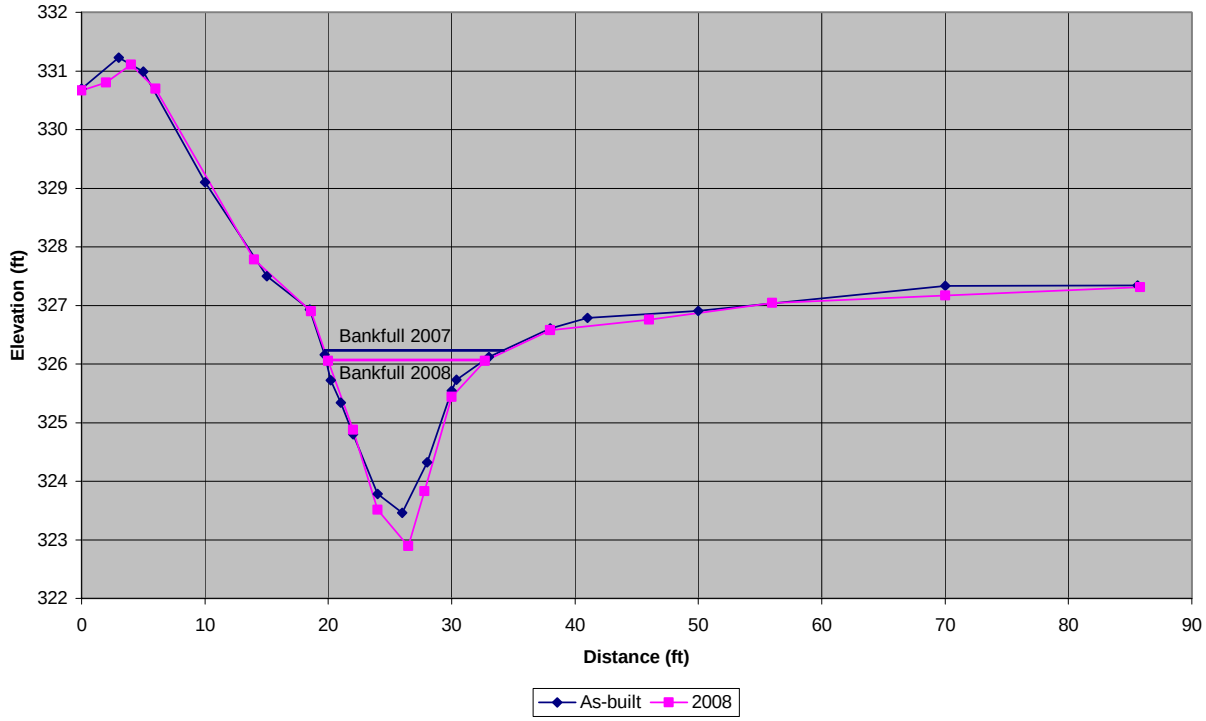



**XSC #14 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 331.07 | | 0 | 331.04 | |
| 4 | 330.21 | | 4 | 330.17 | |
| 10 | 329.09 | | 9 | 329.16 | |
| 16 | 328.41 | 328.41 | 14 | 328.41 | |
| 21 | 327.76 | 328.41 | 19 | 328.1 | 328.1 |
| 25 | 326.99 | 328.41 | 21.5 | 327.53 | 328.1 |
| 26 | 326.89 | 328.41 | 23.2 | 327.2 | 328.1 |
| 27 | 327 | 328.41 | 25.1 | 326.99 | 328.1 |
| 28 | 327.02 | 328.41 | 26.6 | 327.05 | 328.1 |
| 29 | 326.85 | 328.41 | 28.4 | 326.84 | 328.1 |
| 30 | 326.8 | 328.41 | 29.3 | 326.27 | 328.1 |
| 30.8 | 326.88 | 328.41 | 30 | 325.91 | 328.1 |
| 30.9 | 326.98 | 328.41 | 31.2 | 327.13 | 328.1 |
| 32.5 | 327.87 | 328.41 | 33 | 328.08 | |
| 34.5 | 328.48 | 328.41 | 35 | 328.42 | |
| 41 | 328.83 | | 39 | 328.75 | |
| 46 | 330.29 | | 42 | 328.94 | |
| 51.9 | 331.12 | | 46 | 330.28 | |
| | | | 50 | 331.05 | |
| | | | 51.8 | 331.15 | |

**Facing downstream at Cross Section #14 (2008)**

**XSC #15 - Ellington Branch Sta. 46+79.1**
**(pool)**



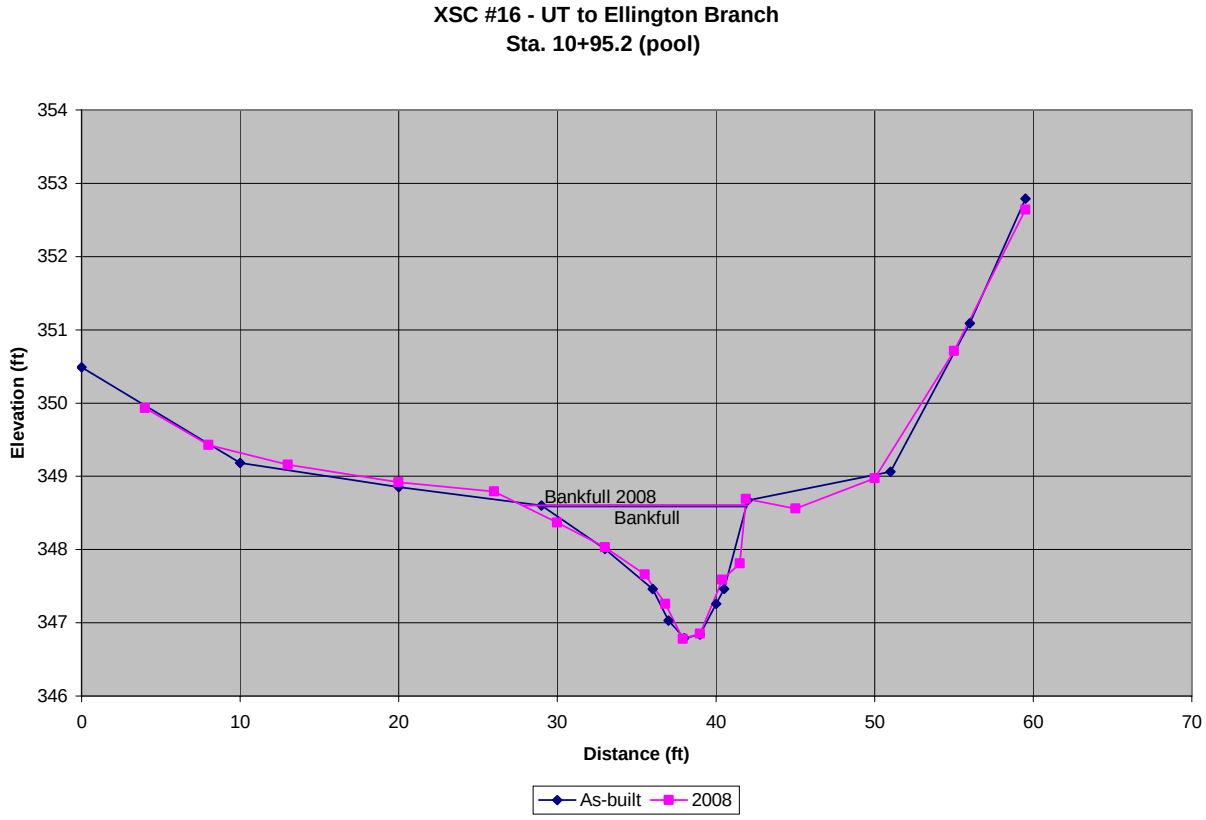

**XSC #15 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 330.7 | | 0 | 330.67 | |
| 3 | 331.23 | | 2 | 330.8 | |
| 5 | 330.99 | | 4 | 331.11 | |
| 10 | 329.1 | | 6 | 330.7 | |
| 15 | 327.5 | | 14 | 327.78 | |
| 18.5 | 326.93 | 326.79 | 18.6 | 326.9 | |
| 19.7 | 326.16 | 326.79 | 20 | 326.05 | 326.05 |
| 20.2 | 325.72 | 326.79 | 22 | 324.88 | 326.05 |
| 21 | 325.34 | 326.79 | 24 | 323.51 | 326.05 |
| 22 | 324.8 | 326.79 | 26.5 | 322.89 | 326.05 |
| 24 | 323.78 | 326.79 | 27.8 | 323.83 | 326.05 |
| 26 | 323.46 | 326.79 | 30 | 325.44 | 326.05 |
| 28 | 324.32 | 326.79 | 32.7 | 326.05 | 326.05 |
| 30 | 325.54 | 326.79 | 38 | 326.58 | |
| 30.4 | 325.73 | 326.79 | 46 | 326.76 | |
| 33 | 326.12 | 326.79 | 56 | 327.04 | |
| 38 | 326.61 | 326.79 | 70 | 327.17 | |
| 41 | 326.79 | 326.79 | 85.8 | 327.31 | |
| 50 | 326.91 | | | | |
| 70 | 327.33 | | | | |
| 85.6 | 327.34 | | | | |

**Facing downstream at Cross Section #15 (2008)**

# APPENDIX B-3 Continued:

## Cross Section Plots and Raw Data Tables – Unnamed Tributary to Ellington Branch

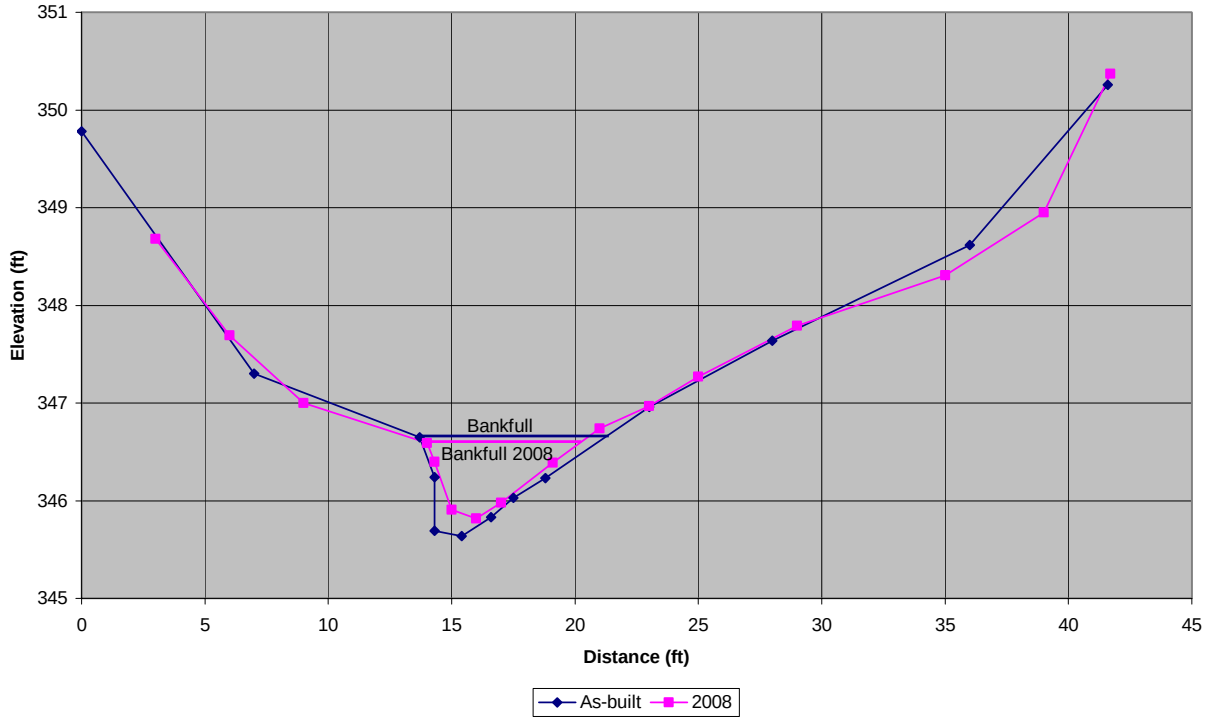



**XSC #16 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 350.49 | | 4 | 349.93 | |
| 10 | 349.18 | | 8 | 349.43 | |
| 20 | 348.85 | | 13 | 349.16 | |
| 29 | 348.6 | 348.6 | 20 | 348.92 | |
| 33 | 348.01 | 348.6 | 26 | 348.79 | |
| 36 | 347.46 | 348.6 | 30 | 348.37 | 348.6 |
| 37 | 347.03 | 348.6 | 33 | 348.03 | 348.6 |
| 38 | 346.79 | 348.6 | 35.5 | 347.66 | 348.6 |
| 39 | 346.84 | 348.6 | 36.8 | 347.26 | 348.6 |
| 40 | 347.26 | 348.6 | 37.9 | 346.78 | 348.6 |
| 40.5 | 347.46 | 348.6 | 39 | 346.85 | 348.6 |
| 42 | 348.67 | 348.6 | 40.4 | 347.59 | 348.6 |
| 51 | 349.06 | | 41.5 | 347.81 | 348.6 |
| 56 | 351.09 | | 41.9 | 348.69 | |
| 59.5 | 352.79 | | 45 | 348.56 | |
| | | | 50 | 348.97 | |
| | | | 55 | 350.71 | |
| | | | 59.5 | 352.64 | |

**Facing downstream at Cross Section #16 (2008)**

**XSC #17 - UT to Ellington Branch**
**Sta. 12+35.1 (riffle)**

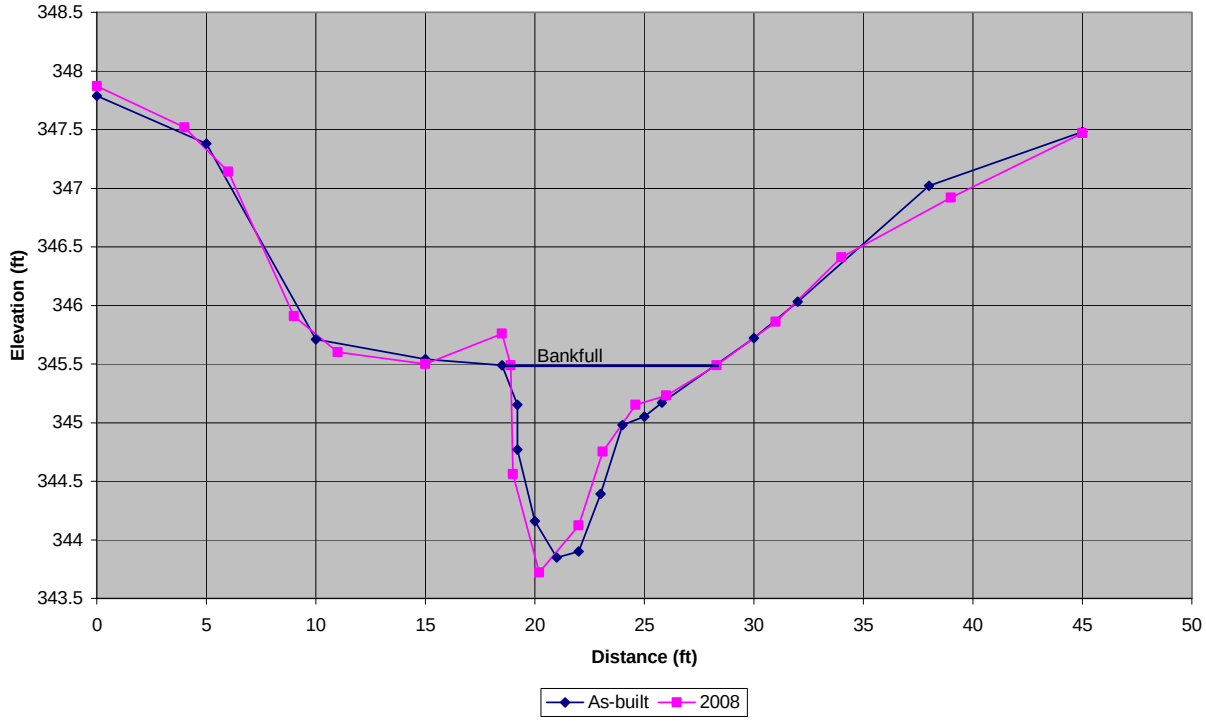



**XSC #17 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 349.78 | | 3 | 348.68 | |
| 7 | 347.3 | | 6 | 347.69 | |
| 13.7 | 346.65 | 346.65 | 9 | 347 | |
| 14.3 | 346.24 | 346.65 | 14 | 346.59 | |
| 14.3 | 345.69 | 346.65 | 14.3 | 346.4 | 346.4 |
| 15.4 | 345.64 | 346.65 | 15 | 345.91 | 346.4 |
| 16.6 | 345.83 | 346.65 | 16 | 345.82 | 346.4 |
| 17.5 | 346.03 | 346.65 | 17 | 345.98 | 346.4 |
| 18.8 | 346.23 | 346.65 | 19.1 | 346.39 | 346.4 |
| 23 | 346.96 | 346.65 | 21 | 346.74 | |
| 28 | 347.64 | | 23 | 346.97 | |
| 36 | 348.62 | | 25 | 347.27 | |
| 41.6 | 350.26 | | 29 | 347.79 | |
| | | | 35 | 348.31 | |
| | | | 39 | 348.95 | |
| | | | 41.7 | 350.37 | |

**Facing downstream at Cross Section #17 (2008)**

**XSC #18 - UT to Ellington Branch**
**Sta. 13+75.2 (pool)**

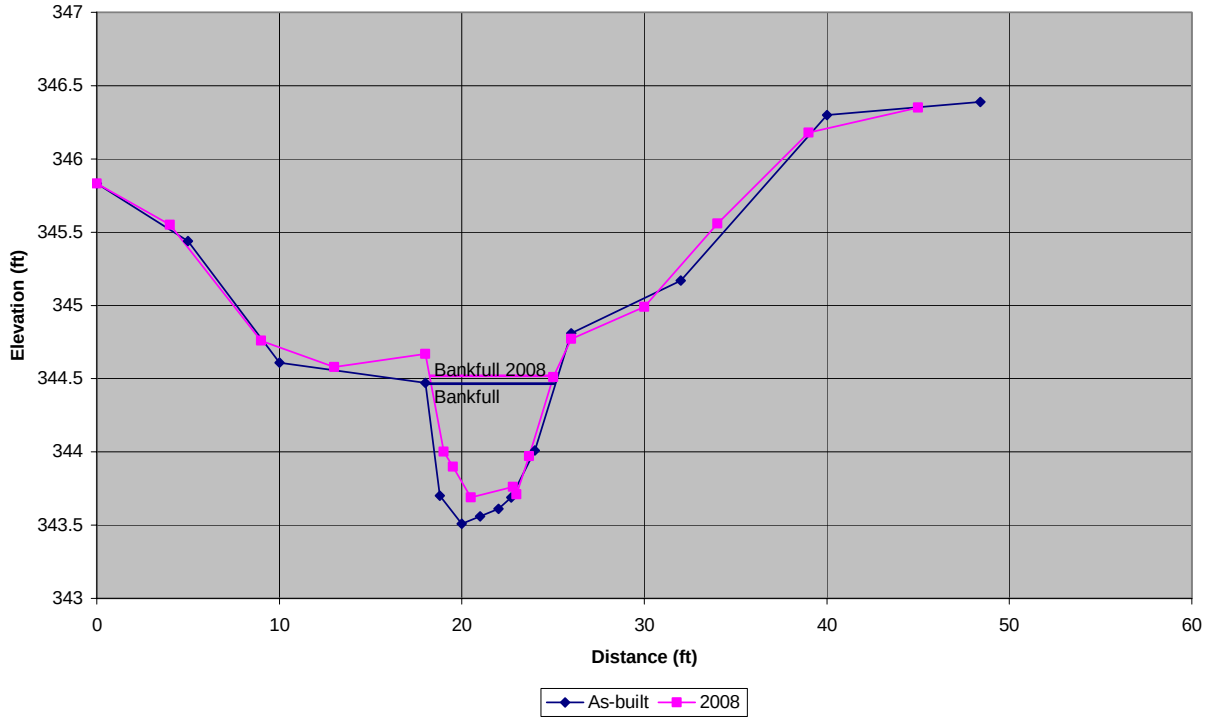



**XSC #18 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 347.79 | | 0 | 347.87 | |
| 5 | 347.38 | | 4 | 347.52 | |
| 10 | 345.71 | | 6 | 347.14 | |
| 15 | 345.54 | | 9 | 345.91 | |
| 18.5 | 345.49 | 345.49 | 11 | 345.6 | |
| 19.2 | 345.15 | 345.49 | 15 | 345.5 | |
| 19.2 | 344.77 | 345.49 | 18.5 | 345.76 | |
| 20 | 344.16 | 345.49 | 18.9 | 345.49 | 345.49 |
| 21 | 343.85 | 345.49 | 19 | 344.56 | 345.49 |
| 22 | 343.9 | 345.49 | 20.2 | 343.72 | 345.49 |
| 23 | 344.39 | 345.49 | 22 | 344.12 | 345.49 |
| 24 | 344.98 | 345.49 | 23.1 | 344.75 | 345.49 |
| 25 | 345.05 | 345.49 | 24.6 | 345.15 | 345.49 |
| 25.8 | 345.17 | 345.49 | 26 | 345.23 | 345.49 |
| 30 | 345.72 | 345.49 | 28.3 | 345.49 | 345.49 |
| 32 | 346.03 | | 31 | 345.86 | |
| 38 | 347.02 | | 34 | 346.41 | |
| 45 | 347.48 | | 39 | 346.92 | |
| | | | 45 | 347.47 | |

**Facing downstream at Cross Section #18 (2008)**

**XSC #19 - UT to Ellington Branch**
**15+39.2 (riffle)**

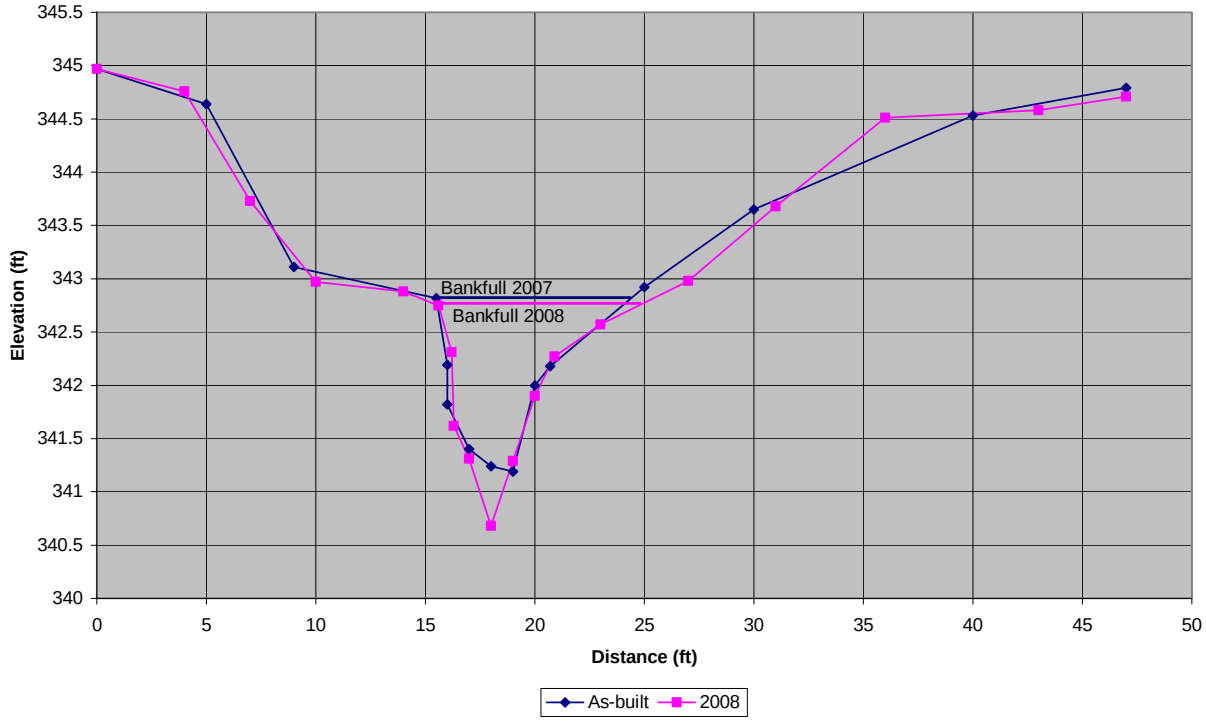



**XSC #19 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 345.83 | | 0 | 345.83 | |
| 5 | 345.44 | | 4 | 345.55 | |
| 10 | 344.61 | | 9 | 344.76 | |
| 18 | 344.47 | 344.47 | 13 | 344.58 | |
| 18.8 | 343.7 | 344.47 | 18 | 344.67 | |
| 20 | 343.51 | 344.47 | 19 | 344 | 344.51 |
| 21 | 343.56 | 344.47 | 19.5 | 343.9 | 344.51 |
| 22 | 343.61 | 344.47 | 20.5 | 343.69 | 344.51 |
| 22.7 | 343.69 | 344.47 | 22.8 | 343.76 | 344.51 |
| 24 | 344.01 | 344.47 | 23 | 343.71 | 344.51 |
| 26 | 344.81 | 344.47 | 23.7 | 343.97 | 344.51 |
| 32 | 345.17 | | 25 | 344.51 | 344.51 |
| 40 | 346.3 | | 26 | 344.77 | |
| 48.4 | 346.39 | | 30 | 344.99 | |
| | | | 34 | 345.56 | |
| | | | 39 | 346.18 | |
| | | | 45 | 346.35 | |

**Facing downstream at Cross Section #19 (2008)**

**XSC #20 - UT to Ellington Branch**
**Sta. 16+82.0 (pool)**

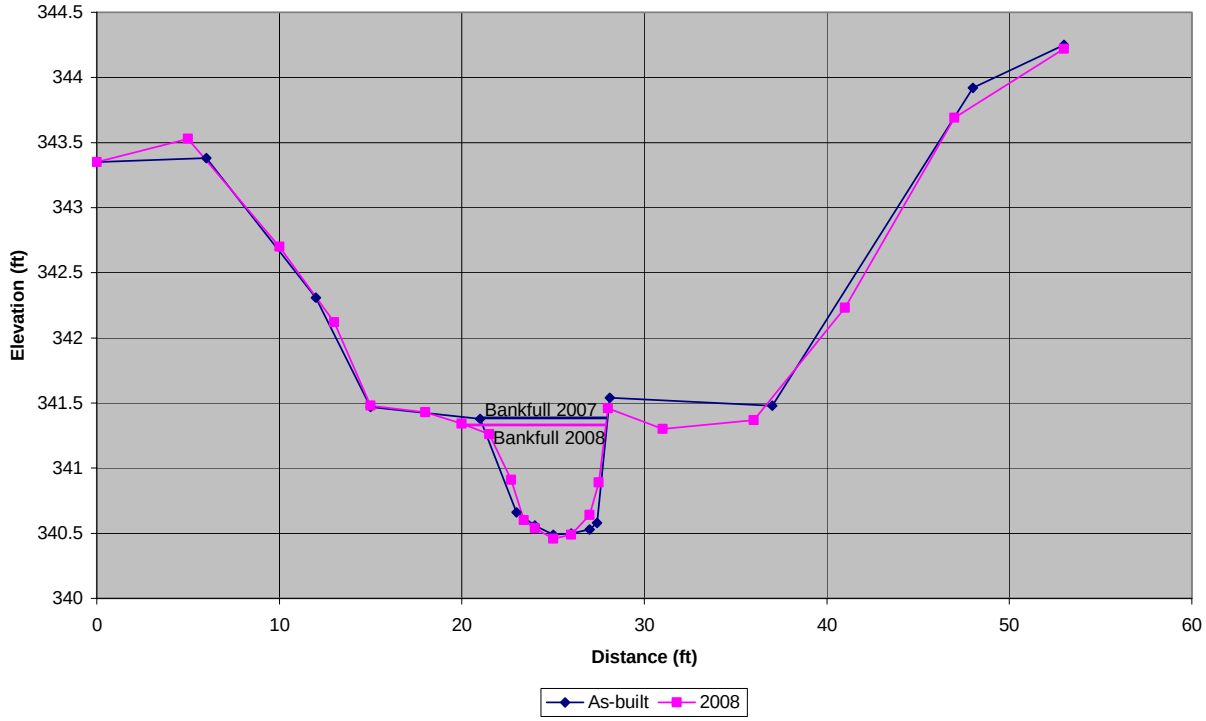



**XSC #20 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 344.97 | | 0 | 344.97 | |
| 5 | 344.64 | | 4 | 344.76 | |
| 9 | 343.11 | | 7 | 343.73 | |
| 15.5 | 342.82 | 342.82 | 10 | 342.97 | |
| 16 | 342.19 | 342.82 | 14 | 342.88 | |
| 16 | 341.82 | 342.82 | 15.6 | 342.75 | 342.75 |
| 17 | 341.4 | 342.82 | 16.2 | 342.31 | 342.75 |
| 18 | 341.24 | 342.82 | 16.3 | 341.62 | 342.75 |
| 19 | 341.19 | 342.82 | 17 | 341.31 | 342.75 |
| 20 | 342 | 342.82 | 18 | 340.68 | 342.75 |
| 20.7 | 342.18 | 342.82 | 19 | 341.29 | 342.75 |
| 25 | 342.92 | 342.82 | 20 | 341.9 | 342.75 |
| 30 | 343.65 | | 20.9 | 342.27 | 342.75 |
| 40 | 344.53 | | 23 | 342.57 | 342.75 |
| 47 | 344.79 | | 27 | 342.98 | |
| | | | 31 | 343.68 | |
| | | | 36 | 344.51 | |
| | | | 43 | 344.58 | |
| | | | 47 | 344.71 | |

**Facing downstream at Cross Section #20 (2008)**

**XSC #21 - UT to Ellington Branch**
**Sta. 18+64.8 (riffle)**

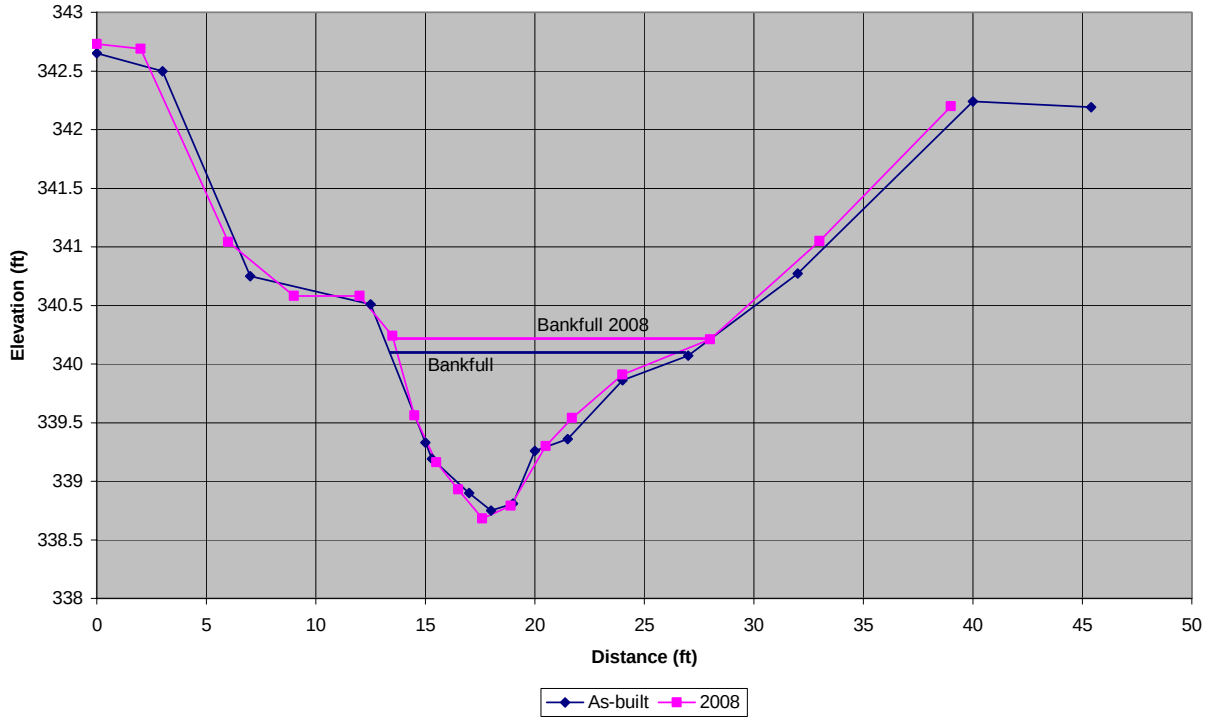



**XSC #21 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 343.35 | | 0 | 343.35 | |
| 6 | 343.38 | | 5 | 343.53 | |
| 12 | 342.31 | | 10 | 342.7 | |
| 15 | 341.47 | | 13 | 342.12 | |
| 21 | 341.38 | 341.38 | 15 | 341.48 | |
| 23 | 340.66 | 341.38 | 18 | 341.43 | |
| 24 | 340.56 | 341.38 | 20 | 341.34 | 341.34 |
| 25 | 340.49 | 341.38 | 21.5 | 341.26 | 341.34 |
| 26 | 340.5 | 341.38 | 22.7 | 340.91 | 341.34 |
| 27 | 340.53 | 341.38 | 23.4 | 340.6 | 341.34 |
| 27.4 | 340.58 | 341.38 | 24 | 340.54 | 341.34 |
| 28.1 | 341.54 | 341.38 | 25 | 340.46 | 341.34 |
| 37 | 341.48 | | 26 | 340.49 | 341.34 |
| 48 | 343.92 | | 27 | 340.64 | 341.34 |
| 53 | 344.25 | | 27.5 | 340.89 | 341.34 |
| | | | 28 | 341.46 | |
| | | | 31 | 341.3 | |
| | | | 36 | 341.37 | |
| | | | 41 | 342.23 | |
| | | | 47 | 343.69 | |
| | | | 53 | 344.22 | |

**Facing downstream at Cross Section #21 (2008)**

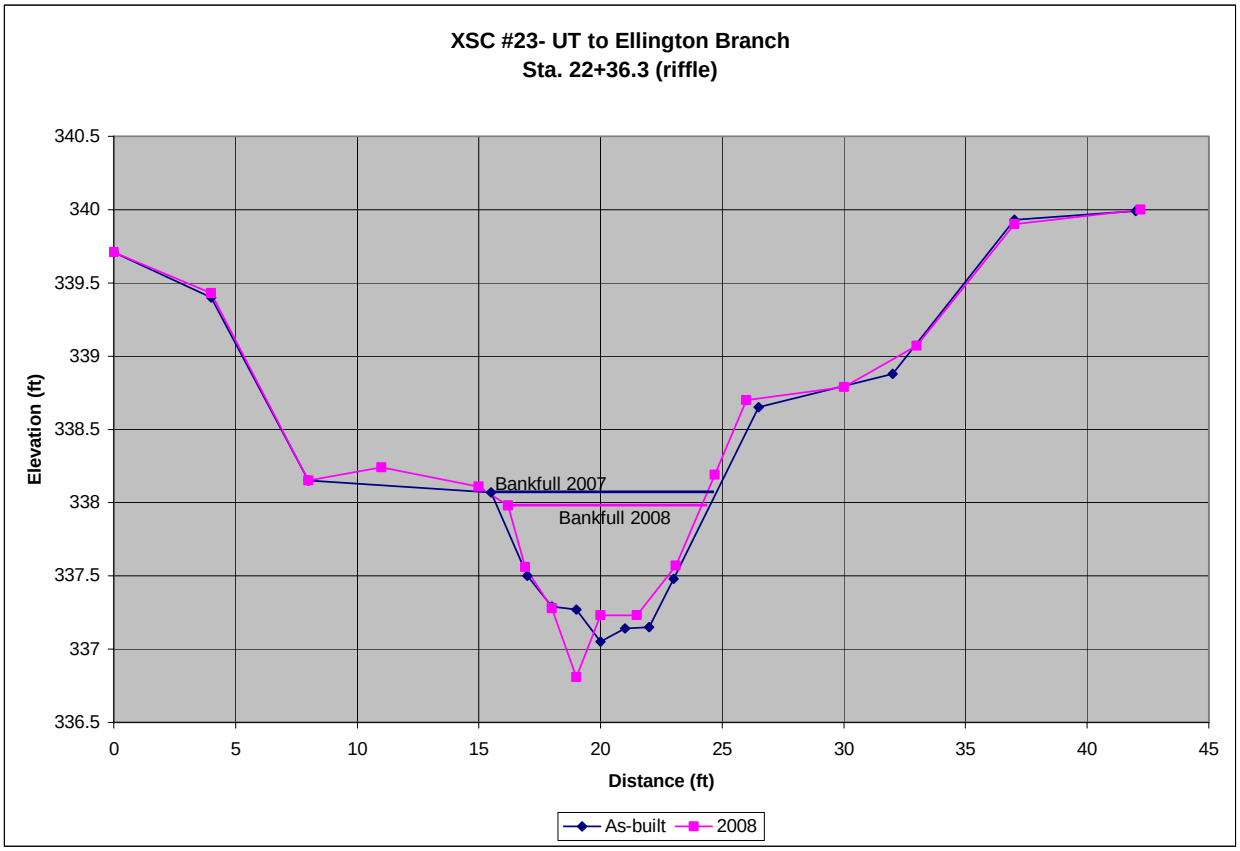
**XSC #22 - UT to Ellington Branch**
**Sta. 19+73.0 (pool)**




**XSC #22 - Pool**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 342.65 | | 0 | 342.73 | |
| 3 | 342.5 | | 2 | 342.69 | |
| 7 | 340.75 | | 6 | 341.04 | |
| 12.5 | 340.51 | 340.07 | 9 | 340.58 | |
| 15 | 339.33 | 340.07 | 12 | 340.58 | |
| 15.3 | 339.19 | 340.07 | 13.5 | 340.24 | |
| 17 | 338.9 | 340.07 | 14.5 | 339.56 | 340.21 |
| 18 | 338.75 | 340.07 | 15.5 | 339.16 | 340.21 |
| 19 | 338.81 | 340.07 | 16.5 | 338.93 | 340.21 |
| 20 | 339.26 | 340.07 | 17.6 | 338.68 | 340.21 |
| 21.5 | 339.36 | 340.07 | 18.9 | 338.79 | 340.21 |
| 24 | 339.86 | 340.07 | 20.5 | 339.3 | 340.21 |
| 27 | 340.07 | 340.07 | 21.7 | 339.54 | 340.21 |
| 32 | 340.77 | | 24 | 339.91 | 340.21 |
| 40 | 342.24 | | 28 | 340.21 | 340.21 |
| 45.4 | 342.19 | | 33 | 341.05 | |
| | | | 39 | 342.2 | |

**Facing downstream at Cross Section #22 (2008)**

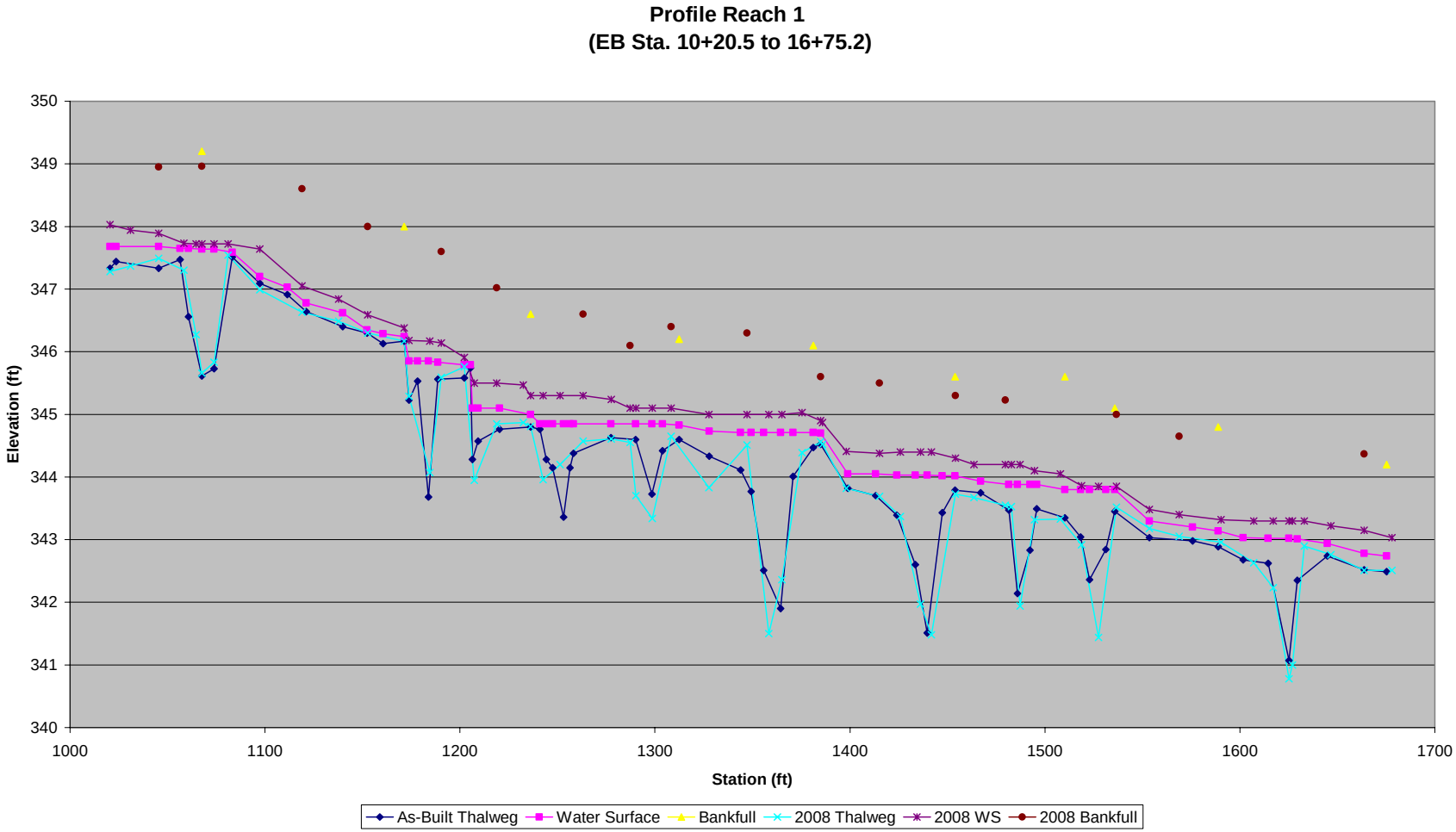



**XSC #23 - Riffle**

| As-built | | | Year 1 | | |
|---|---|---|---|---|---|
| Station | Elevation | BKF | Station | Elevation | BKF |
| 0 | 339.71 | | 0 | 339.71 | |
| 4 | 339.4 | | 4 | 339.43 | |
| 8 | 338.15 | | 8 | 338.15 | |
| 15.5 | 338.07 | 338.07 | 11 | 338.24 | |
| 17 | 337.5 | 338.07 | 15 | 338.11 | |
| 18 | 337.29 | 338.07 | 16.2 | 337.98 | 337.98 |
| 19 | 337.27 | 338.07 | 16.9 | 337.56 | 337.98 |
| 20 | 337.05 | 338.07 | 18 | 337.28 | 337.98 |
| 21 | 337.14 | 338.07 | 19 | 336.81 | 337.98 |
| 22 | 337.15 | 338.07 | 20 | 337.23 | 337.98 |
| 23 | 337.48 | 338.07 | 21.5 | 337.23 | 337.98 |
| 26.5 | 338.65 | 338.07 | 23.1 | 337.57 | 337.98 |
| 32 | 338.88 | | 24.7 | 338.19 | |
| 37 | 339.93 | | 26 | 338.7 | |
| 42 | 339.99 | | 30 | 338.79 | |
| | | | 33 | 339.07 | |
| | | | 37 | 339.9 | |
| | | | 42.2 | 340 | |

**Facing downstream at Cross Section #23 (2008)**

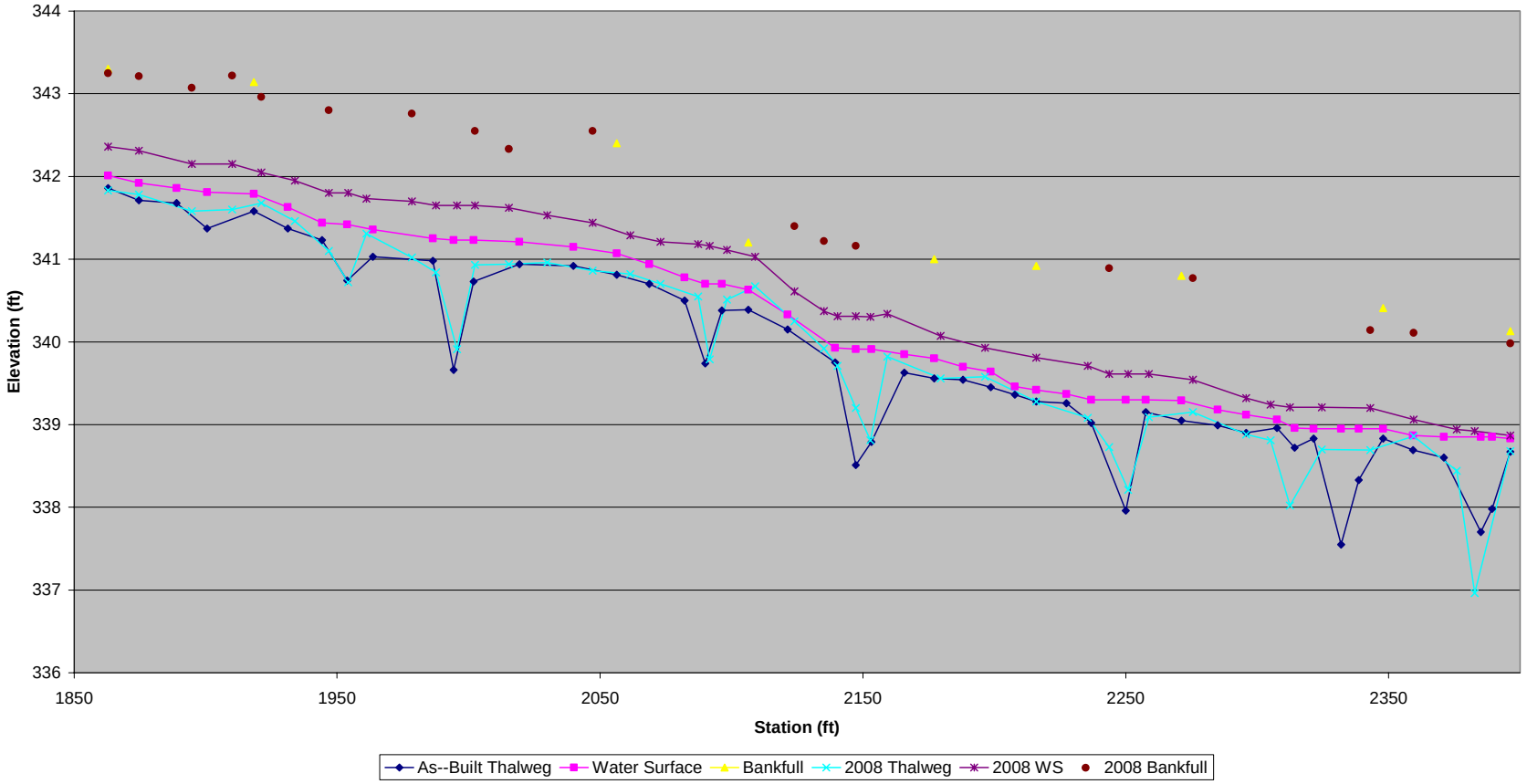
# APPENDIX B-4:
## Longitudinal Plots and Raw Data Tables



**Profile Reach #1**

| As-Built | | | | | Year 1 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** | **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** |
| 1020.5 | 347.33 | 347.68 | | | 1020.5 | 347.28 | 348.03 | | |
| 1023.7 | 347.44 | 347.68 | | | 1030.96 | 347.37 | 347.94 | | |
| 1045.5 | 347.33 | 347.68 | | | 1045.43 | 347.49 | 347.89 | 348.95 | |
| 1056.5 | 347.47 | 347.65 | | H Pool | 1058.45 | 347.3 | 347.73 | | |
| 1060.7 | 346.56 | 347.65 | | | 1064.62 | 346.27 | 347.72 | | |
| 1067.7 | 345.61 | 347.64 | 349.2 | Max D | 1067.7 | 345.66 | 347.72 | 348.96 | |
| 1073.9 | 345.73 | 347.64 | | H Glide | 1073.84 | 345.83 | 347.72 | | |
| 1083.2 | 347.51 | 347.59 | | H Riffle | 1081.07 | 347.54 | 347.72 | | |
| 1097.4 | 347.09 | 347.2 | | | 1097.37 | 346.99 | 347.64 | | |
| 1111.5 | 346.91 | 347.03 | | | 1119 | 346.63 | 347.05 | 348.6 | |
| 1121.2 | 346.64 | 346.78 | | | 1137.76 | 346.49 | 346.84 | | |
| 1139.8 | 346.4 | 346.62 | | | 1152.64 | 346.3 | 346.59 | 348 | |
| 1152.4 | 346.3 | 346.35 | | | 1171.4 | 346.17 | 346.38 | | X-Vane |
| 1160.6 | 346.13 | 346.29 | | H Run | 1173.8 | 345.29 | 346.18 | | |
| 1171.4 | 346.17 | 346.24 | 348 | X-Vane | 1184.51 | 344.07 | 346.17 | | |
| 1173.8 | 345.23 | 345.85 | | H Pool | 1190.39 | 345.59 | 346.14 | 347.6 | |
| 1178.3 | 345.53 | 345.85 | | | 1202.3 | 345.76 | 345.91 | | X-Vane |
| 1183.8 | 343.68 | 345.85 | | Max D | 1207.35 | 343.95 | 345.5 | | |
| 1188.7 | 345.56 | 345.83 | | H Glide | 1218.86 | 344.85 | 345.5 | 347.02 | |
| 1202.3 | 345.58 | 345.79 | | X-Vane | 1232.38 | 344.87 | 345.47 | | |
| 1205.3 | 345.74 | 345.79 | | H Pool | 1236.3 | 344.81 | 345.3 | | X-Vane |
| 1206.3 | 344.28 | 345.1 | | Max D | 1242.61 | 343.96 | 345.3 | | |
| 1209.3 | 344.57 | 345.1 | | | 1251.26 | 344.2 | 345.3 | | |
| 1220.3 | 344.76 | 345.1 | | | 1263.12 | 344.57 | 345.3 | 346.6 | |
| 1236.3 | 344.8 | 345 | 346.6 | X-Vane | 1277.58 | 344.61 | 345.24 | | |
| 1241 | 344.76 | 344.85 | | H Pool | 1287.28 | 344.55 | 345.1 | 346.1 | |
| 1244.2 | 344.28 | 344.85 | | | 1290.25 | 343.7 | 345.1 | | |
| 1247.6 | 344.15 | 344.85 | | Max D | 1298.55 | 343.34 | 345.1 | | |
| 1253.2 | 343.36 | 344.85 | | | 1308.34 | 344.65 | 345.1 | 346.4 | |
| 1256.4 | 344.15 | 344.85 | | H Glide | 1327.7 | 343.83 | 345 | | |
| 1258.2 | 344.38 | 344.85 | | | 1347.26 | 344.51 | 345 | 346.3 | |
| 1277.4 | 344.63 | 344.85 | | | 1358.41 | 341.5 | 345 | | |
| 1290 | 344.6 | 344.85 | | H Pool | 1365.11 | 342.36 | 345 | | |
| 1298.5 | 343.73 | 344.85 | | Max D | 1375.46 | 344.39 | 345.03 | | |
| 1303.8 | 344.42 | 344.85 | | H Glide | 1385 | 344.56 | 344.9 | 345.6 | |
| 1312.4 | 344.6 | 344.83 | 346.2 | H Riffle | 1385.9 | 344.52 | 344.87 | | |
| 1327.9 | 344.33 | 344.73 | | H Run | 1398.16 | 343.82 | 344.41 | | |
| 1344 | 344.11 | 344.71 | | H Pool | 1415.2 | 343.69 | 344.38 | 345.5 | |
| 1349.4 | 343.77 | 344.71 | | | 1425.82 | 343.37 | 344.4 | | |
| 1355.8 | 342.51 | 344.71 | | | 1436.14 | 341.97 | 344.4 | | |
| 1364.4 | 341.9 | 344.71 | | Max D | 1441.71 | 341.48 | 344.4 | | |
| 1370.9 | 344.01 | 344.71 | | H Glide | 1454.01 | 343.73 | 344.3 | 345.3 | |
| 1381.2 | 344.47 | 344.71 | 346.1 | H Riff | 1463.55 | 343.67 | 344.2 | | |
| 1385 | 344.52 | 344.7 | | | 1479.66 | 343.55 | 344.2 | 345.23 | |
| 1398.9 | 343.82 | 344.05 | | H Run | 1482.73 | 343.53 | 344.2 | | |
| 1413.2 | 343.7 | 344.05 | | | 1487.16 | 341.94 | 344.2 | | |
| 1424.1 | 343.39 | 344.03 | | H Pool | 1494.69 | 343.32 | 344.1 | | |
| 1433.6 | 342.6 | 344.03 | | | 1507.85 | 343.33 | 344.05 | | |
| 1439.6 | 341.51 | 344.03 | | Max D | 1518.68 | 342.92 | 343.86 | | |
| 1447.3 | 343.43 | 344.02 | | H Glide | 1527.45 | 341.44 | 343.85 | | |
| 1453.9 | 343.79 | 344.02 | 345.6 | | 1536.66 | 343.52 | 343.85 | 345 | |
| 1467.1 | 343.75 | 343.93 | | | 1553.56 | 343.18 | 343.48 | | |
| 1481.5 | 343.47 | 343.88 | | | 1568.83 | 343.05 | 343.4 | 344.65 | |
| 1486 | 342.14 | 343.88 | | | 1590.37 | 342.96 | 343.32 | | |
| 1492.3 | 342.83 | 343.88 | | | 1607.13 | 342.63 | 343.3 | | |
| 1495.7 | 343.49 | 343.88 | | | 1617.09 | 342.23 | 343.3 | | |
| 1510.2 | 343.35 | 343.8 | 345.6 | | 1625.2 | 340.78 | 343.3 | | |
| 1518.2 | 343.04 | 343.8 | | | 1626.96 | 341 | 343.3 | | |
| 1522.8 | 342.36 | 343.8 | | | 1633.08 | 342.9 | 343.3 | | |
| 1531.3 | 342.84 | 343.8 | | | 1646.72 | 342.76 | 343.22 | | |
| 1535.8 | 343.45 | 343.8 | 345.1 | | 1663.65 | 342.51 | 343.15 | 344.37 | |
| 1553.5 | 343.03 | 343.3 | | | 1678.03 | 342.51 | 343.03 | | |
| 1575.8 | 342.98 | 343.2 | | | | | | | |
| 1588.9 | 342.89 | 343.14 | 344.8 | | | | | | |
| 1601.7 | 342.68 | 343.03 | | | | | | | |
| 1614.4 | 342.62 | 343.02 | | | | | | | |
| 1625.2 | 341.07 | 343.02 | | | | | | | |
| 1629.4 | 342.35 | 343.01 | | | | | | | |
| 1644.8 | 342.74 | 342.94 | | | | | | | |
| 1663.7 | 342.52 | 342.78 | | | | | | | |
| 1675.2 | 342.49 | 342.74 | 344.2 | | | | | | |

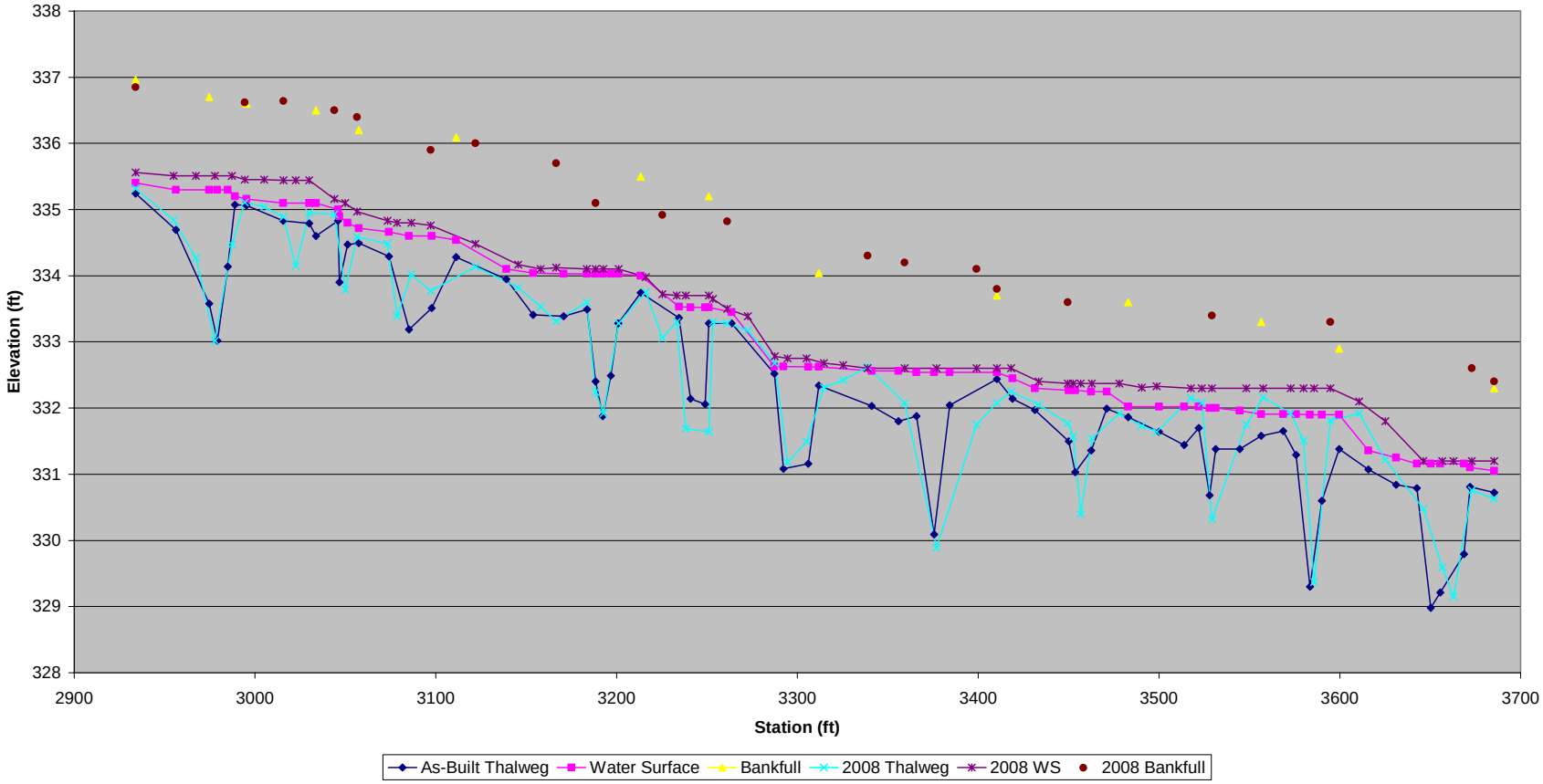
**Profile Reach 2**
**(EB Sta. 18+62.9 to 23+96.3)**



**Profile Reach #2**

| As-Built | | | | | Year 1 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** | **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** |
| 1862.9 | 341.86 | 342.01 | 343.3 | | 1862.9 | 341.83 | 342.36 | 343.25 | |
| 1874.7 | 341.71 | 341.92 | | | 1874.7 | 341.78 | 342.31 | 343.21 | |
| 1889 | 341.68 | 341.86 | | | 1894.72 | 341.58 | 342.15 | 343.07 | |
| 1900.6 | 341.37 | 341.81 | | | 1910.13 | 341.6 | 342.15 | 343.22 | |
| 1918.3 | 341.58 | 341.79 | 343.14 | | 1921.18 | 341.68 | 342.05 | 342.96 | |
| 1931.2 | 341.37 | 341.63 | | | 1933.97 | 341.46 | 341.95 | | |
| 1944.3 | 341.23 | 341.44 | | | 1946.92 | 341.1 | 341.8 | 342.8 | |
| 1953.8 | 340.74 | 341.42 | | | 1954.2 | 340.72 | 341.8 | | |
| 1963.6 | 341.03 | 341.36 | | | 1961.19 | 341.31 | 341.73 | | |
| 1986.5 | 340.98 | 341.25 | | | 1978.43 | 341.02 | 341.7 | 342.76 | |
| 1994.4 | 339.66 | 341.23 | | | 1987.66 | 340.84 | 341.65 | | |
| 2002 | 340.73 | 341.23 | | | 1995.68 | 339.91 | 341.65 | | |
| 2019.3 | 340.94 | 341.21 | | | 2002.42 | 340.93 | 341.65 | 342.55 | |
| 2039.9 | 340.92 | 341.15 | | | 2015.33 | 340.94 | 341.62 | 342.33 | |
| 2056.4 | 340.81 | 341.07 | 342.4 | | 2029.96 | 340.96 | 341.53 | | |
| 2068.7 | 340.7 | 340.94 | | | 2047.18 | 340.86 | 341.44 | 342.55 | |
| 2082.2 | 340.5 | 340.78 | | | 2061.58 | 340.82 | 341.29 | | |
| 2090 | 339.74 | 340.7 | | | 2072.97 | 340.7 | 341.21 | | |
| 2096.4 | 340.38 | 340.7 | | | 2087.29 | 340.55 | 341.18 | | |
| 2106.4 | 340.39 | 340.63 | 341.2 | | 2091.66 | 339.79 | 341.16 | | |
| 2121.4 | 340.15 | 340.33 | | | 2098.26 | 340.51 | 341.11 | | |
| 2139.4 | 339.75 | 339.93 | | | 2109.05 | 340.67 | 341.03 | | |
| 2147.3 | 338.51 | 339.91 | | | 2123.93 | 340.25 | 340.61 | 341.4 | |
| 2153.3 | 338.79 | 339.91 | | | 2135.23 | 339.92 | 340.37 | 341.22 | |
| 2165.8 | 339.63 | 339.85 | | | 2140.37 | 339.71 | 340.31 | | |
| 2177.1 | 339.56 | 339.8 | 341 | | 2147.3 | 339.2 | 340.31 | 341.16 | |
| 2188.1 | 339.54 | 339.7 | | | 2152.82 | 338.81 | 340.3 | | |
| 2198.7 | 339.45 | 339.64 | | | 2159.33 | 339.82 | 340.34 | | |
| 2207.8 | 339.36 | 339.46 | | | 2179.62 | 339.56 | 340.07 | | |
| 2216 | 339.28 | 339.42 | 340.92 | | 2196.52 | 339.58 | 339.93 | | |
| 2227.4 | 339.26 | 339.37 | | | 2215.97 | 339.28 | 339.81 | | |
| 2236.8 | 339.02 | 339.3 | | | 2235.48 | 339.08 | 339.71 | | |
| 2250 | 337.96 | 339.3 | | | 2243.62 | 338.73 | 339.61 | 340.89 | |
| 2257.6 | 339.15 | 339.3 | | | 2250.89 | 338.21 | 339.61 | | |
| 2271.1 | 339.05 | 339.29 | 340.8 | | 2258.79 | 339.09 | 339.61 | | |
| 2285 | 338.99 | 339.18 | | | 2275.49 | 339.15 | 339.54 | 340.77 | |
| 2295.8 | 338.9 | 339.12 | | | 2295.8 | 338.88 | 339.32 | | |
| 2307.5 | 338.96 | 339.06 | | | 2305.09 | 338.81 | 339.24 | | |
| 2314.2 | 338.72 | 338.96 | | | 2312.4 | 338.02 | 339.21 | | |
| 2321.5 | 338.83 | 338.95 | | | 2324.56 | 338.7 | 339.21 | | |
| 2331.9 | 337.55 | 338.95 | | | 2343 | 338.69 | 339.2 | 340.14 | |
| 2338.6 | 338.33 | 338.95 | | | 2359.53 | 338.86 | 339.06 | 340.11 | |
| 2347.9 | 338.83 | 338.95 | 340.41 | | 2375.9 | 338.44 | 338.94 | | |
| 2359.3 | 338.69 | 338.87 | | | 2382.7 | 336.96 | 338.92 | | |
| 2371 | 338.6 | 338.85 | | | 2396.3 | 338.68 | 338.87 | 339.98 | |
| 2385 | 337.7 | 338.85 | | | | | | | |
| 2389.3 | 337.98 | 338.85 | | | | | | | |
| 2396.3 | 338.67 | 338.83 | 340.13 | | | | | | |

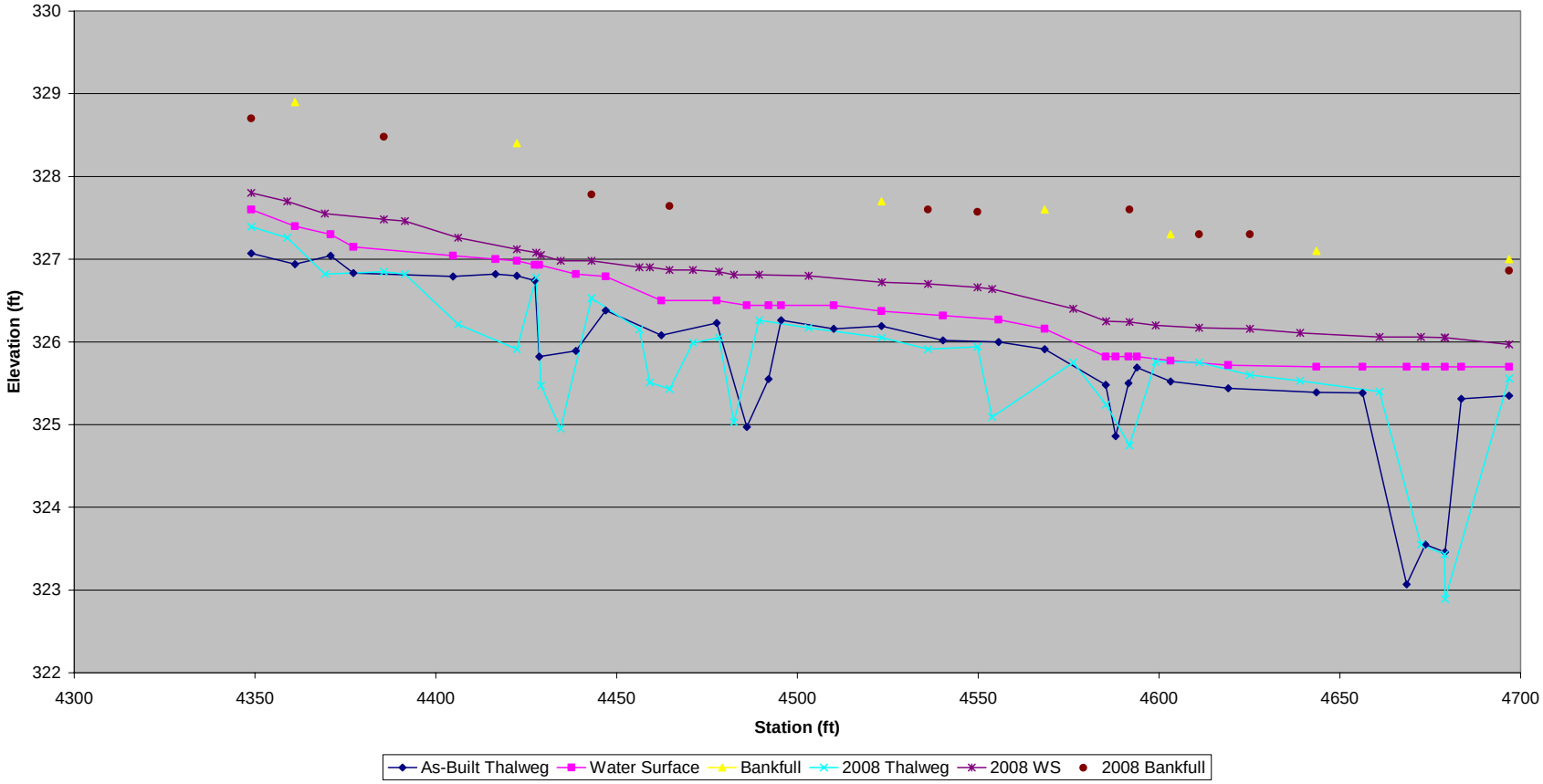
**Profile Reach 3**
**(EB Sta. 29+33.9 to 36+85.3)**



**Profile Reach #3**

| As-Built | | | | | Year 1 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** | **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** |
| 2933.9 | 335.24 | 335.4 | 336.96 | | 2933.9 | 335.32 | 335.56 | 336.85 | |
| 2956.3 | 334.69 | 335.3 | | | 2954.95 | 334.84 | 335.51 | | |
| 2974.7 | 333.58 | 335.3 | 336.7 | | 2967.36 | 334.27 | 335.51 | | |
| 2979.1 | 333.02 | 335.3 | | | 2977.87 | 333.02 | 335.51 | | |
| 2984.9 | 334.14 | 335.3 | | | 2987.24 | 334.47 | 335.51 | | |
| 2989 | 335.07 | 335.2 | | | 2994.35 | 335.11 | 335.45 | 336.62 | |
| 2995.4 | 335.06 | 335.16 | 336.6 | | 3005 | 335.04 | 335.45 | | |
| 3015.5 | 334.83 | 335.1 | | | 3015.81 | 334.89 | 335.44 | 336.64 | |
| 3030 | 334.79 | 335.1 | | | 3022.49 | 334.15 | 335.44 | | |
| 3033.8 | 334.6 | 335.1 | 336.5 | | 3029.98 | 334.95 | 335.44 | | |
| 3045.9 | 334.83 | 335 | | | 3043.93 | 334.93 | 335.16 | 336.5 | |
| 3046.8 | 333.9 | 334.9 | | | 3049.94 | 333.79 | 335.1 | | |
| 3051.2 | 334.47 | 334.8 | | | 3056.42 | 334.59 | 334.97 | 336.4 | |
| 3057.5 | 334.49 | 334.72 | 336.2 | | 3073.33 | 334.48 | 334.83 | | |
| 3074.2 | 334.29 | 334.66 | | | 3078.65 | 333.39 | 334.8 | | |
| 3085.2 | 333.19 | 334.6 | | | 3086.45 | 334.02 | 334.8 | | |
| 3097.8 | 333.51 | 334.6 | | | 3097.14 | 333.77 | 334.76 | 335.9 | |
| 3111.3 | 334.28 | 334.54 | 336.09 | | 3122 | 334.14 | 334.48 | 336 | |
| 3139 | 333.95 | 334.1 | | | 3145.57 | 333.82 | 334.17 | | |
| 3153.8 | 333.41 | 334.04 | | | 3158.04 | 333.53 | 334.1 | | |
| 3170.7 | 333.39 | 334.03 | | | 3166.57 | 333.31 | 334.12 | 335.7 | |
| 3183.6 | 333.49 | 334.03 | | | 3183.54 | 333.6 | 334.1 | | |
| 3188.3 | 332.4 | 334.03 | | | 3188.34 | 332.24 | 334.1 | 335.1 | |
| 3192.3 | 331.88 | 334.03 | | | 3192.72 | 331.92 | 334.1 | | |
| 3196.8 | 332.49 | 334.03 | | | 3201.04 | 333.28 | 334.1 | | |
| 3201 | 333.28 | 334.03 | | | 3216.14 | 333.75 | 333.98 | | |
| 3213.3 | 333.74 | 334 | 335.5 | | 3225.27 | 333.06 | 333.72 | 334.92 | |
| 3234.6 | 333.36 | 333.53 | | | 3233.29 | 333.3 | 333.7 | | |
| 3240.9 | 332.14 | 333.52 | | | 3238.3 | 331.69 | 333.7 | | |
| 3248.9 | 332.06 | 333.52 | | | 3251.07 | 331.64 | 333.7 | | |
| 3251 | 333.28 | 333.52 | 335.2 | | 3253.37 | 333.3 | 333.65 | | |
| 3263.6 | 333.28 | 333.45 | | | 3261.08 | 333.28 | 333.5 | 334.82 | |
| 3287.3 | 332.52 | 332.63 | | | 3272.53 | 333.17 | 333.39 | | |
| 3292.4 | 331.08 | 332.63 | | | 3287.34 | 332.68 | 332.78 | | |
| 3306 | 331.16 | 332.62 | | | 3294.51 | 331.18 | 332.75 | | |
| 3311.8 | 332.34 | 332.62 | 334.04 | | 3305.1 | 331.49 | 332.75 | | |
| 3341 | 332.03 | 332.56 | | | 3314.65 | 332.31 | 332.68 | | |
| 3356 | 331.8 | 332.56 | | | 3325.25 | 332.42 | 332.65 | | |
| 3365.8 | 331.88 | 332.54 | | | 3338.9 | 332.62 | 332.6 | 334.3 | |
| 3375.6 | 330.09 | 332.54 | | | 3359.34 | 332.08 | 332.6 | 334.2 | |
| 3384.3 | 332.04 | 332.54 | | | 3376.85 | 329.89 | 332.6 | | |
| 3410.4 | 332.44 | 332.54 | 333.7 | | 3399.14 | 331.75 | 332.6 | 334.1 | |
| 3418.9 | 332.14 | 332.45 | | | 3410.36 | 332.08 | 332.6 | 333.8 | |
| 3431.4 | 331.97 | 332.3 | | | 3418.24 | 332.25 | 332.6 | | |
| 3450 | 331.5 | 332.27 | | | 3433.37 | 332.05 | 332.4 | | |
| 3453.6 | 331.03 | 332.27 | | | 3449.44 | 331.77 | 332.37 | 333.6 | |
| 3462.5 | 331.36 | 332.25 | | | 3452.44 | 331.57 | 332.37 | | |
| 3471.2 | 331.99 | 332.25 | | | 3456.6 | 330.4 | 332.37 | | |
| 3482.9 | 331.86 | 332.02 | 333.6 | | 3462.91 | 331.54 | 332.37 | | |
| 3500 | 331.64 | 332.02 | | | 3478.02 | 331.92 | 332.37 | | |
| 3513.9 | 331.44 | 332.02 | | | 3490.37 | 331.73 | 332.31 | | |
| 3521.9 | 331.7 | 332.02 | | | 3498.75 | 331.64 | 332.33 | | |
| 3527.9 | 330.68 | 332 | | | 3517.57 | 332.15 | 332.3 | | |
| 3531.4 | 331.38 | 332 | | | 3523.57 | 332.08 | 332.3 | | |
| 3544.6 | 331.38 | 331.96 | | | 3529.31 | 330.32 | 332.3 | 333.4 | |
| 3556.5 | 331.58 | 331.91 | 333.3 | | 3548.24 | 331.75 | 332.3 | | |
| 3568.6 | 331.65 | 331.91 | | | 3557.54 | 332.16 | 332.3 | | |
| 3575.8 | 331.29 | 331.91 | | | 3572.81 | 331.92 | 332.3 | | |
| 3583.4 | 329.3 | 331.9 | | | 3579.9 | 331.51 | 332.3 | | |
| 3590 | 330.6 | 331.9 | | | 3585.72 | 329.37 | 332.3 | | |
| 3599.7 | 331.38 | 331.9 | 332.9 | | 3594.77 | 331.81 | 332.3 | 333.3 | |
| 3615.8 | 331.07 | 331.36 | | | 3610.62 | 331.92 | 332.1 | | |
| 3631.1 | 330.84 | 331.25 | | | 3625.12 | 331.22 | 331.8 | | |
| 3642.5 | 330.79 | 331.16 | | | 3646.2 | 330.48 | 331.2 | | |
| 3650.3 | 328.98 | 331.16 | | | 3656.67 | 329.59 | 331.2 | | |
| 3655.6 | 329.21 | 331.16 | | | 3662.93 | 329.15 | 331.2 | | |
| 3668.7 | 329.79 | 331.16 | | | 3672.98 | 330.76 | 331.2 | 332.6 | |
| 3672 | 330.81 | 331.1 | | | 3685.3 | 330.63 | 331.2 | 332.4 | |
| 3685.3 | 330.72 | 331.05 | 332.3 | | | | | | |

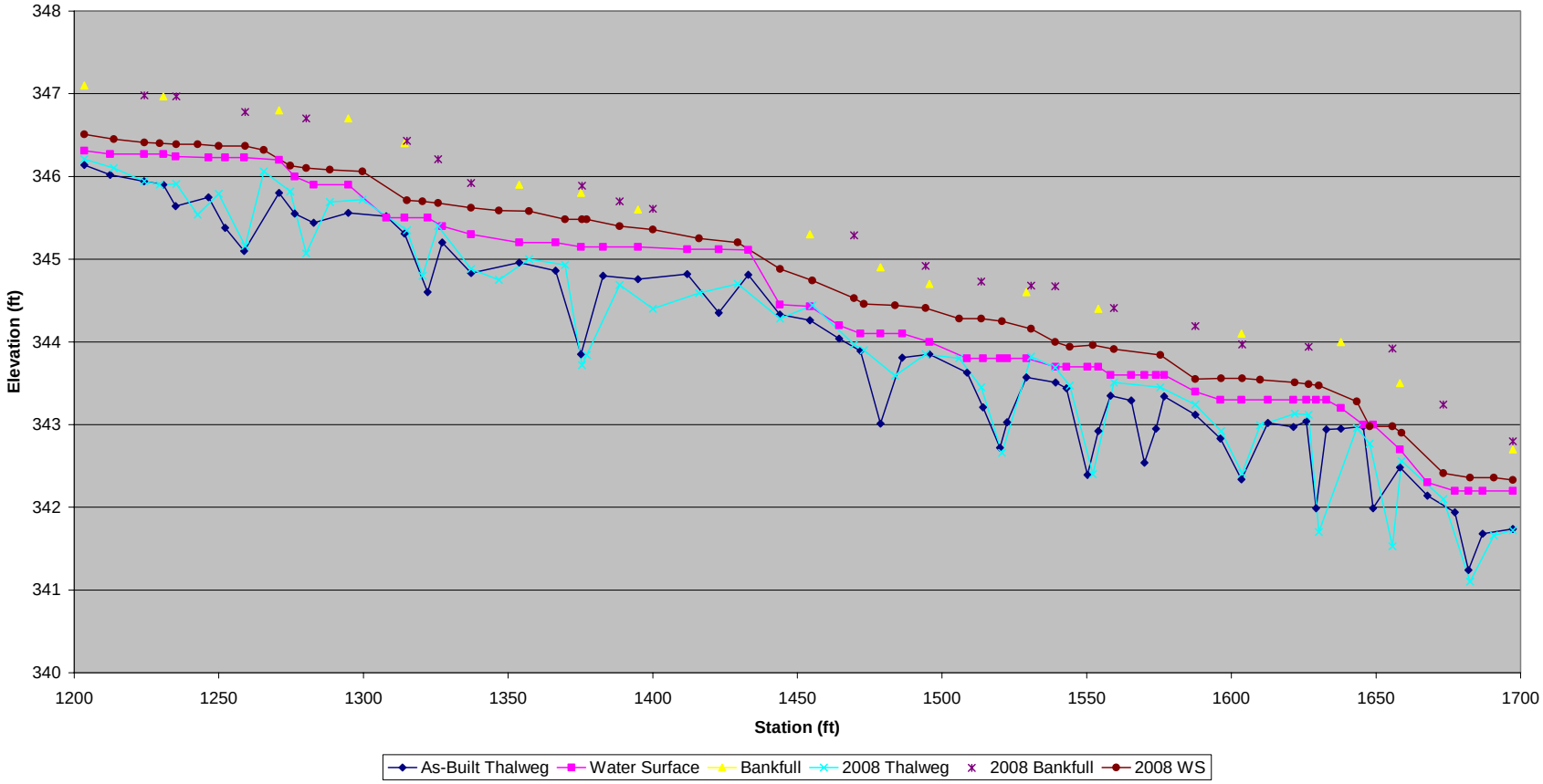
**Profile Reach 4**
**(EB Sta. 43+49 to 46+96.8)**



**Profile Reach #4**

| As-Built | | | | | Year 1 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** | **Sta.** | **Elev** | **WS** | **Bankfull** | **Feature** |
| 4349 | 327.07 | 327.6 | | | 4349 | 327.39 | 327.8 | 328.7 | |
| 4361.1 | 326.94 | 327.4 | 328.9 | | 4358.94 | 327.26 | 327.7 | | |
| 4370.9 | 327.04 | 327.3 | | | 4369.29 | 326.82 | 327.55 | | |
| 4377.2 | 326.83 | 327.15 | | | 4385.61 | 326.85 | 327.48 | 328.48 | |
| 4404.8 | 326.79 | 327.04 | | | 4391.51 | 326.82 | 327.46 | | |
| 4416.5 | 326.82 | 327 | | | 4406.2 | 326.21 | 327.26 | | |
| 4422.4 | 326.8 | 326.98 | 328.4 | | 4422.4 | 325.91 | 327.12 | | |
| 4427.4 | 326.74 | 326.93 | | | 4427.81 | 326.78 | 327.08 | | |
| 4428.6 | 325.82 | 326.93 | | | 4429.07 | 325.47 | 327.05 | | |
| 4438.7 | 325.89 | 326.82 | | | 4434.49 | 324.95 | 326.98 | | |
| 4447 | 326.38 | 326.79 | | | 4443.03 | 326.53 | 326.98 | 327.78 | |
| 4462.4 | 326.08 | 326.5 | | | 4456.28 | 326.15 | 326.9 | | |
| 4477.7 | 326.23 | 326.5 | | | 4459.23 | 325.51 | 326.9 | | |
| 4486 | 324.97 | 326.44 | | | 4464.59 | 325.43 | 326.87 | 327.64 | |
| 4492 | 325.55 | 326.44 | | | 4471.11 | 325.99 | 326.87 | | |
| 4495.5 | 326.26 | 326.44 | | | 4478.33 | 326.05 | 326.85 | | |
| 4510 | 326.16 | 326.44 | | | 4482.5 | 325.03 | 326.81 | | |
| 4523.3 | 326.19 | 326.37 | 327.7 | | 4489.38 | 326.26 | 326.81 | | |
| 4540.2 | 326.02 | 326.32 | | | 4503.1 | 326.17 | 326.8 | | |
| 4555.6 | 326 | 326.27 | | | 4523.32 | 326.05 | 326.72 | | |
| 4568.4 | 325.91 | 326.16 | 327.6 | | 4536.14 | 325.91 | 326.7 | 327.6 | |
| 4585.3 | 325.48 | 325.82 | | | 4549.8 | 325.94 | 326.66 | 327.57 | |
| 4588 | 324.86 | 325.82 | | | 4553.83 | 325.09 | 326.64 | | |
| 4591.6 | 325.5 | 325.82 | | | 4576.3 | 325.75 | 326.4 | | |
| 4593.9 | 325.69 | 325.82 | | | 4585.37 | 325.24 | 326.25 | | |
| 4603.2 | 325.52 | 325.77 | 327.3 | | 4591.83 | 324.75 | 326.24 | 327.6 | |
| 4619.1 | 325.44 | 325.72 | | | 4599.05 | 325.76 | 326.2 | | |
| 4643.5 | 325.39 | 325.7 | 327.1 | | 4611.03 | 325.75 | 326.17 | 327.3 | |
| 4656.3 | 325.38 | 325.7 | | | 4625.17 | 325.6 | 326.16 | 327.3 | |
| 4668.5 | 323.07 | 325.7 | | | 4639.01 | 325.53 | 326.11 | | |
| 4673.6 | 323.55 | 325.7 | | | 4661 | 325.4 | 326.06 | | |
| 4679.1 | 323.46 | 325.7 | | | 4672.42 | 323.55 | 326.06 | | |
| 4683.6 | 325.31 | 325.7 | | | 4678.97 | 323.43 | 326.05 | | |
| 4696.8 | 325.35 | 325.7 | 327 | | 4679.1 | 322.89 | 326.05 | | |
| | | | | | 4696.8 | 325.56 | 325.97 | 326.86 | |

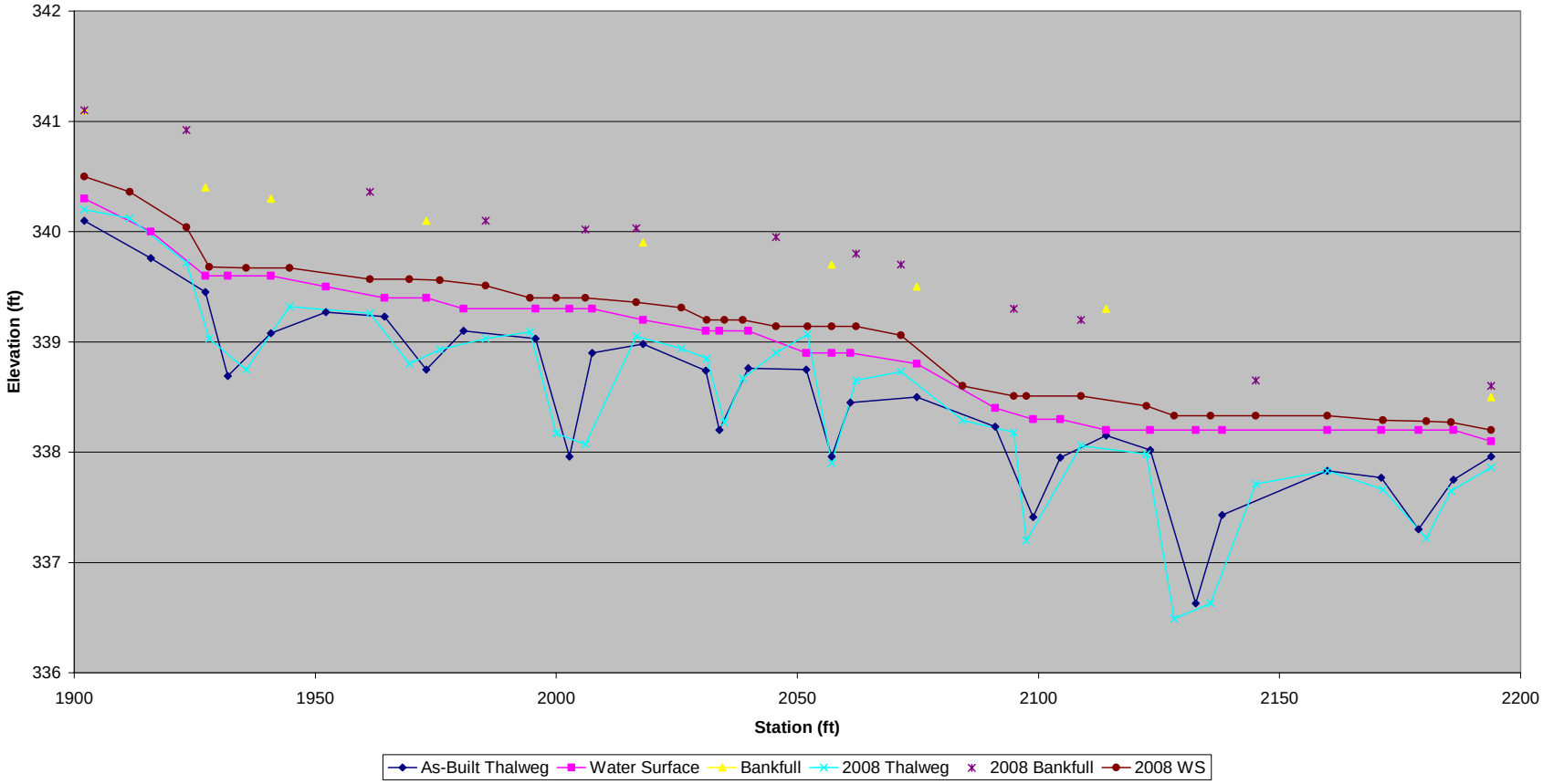
**Profile Reach 5**
**(UT Sta. 12+03.5 to 16+97.3)**



**Profile Reach #5 (UT)**

| As-Built | | | | | Year 1 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sta.** | **Elev** | **Bankfull** | **WS** | **Feature** | **Sta.** | **Elev** | **Bankfull** | **WS** | **Feature** |
| 1203.5 | 346.14 | 347.1 | 346.31 | | 1203.5 | 346.21 | | 346.51 | |
| 1212.4 | 346.02 | | 346.27 | | 1213.76 | 346.1 | | 346.45 | |
| 1224.2 | 345.94 | | 346.27 | | 1224.33 | 345.94 | 346.98 | 346.41 | |
| 1230.8 | 345.9 | 346.97 | 346.27 | | 1229.58 | 345.9 | | 346.4 | |
| 1235.1 | 345.64 | | 346.24 | | 1235.25 | 345.91 | 346.97 | 346.39 | |
| 1246.4 | 345.75 | | 346.23 | | 1242.66 | 345.54 | | 346.39 | |
| 1252.2 | 345.38 | | 346.23 | | 1249.91 | 345.79 | | 346.37 | |
| 1258.8 | 345.1 | | 346.23 | | 1259.07 | 345.16 | 346.78 | 346.37 | |
| 1270.8 | 345.8 | 346.8 | 346.2 | | 1265.57 | 346.06 | | 346.32 | |
| 1276.2 | 345.55 | | 346 | | 1274.7 | 345.82 | | 346.13 | |
| 1282.8 | 345.44 | | 345.9 | | 1280.2 | 345.07 | 346.7 | 346.1 | |
| 1294.8 | 345.56 | 346.7 | 345.9 | | 1288.45 | 345.69 | | 346.08 | |
| 1307.9 | 345.52 | | 345.5 | | 1299.67 | 345.72 | | 346.06 | |
| 1314.2 | 345.31 | 346.4 | 345.5 | | 1315.04 | 345.35 | 346.43 | 345.71 | |
| 1322.2 | 344.6 | | 345.5 | | 1320.42 | 344.8 | | 345.7 | |
| 1327.2 | 345.2 | | 345.4 | | 1325.8 | 345.4 | 346.21 | 345.68 | |
| 1337.2 | 344.83 | | 345.3 | | 1337.19 | 344.88 | 345.92 | 345.62 | |
| 1353.8 | 344.96 | 345.9 | 345.2 | | 1346.81 | 344.75 | | 345.59 | |
| 1366.4 | 344.86 | | 345.2 | | 1357.26 | 345 | | 345.58 | |
| 1375.2 | 343.85 | 345.8 | 345.15 | | 1369.73 | 344.93 | | 345.48 | |
| 1382.8 | 344.8 | | 345.15 | | 1375.53 | 343.72 | 345.89 | 345.48 | |
| 1394.9 | 344.76 | 345.6 | 345.15 | | 1377.17 | 343.84 | | 345.48 | |
| 1411.9 | 344.82 | | 345.12 | | 1388.56 | 344.69 | 345.7 | 345.4 | |
| 1422.8 | 344.35 | | 345.12 | | 1400 | 344.4 | 345.61 | 345.36 | |
| 1433 | 344.81 | | 345.11 | | 1416.04 | 344.59 | | 345.25 | |
| 1443.9 | 344.33 | | 344.45 | | 1429.37 | 344.7 | | 345.2 | |
| 1454.3 | 344.26 | 345.3 | 344.43 | | 1444.02 | 344.28 | | 344.88 | |
| 1464.4 | 344.04 | | 344.2 | | 1455.19 | 344.44 | | 344.74 | |
| 1471.8 | 343.89 | | 344.1 | | 1469.59 | 343.97 | 345.29 | 344.53 | |
| 1478.7 | 343.01 | 344.9 | 344.1 | | 1472.95 | 343.9 | | 344.46 | |
| 1486.2 | 343.81 | | 344.1 | | 1483.8 | 343.59 | | 344.44 | |
| 1495.6 | 343.85 | 344.7 | 344 | | 1494.37 | 343.85 | 344.92 | 344.41 | |
| 1508.6 | 343.63 | | 343.8 | | 1505.88 | 343.8 | | 344.28 | |
| 1514.2 | 343.21 | | 343.8 | | 1513.53 | 343.45 | 344.73 | 344.28 | |
| 1520 | 342.72 | | 343.8 | | 1520.71 | 342.66 | | 344.25 | |
| 1522.5 | 343.03 | | 343.8 | | 1530.78 | 343.82 | 344.68 | 344.16 | |
| 1529.2 | 343.57 | 344.6 | 343.8 | | 1539.06 | 343.69 | 344.67 | 344 | |
| 1539.2 | 343.51 | | 343.7 | | 1544.16 | 343.47 | | 343.94 | |
| 1543 | 343.44 | | 343.7 | | 1552.16 | 342.4 | | 343.96 | |
| 1550.2 | 342.39 | | 343.7 | | 1559.41 | 343.51 | 344.41 | 343.91 | |
| 1554 | 342.92 | 344.4 | 343.7 | | 1575.5 | 343.45 | | 343.84 | |
| 1558.2 | 343.35 | | 343.6 | | 1587.52 | 343.24 | 344.19 | 343.55 | |
| 1565.4 | 343.29 | | 343.6 | | 1596.5 | 342.92 | | 343.56 | |
| 1570 | 342.54 | | 343.6 | | 1603.71 | 342.41 | 343.97 | 343.56 | |
| 1573.9 | 342.95 | | 343.6 | | 1610 | 342.99 | | 343.54 | |
| 1576.8 | 343.34 | | 343.6 | | 1621.94 | 343.13 | | 343.51 | |
| 1587.6 | 343.12 | | 343.4 | | 1626.77 | 343.12 | 343.94 | 343.49 | |
| 1596.2 | 342.83 | | 343.3 | | 1630.25 | 341.7 | | 343.47 | |
| 1603.5 | 342.34 | 344.1 | 343.3 | | 1643.42 | 342.96 | | 343.28 | |
| 1612.6 | 343.02 | | 343.3 | | 1647.83 | 342.77 | | 342.98 | |
| 1621.4 | 342.97 | | 343.3 | | 1655.68 | 341.53 | 343.92 | 342.98 | |
| 1625.9 | 343.04 | | 343.3 | | 1658.89 | 342.56 | | 342.9 | |
| 1629.3 | 341.99 | | 343.3 | | 1673.22 | 342.1 | 343.24 | 342.41 | |
| 1632.8 | 342.94 | | 343.3 | | 1682.47 | 341.1 | | 342.36 | |
| 1637.9 | 342.95 | 344 | 343.2 | | 1690.77 | 341.66 | | 342.36 | |
| 1645.6 | 342.98 | | 343 | | 1697.3 | 341.72 | 342.8 | 342.33 | |
| 1649 | 341.99 | | 343 | | | | | | |
| 1658.3 | 342.48 | 343.5 | 342.7 | | | | | | |
| 1667.7 | 342.14 | | 342.3 | | | | | | |
| 1677.2 | 341.94 | | 342.2 | | | | | | |
| 1682 | 341.24 | | 342.2 | | | | | | |
| 1686.9 | 341.68 | | 342.2 | | | | | | |
| 1697.3 | 341.74 | 342.7 | 342.2 | | | | | | |

**Profile Reach 6**
**(UT Sta. 19+02.1 to 21+93.9)**



**Profile Reach #6 (UT)**

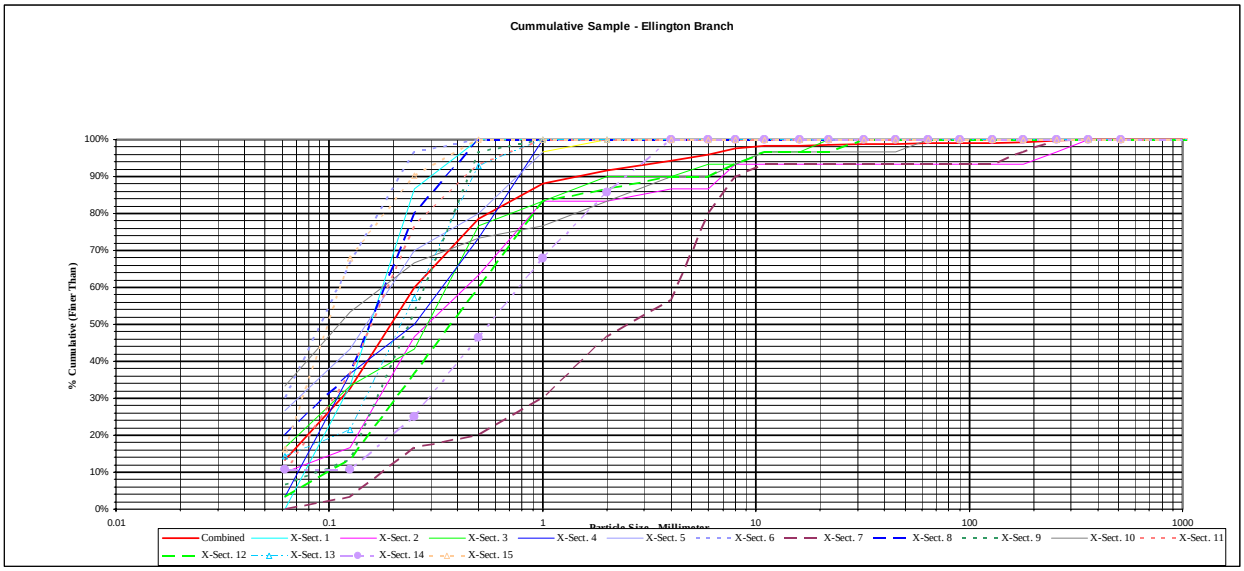
| As-Built | | | | | Year 1 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sta.** | **Elev** | **Bankfull** | **WS** | **Feature** | **Sta.** | **Elev** | **Bankfull** | **WS** | **Feature** |
| 1902.1 | 340.1 | 341.1 | 340.3 | | 1902.1 | 340.2 | 341.1 | 340.5 | |
| 1915.9 | 339.76 | | 340 | | 1911.52 | 340.12 | | 340.36 | |
| 1927.2 | 339.45 | 340.4 | 339.6 | | 1923.31 | 339.72 | 340.92 | 340.04 | |
| 1931.9 | 338.69 | | 339.6 | | 1928.02 | 339.03 | | 339.68 | |
| 1940.8 | 339.08 | 340.3 | 339.6 | | 1935.66 | 338.75 | | 339.67 | |
| 1952.2 | 339.27 | | 339.5 | | 1944.68 | 339.32 | | 339.67 | |
| 1964.4 | 339.23 | | 339.4 | | 1961.35 | 339.26 | 340.36 | 339.57 | |
| 1973 | 338.75 | 340.1 | 339.4 | | 1969.54 | 338.8 | | 339.57 | |
| 1980.8 | 339.1 | | 339.3 | | 1975.83 | 338.93 | | 339.56 | |
| 1995.7 | 339.03 | | 339.3 | | 1985.37 | 339.03 | 340.1 | 339.51 | |
| 2002.7 | 337.96 | | 339.3 | | 1994.56 | 339.09 | | 339.4 | |
| 2007.4 | 338.9 | | 339.3 | | 2000 | 338.17 | | 339.4 | |
| 2018 | 338.98 | 339.9 | 339.2 | | 2006.05 | 338.07 | 340.02 | 339.4 | |
| 2031 | 338.74 | | 339.1 | | 2016.56 | 339.05 | 340.03 | 339.36 | |
| 2033.8 | 338.2 | | 339.1 | | 2025.94 | 338.94 | | 339.31 | |
| 2039.8 | 338.76 | | 339.1 | | 2031.24 | 338.85 | | 339.2 | |
| 2051.8 | 338.75 | | 338.9 | | 2034.87 | 338.27 | | 339.2 | |
| 2057.1 | 337.96 | 339.7 | 338.9 | | 2038.66 | 338.67 | | 339.2 | |
| 2061 | 338.45 | | 338.9 | | 2045.55 | 338.9 | 339.95 | 339.14 | |
| 2074.8 | 338.5 | 339.5 | 338.8 | | 2052.08 | 339.07 | | 339.14 | |
| 2091 | 338.23 | | 338.4 | | 2057.14 | 337.9 | | 339.14 | |
| 2098.9 | 337.41 | | 338.3 | | 2062.2 | 338.65 | 339.8 | 339.14 | |
| 2104.5 | 337.95 | | 338.3 | | 2071.43 | 338.73 | 339.7 | 339.06 | |
| 2114 | 338.15 | 339.3 | 338.2 | | 2084.27 | 338.29 | | 338.6 | |
| 2123.2 | 338.02 | | 338.2 | | 2094.86 | 338.18 | 339.3 | 338.51 | |
| 2132.6 | 336.63 | | 338.2 | | 2097.5 | 337.2 | | 338.51 | |
| 2138.1 | 337.43 | | 338.2 | | 2108.81 | 338.06 | 339.2 | 338.51 | |
| 2159.9 | 337.83 | | 338.2 | | 2122.38 | 337.98 | | 338.42 | |
| 2171.1 | 337.77 | | 338.2 | | 2128.2 | 336.49 | | 338.33 | |
| 2178.8 | 337.3 | | 338.2 | | 2135.7 | 336.63 | | 338.33 | |
| 2186.1 | 337.75 | | 338.2 | | 2145.07 | 337.71 | 338.65 | 338.33 | |
| 2193.9 | 337.96 | 338.5 | 338.1 | | 2159.93 | 337.83 | | 338.33 | |
| | | | | | 2171.41 | 337.66 | | 338.29 | |
| | | | | | 2180.41 | 337.22 | | 338.28 | |
| | | | | | 2185.55 | 337.65 | | 338.27 | |
| | | | | | 2193.9 | 337.86 | 338.6 | 338.2 | |

# APPENDIX B-5:
## Pebble Count Plots and Raw Data Tables – Ellington Branch

**PEBBLE COUNT DATA - CUMMULATIVE SAMPLE**

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Site:** | Ellington Branch Stream Mitigation Site | | | | | | | | | | | | | | | | | **Date:** | August-08 | | |
| **Location:** | Warren County - North Carolina | | | | | | | | | | | | | | | | | **Party:** | GLS | | |
| | | | | **PARTICLE COUNTS** | | | | | | | | | | | | | | | | | |
| **Inches** | **Particle** | **Millimeter** | **Group** | **EB XS1** | **EB XS2** | **EB XS3** | **EB XS4** | **EB XS5** | **EB XS 6** | **EB XS7** | **EB XS8** | **EB XS 9** | **EB XS10** | **EB XS11** | **EB XS12** | **EB XS13** | **EB XS14** | **EB XS 15** | **Total No.** | **Item %** | **% Cumulative** |
| | Silt/Clay | < 0.062 | Silt/Clay | | 3 | 5 | 1 | 8 | 9 | | 6 | 2 | 10 | 3 | 1 | 4 | 3 | 5 | 60 | 13.4% | 13.4% |
| | Very Fine | .062 - .125 | S | 10 | 2 | 5 | 10 | 5 | 11 | 1 | 5 | 2 | 6 | 8 | 3 | 2 | | 16 | 86 | 19.2% | 32.7% |
| | Fine | .125 - .25 | A | 16 | 9 | 3 | 4 | 8 | 9 | 4 | 13 | 12 | 4 | 12 | 7 | 10 | 4 | 7 | 122 | 27.3% | 60.0% |
| | Medium | .25 - .50 | N | 4 | 5 | 10 | 7 | 3 | 1 | 1 | 6 | 13 | 2 | 5 | 7 | 10 | 6 | 3 | 83 | 18.6% | 78.5% |
| | Coarse | .50 - 1.0 | D | | 6 | 2 | 8 | 5 | | 3 | | 1 | 1 | 2 | 7 | 2 | 6 | | 43 | 9.6% | 88.1% |
| .04 - .08 | Very Coarse | 1.0 - 2.0 | S | | | 2 | | 1 | | 5 | | | 2 | | 1 | | 5 | | 16 | 3.6% | 91.7% |
| .08 - .16 | Very Fine | 2.0 - 4.0 | | | 1 | | | | | 3 | | | 2 | | 1 | | 4 | | 11 | 2.5% | 94.2% |
| .16 - .22 | Fine | 4.0 - 5.7 | G | | | 1 | | | | 7 | | | | | | | | | 8 | 1.8% | 96.0% |
| .22 - .31 | Fine | 5.7 - 8.0 | R | | 2 | | | | | 3 | | | 1 | | 1 | | | | 7 | 1.6% | 97.5% |
| .31 - .44 | Medium | 8.0 - 11.3 | A | | | 1 | | | | 1 | | | 1 | | 1 | | | | 4 | 0.9% | 98.4% |
| .44 - .63 | Medium | 11.3 - 16.0 | V | | | | | | | | | | | | | | | | 0 | 0.0% | 98.4% |
| .63 - .89 | Coarse | 16.0 - 22.6 | E | | | 1 | | | | | | | | | | | | | 1 | 0.2% | 98.7% |
| .89 - 1.26 | Coarse | 22.6 - 32.0 | L | | | | | | | | | | | | 1 | | | | 1 | 0.2% | 98.9% |
| 1.26 - 1.77 | Very Coarse | 32.0 - 45.0 | S | | | | | | | | | | | | | | | | 0 | 0.0% | 98.9% |
| 1.77 - 2.5 | Very Coarse | 45.0 - 64.0 | | | | | | | | | | | 1 | | | | | | 1 | 0.2% | 99.1% |
| 2.5 - 3.5 | Small | 64 - 90 | C | | | | | | | | | | | | | | | | 0 | 0.0% | 99.1% |
| 3.5 - 5.0 | Small | 90 - 128 | O | | | | | | | | | | | | | | | | 0 | 0.0% | 99.1% |
| 5.0 - 7.1 | Large | 128 - 180 | B | | | | | | | 1 | | | | | | | | | 1 | 0.2% | 99.3% |
| 7.1 - 10.1 | Large | 180 - 256 | L | | 1 | | | | | 1 | | | | | | | | | 2 | 0.4% | 99.8% |
| 10.1 - 14.3 | Small | 256 - 362 | B | | 1 | | | | | | | | | | | | | | 1 | 0.2% | 100.0% |
| 14.3 - 20 | Small | 362 - 512 | L | | | | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| 20 - 40 | Medium | 512 - 1024 | D | | | | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| 40 - 80 | Lrg- Very Lrg | 1024 - 2048 | R | | | | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| | Bedrock | | BDRK | | | | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| | | | **Totals** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **28** | **28** | **31** | **447** | **100%** | **100%** |
| | **Feature or Pebble Count Type** | | | Pool | Riffle | Pool | Riffle | Pool | Riffle | Riffle | Pool | Pool | Riffle | Pool | Riffle | Pool | Riffle | Pool | | | |

(i.e. Riffle, Pool, Pavement, Classification)



# APPENDIX B-5 Continued:
## Pebble Count Plots and Raw Data Tables – Unnamed Tributary to Ellington Branch

**PEBBLE COUNT DATA - UNNAMED TRIBUTARY TO ELLINGTON BRANCH**

Ellington Branch Stream Mitigation Site - Unnamed Tributary
Warren County North Carolina

**Date:** August-08
**Party:** GLS

**PARTICLE COUNTS**

| Particle | Millimeter | Group | XS1 | XS2 | XS3 | XS4 | XS5 | XS6 | XS7 | XS8 | XS9 | XS10 | XS11 | XS12 | Total No. | Item % | % Cumulativ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Silt/Clay | < 0.062 | Silt/Clay | | | 1 | 2 | 2 | | 3 | | | | | | 8 | 3.3% | 3.3% |
| Very Fine | .062 - .125 | S | | 10 | 5 | 9 | 8 | 2 | 5 | 4 | | | | | 43 | 17.7% | 21.0% |
| Fine | .125 - .25 | A | 5 | 4 | 7 | 8 | 9 | 11 | 4 | 10 | | | | | 58 | 23.9% | 44.9% |
| Medium | .25 - .50 | N | 8 | 10 | 18 | 8 | 10 | 6 | 11 | 15 | | | | | 86 | 35.4% | 80.2% |
| Coarse | .50 - 1.0 | D | 6 | 4 | 3 | 3 | 3 | 3 | 6 | 1 | | | | | 29 | 11.9% | 92.2% |
| Very Coarse | 1.0 - 2.0 | S | 7 | 2 | | | | 3 | | | | | | | 12 | 4.9% | 97.1% |
| Very Fine | 2.0 - 4.0 | | 1 | | | | | 2 | | | | | | | 3 | 1.2% | 98.4% |
| Fine | 4.0 - 5.7 | G | 1 | | | | | 1 | | | | | | | 2 | 0.8% | 99.2% |
| Fine | 5.7 - 8.0 | R | | | | | | | | | | | | | 0 | 0.0% | 99.2% |
| Medium | 8.0 - 11.3 | A | | | | | | | | | | | | | 0 | 0.0% | 99.2% |
| Medium | 11.3 - 16.0 | V | 1 | | | | | | | | | | | | 1 | 0.4% | 99.6% |
| Coarse | 16.0 - 22.6 | E | | | | | | | | | | | | | 0 | 0.0% | 99.6% |
| Coarse | 22.6 - 32.0 | L | 1 | | | | | | | | | | | | 1 | 0.4% | 100.0% |
| Very Coarse | 32.0 - 45.0 | S | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Very Coarse | 45.0 - 64.0 | | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Small | 64 - 90 | C | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Small | 90 - 128 | O | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Large | 128 - 180 | B | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Large | 180 - 256 | L | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Small | 256 - 362 | B | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Small | 362 - 512 | L | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Medium | 512 - 1024 | D | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Lrg- Very Lrg | 1024 - 2048 | R | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| Bedrock | | BDRK | | | | | | | | | | | | | 0 | 0.0% | 100.0% |
| | | **Totals** | **30** | **30** | **34** | **30** | **32** | **28** | **29** | **30** | **0** | **0** | **0** | **0** | **243** | **100%** | **100%** |
| **Feature or Pebble Count Type** (i.e. Riffle, Pool, Pavement, Classification) | | | Pool | Riffle | Pool | Riffle | Pool | Riffle | Pool | Riffle | | | | | | | |