Newtown Stream and Wetland Restoration Project

Union County, North Carolina

RFP 16-001117, SCO ID# 002025

Baseline Monitoring Document and As-Built Baseline Report Final

Data Collected: April 2011
Submitted: June 13, 2011

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APPENDICES

1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Newtown Stream and Wetland Restoration Site is located within the sub-basin 03-08-38 of the Catawba River Basin in Union County, North Carolina and contains Underwood Creek and one Unnamed Tributary (UT) to Underwood Creek. The restoration lengths of Underwood Creek (Main Channel) and UT to Underwood Creek (Tributary) are 1273 and 4075 feet, respectively, for a total project length of 5348 feet (Figure 1). The project included restoration of 3.38 acres of riparian wetland and wetland preservation of 0.15 acres. The project site is owned by one property owner Mr. Frank W. Howey, Jr. The project is located within the HUC 03050103030020 (Lower Catawba Basin) of the South Atlantic-Gulf Region; however it is not located within a North Carolina Department of Water Quality (NCDWQ) Ecosystem Enhancement Program (EEP) Local Watershed Plan area. NCDWQ classifies Underwood Creek (DWQ Stream Index Number 11-138-2-3-1) as class C. The 1.5 square mile watershed contributing drainage to the stream restoration segment is located in a rural setting. The land adjacent to the project streams is primarily used for agricultural practices and single family development. The floodplain is more confined in the upper reach of the project and opens up to a broad width for the majority of the project length. Vegetation typical of a Piedmont Alluvial Forest was planted throughout the conservation easement.

Project Goals Achieved:

- Improve water quality with the construction of stable stream banks and the establishment of a vegetated buffer
- Improve the stream function and habitat with the connection of the channelized and incised stream back to its floodplain
- Improve wetland hydrology with the functional uplift of the proposed channel
- Restore long-term stability with the restoration of channel pattern, profile and dimension
- Improve in-stream habitat with the installation of root wads, constructed riffles, log vanes and rock cross vanes to enhance pool depths

Project Objectives Achieved:

- The restoration of 4690 linear feet of Priority I, 558 feet of Priority II and 100 feet of Enhancement II in order to raise the stream elevation, reconnect the floodplain, restore pattern, and re-establish channel dimension on Underwood Creek and UT to Underwood Creek
- Restoration of 3.38 acres of wetlands through the functional uplift of the stream to improve wetland hydrology and the removal of depositional sediment from the wetland surface due to agricultural field soil wash
- Preserve an existing 0.15-acre jurisdictional wetland
- Establish a minimum 50 feet riparian buffer along the entire stream length

Construction, as-built survey and plantings were completed in April 2011. In April 2011, 13 vegetation plots were established and baseline vegetation data was collected, excluding natural stems, in accordance with Level I of the EEP/CVS protocol Version 4.2. Data collected for these plots are in Appendix C. The success criterion for planted

woody species is 320 stems/acre after MY-03. A mortality rate of ten percent will be allowed after MY-04 (288 stems/acre), with another ten percent allowed after MY-05 (260 stems/acre). Invasive exotic vegetation was present prior to restoration. Currently there are no invasive exotics within the conservation easement.

1.1 Restoration Type and Approach

The project site is immediately surrounded by land used primarily for farming. The streams were incised, with unstable banks and little buffer vegetation was present prior to the beginning of the project. The streams were restored and enhanced using a combination of Rosgen Priority 1 and 2 Restoration techniques. The wetland restoration portion of this project involved removing depositional sediment that had eroded and imported from the adjacent farmland. The riparian buffer and wetlands were planted with native vegetation. The mitigation work at the project site has resulted in the restoration of 5248 linear feet of stream, the enhancement (Level II) of 100 linear feet of stream, the restoration of 3.38 acres of riparian wetlands, and the preservation of 0.15 acres of riparian wetlands. The project component breakdown can be found in Table 1a and overall project component summations can be found in Table 1b.

1.2 Project History, Contacts and Attribute Data

Stream construction began in November 2010 and concluded in April 2011. Live stakes and bare root planting of the site occurred in April 2011. Baseline stream data collection coincided with the designer verification survey and was an ongoing process that took place throughout construction and concluded in April 2011. Vegetation monitoring baseline data was established and collected in April 2011. Significant milestone dates for the project can be found in Table 2. The project designer, construction contractor and all other consultants, contractors and suppliers contact information can be found in Table 3. The drainage area for Underwood Creek is approximately 0.72 square miles at the downstream limit, where Underwood Creek crosses Newtown Road. The Unnamed Tributary to Underwood Creek has an approximate drainage area of 0.74 square miles. The combined watershed, 1.46 square miles, consists of 21% forested land, 66% cleared land for agricultural use (row crops), and 14% remaining land in single family residential use with 1 acre lots. All project attributes can be found in Table 4.

1.3 Modifications to the Restoration Plan and Construction Plan Summary

The following is a summary of changes implemented during construction that differ from the Construction Drawings. Several structures were not installed during construction as field conditions did not warrant their installation. Several rock structures were changed to log structures to better utilize onsite woody vegetation.

Underwood Creek:

- No clay plugs were installed throughout the entire length of the stream. Deemed unnecessary and no suitable impervious material was found onsite,
- Rock cross vane at station 5+50 installed as a single wing rock vane
- Log vanes were installed in place of single wing rock vanes at stations: 6+60, 10+20 and 11+59

- Log vane arms used on A-Vane structures from station 18+61 through 19+06

UT to Underwood Creek:

- No clay plugs were installed throughout the entire length of the stream. Deemed unnecessary and no suitable impervious material was found onsite
- Floodplain sill at station 9+90 not installed
- Single wing rock vane at station 10+60 not installed
- Earthen berms with openings added to the south floodplain debris toe between approximate stations 11+00 – 20+00
- Earthen berm added to floodplain at approximate stations 23+50 – 25+00 to preserve the existing wetland
- Log vanes were installed in place of single wing rock vanes at stations 34+65, 36+32, 37+89 and 39+33
- Constructed riffles not installed at stations 35+61 and 39+85
- Rock toe stabilization not installed at station 42+00
- Log vane arms used on A-Vane structures from station 42+70 through 43+00

2.0 SUCCESS CRITERIA

2.1 Morphologic Parameters and Channel Stability

2.1.1 Dimension

The dimension parameters of the restored channel should remain stable throughout the monitoring period. Cross sectional overlays should show modest changes from year to year. The channel should not show a trend towards widening or increases in cross sectional area. Riffle depths should maintain a low bank height ratio (<1.2).

2.1.2 Pattern and Profile

Annual overlays of the longitudinal profile should not indicate significant aggradation or degradation over any substantial continuous lengths of channel. The bedform should develop or be maintained during the monitoring period and be consistent with the reference and design reaches. Variation within bedform parameters is acceptable as long as they are within design distributions. Pattern parameters should show little change over the monitoring period.

2.1.3 Substrate

The substrate should maintain or progress towards the design distribution. Particle size distribution within riffles should coarsen throughout the monitoring period.

2.1.4 Sediment Transport

The success of parameters described above should be demonstrated by the lack on any significant aggradation or deposition within the channel. Point bar and inner berms should not encroach excessively into the channel. Mid-channel bars should not be present.

2.2 Vegetation

Vegetation success is based on the criteria established in the USACE Stream Mitigation Guidelines (2003). The success criteria of the planted woody species will be the survival of 320 stems/acre after monitoring year three (MY3). A mortality rate of ten percent will be allowed after MY4 (288 stems/acre), with another ten percent mortality rate allowed after MY5 (260 stems/acre). Invasive exotic species were observed before construction. Additional treatments will be conducted where deemed necessary if regeneration of these invasive exotic species is observed.

2.3 Hydrology

2.3.1 Streams

Two bankfull storm events must be recorded during the standard 5-year monitoring period. For the monitoring to be completed, these events must occur in separate monitoring years.

2.3.2 Wetlands

In February of 2010, seven (7) groundwater gauges were installed to collect pre-construction groundwater data. An additional groundwater gauge will be installed in June 2011. An additional groundwater gauge (Gauge 8) will be installed in June 2011. No data for gauge 8 will be included in this report. Gauges were installed according to the specifications of Technical Note HY-1A-3.1 (USACE 1993). Six gauges were installed within areas containing hydric soils and one (Gauge 4) was installed within the wetland preservation area. Pre-construction data for Gauges 3 and 7 was corrupt therefore it is not included. Post construction, groundwater levels should be within 12 inches of the surface for at least 6.3% of the growing season to meet wetland hydrology success criteria. Union County has a growing season of 221 days (March 28-November 3), based upon Union County Soil Survey. Therefore groundwater levels must be within 12 inches of the soil surface for a minimum of 14 consecutive days within the growing season to meet wetland hydrology success criteria. Gauges 2 and 5 displayed wetland hydrology while Gauges 1, 4 and 6 did not meet the wetland hydrology success criteria. Gauge 2 hydrology was affected by the adjacent downstream farmer damming the stream and Gauge 5 hydrology was affected by beaver activity, which were subsequently removed.

3.0 MONITORING PLAN GUIDELINES

Monitoring protocol will follow that outlined within the EEP Monitoring Report guidelines and detailed in the U.S. Army Corps of Engineers (USACE) Stream Mitigation Guidelines for Monitoring Level I. Monitoring shall occur annually for a minimum of five years and consist of the collection and analysis of stream stability and riparian/stream bank vegetation survivability data to support the evaluation of the project in meeting established restoration objectives. Monitoring shall include measurements of stream dimension, profile, pattern, bed materials, photo documentation, vegetation survivability sampling, and stream bankfull return interval.

3.1 Hydrology

3.1.1 Wetland

Currently there are seven Remote Data Systems (RDS) groundwater gauges (1-8) within wetlands in the conservation easement. Gauge 4 is located within an onsite reference wetland. The gauges record groundwater levels every twelve hours and will be checked and downloaded on a monthly basis. One RDS rain bucket gauge and one manual funnel rain gauge were installed adjacent to UT to Underwood Creek collects precipitation data to correlate groundwater level fluctuations and site specific data.

3.1.2 Stream

A crest gage shall be installed on the site to document bankfull events. The gauge shall be checked, documented, and reset during each site visit by the monitoring performer.

3.2 Stream Channel Stability and Geomorphology

This project consisted of two restoration reaches: Underwood Creek (Main Channel) and UT to Underwood Creek (Tributary). Ten permanent cross sections were established on the site as detailed below:

Underwood Creek: Station 5+00 – 18+91

- Cross Section 1: Station 9+54 – Riffle
- Cross Section 2: Station 13+36 – Riffle
- Cross Section 3: Station 17+12 – Riffle

UT to Underwood Creek: Station 5+82 – 36+78

- Cross Section 1: Station 6+40 – Riffle
- Cross Section 2: Station 14+45 – Riffle
- Cross Section 3: Station 20+04 – Riffle
- Cross Section 4: Station 26+68 – Riffle
- Cross Section 5: Station 31+26 – Riffle
- Cross Section 6: Station 35+35 – Riffle
- Cross Section 7: Station 39+90 – Riffle

Cross sections were established only on riffle sections. Pool data is neglected from the Dimension portion of Table 11b and does not provide adequate data to forecast function and stability in the stream performance. More riffle cross sections were established to provide additional data for better statistical evaluation.

3.2.1 Dimension

The permanent cross sections shall be surveyed annually during the monitoring period. These sections should be overlaid to allow for comparison. Dimension parameters shall be calculated from the surveyed cross sections and compared to previous monitoring periods. The dimension data is detailed by section in Table 11a. and summarized in the Table 11b.

3.2.2 Profile and Pattern
The entire project length of Underwood Creek and a 3000 LF length of UT to Underwood Creek were surveyed for this baseline monitoring plan. The MY-00 profile data for each reach is summarized in Table 11b. For subsequent monitoring years, these reaches shall be surveyed and the profiles overlaid for comparison. Pattern data shall be extracted and compared during the monitoring period.

3.2.3 Visual Assessment
An annual visual assessment shall be conducted during each monitoring year per NCEEP morphometric monitoring guidelines.

3.2.4 Bank Stability Assessment
Bank stability assessment (BEHI and NBS) shall be assessed during monitoring year 5.

3.2.5 Vegetation
Thirteen (13) vegetation plots were installed along Underwood Creek and UT to Underwood Creek. Vegetation data collection for the baseline monitoring report follows the CVS-EEP Protocol for Recording Vegetation Version 4.2 (Lee et al. 2008). The baseline vegetation monitoring was conducted according to the Level I: Inventory of Planted Stems. Level I will also be used for MY-01data collection. However, from MY-02 and through the remainder of the monitoring period, vegetation monitoring data collection will follow Level II of the CVS-EEP protocol which includes planted and natural stems. Plant identification will be verified according to Alan Weakley's, *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2010).

3.2.6 Digital Photos
Photo points were established at the start/end of the project, at each vegetation monitoring plot, and at each cross section. For each subsequent monitoring period, photos shall be taken at the same location and, preferably, within the same two-month window between monitoring periods. The cross section photos can be found on their corresponding cross section sheets located in Appendix B. The vegetation monitoring plot photo log is located in Appendix C.

3.3 Maintenance and Contingency Plans
If deemed necessary, recommendations for increased monitoring, maintenance, or repair shall be made in the annual monitoring reports. Problem areas shall be located on the monitoring report plan view and tabulated noting the severity and possible causes.

4.0 DOCUMENTING THE AS-BUILT CONDITION (BASELINE)

4.1 As-Built/Record Drawings
The project as-built survey was conducted in April 2011 upon completion of construction in two parts. The entire project length of Underwood Creek (Main Channel) and the portion downstream of the tributary crossing at station 36+84 is

FEMA regulated. Therefore, the as-built survey of these portions was conducted by a Registered Land Surveyor. UT to Underwood Creek (Tributary) survey from the beginning of the project to the stream crossing at station 36+84) was conducted by the staff of the Designer/Monitoring Performer. A compilation of these two maps are used to complete the Record Drawings. The Record Drawings (including red-line markups) were completed on May 13, 2011. Baseline vegetative data was collected in April 2011.

4.2 Installation and Marking of Monitoring Features

Monitoring features installation and the baseline monitoring data collection occurred in April 2011. Cross Section pins are 5/8" rebar and are located with 8' gardening stakes with pink flagging. Vegetation monitoring plots were established as 10mX10m squares with each corner marked with 3' long ½"in diameter PVC pipes and orange pin flags. One corner of each vegetation plot is marked with a 10' PVC pipe. Plants within the plot were marked with pink flagging. Groundwater monitoring gauges are marked with pink flagging and 48" green T posts.

5.0 REPORT AND DATA SUBMISSION FORMAT

Refer to the NCEEP Monitoring Report guidelines for report and data submission requirements, formats and procedures.

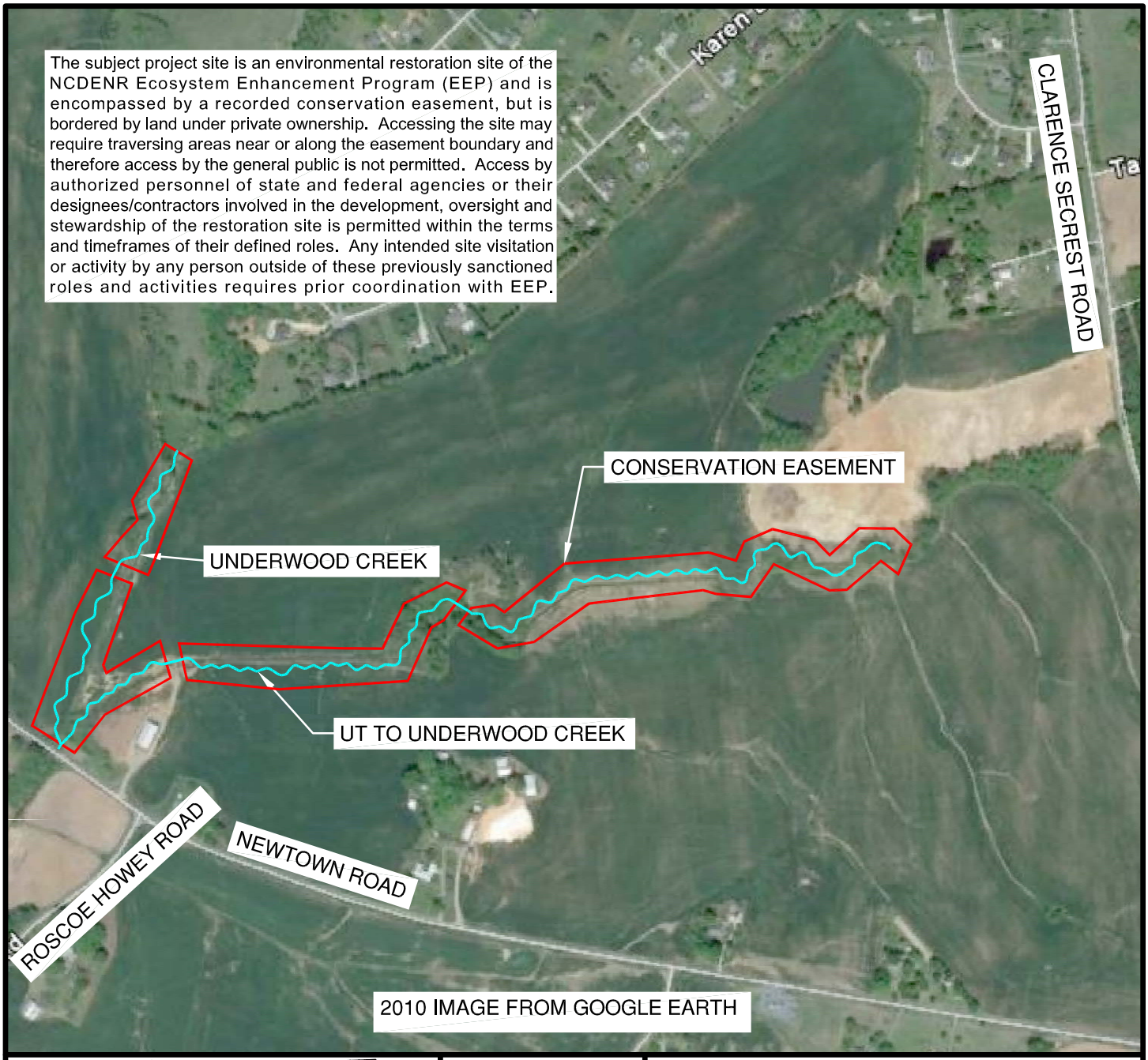
6.0 REFERENCES

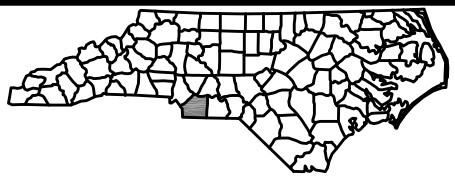
Lee, Michael T. Peet, Robert K. Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation Version 4.2.*

Weakley, Alan (2010). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. http://www.herbarium.unc.edu/flora.htm.

Appendix A. General Tables and Figures

The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP.





Ecosystem Enhancement PROGRAM

North Carolina - Ecosystem Enhancement Program

Newtown Stream and Wetland Restoration Site
Union County, North Carolina

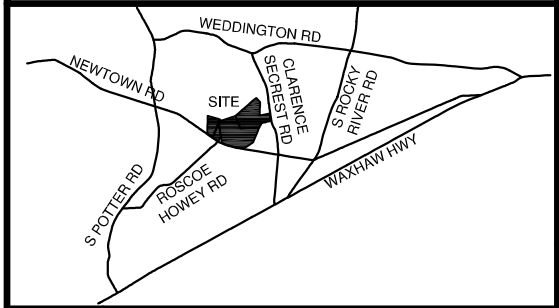
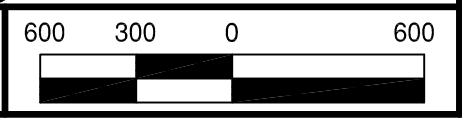


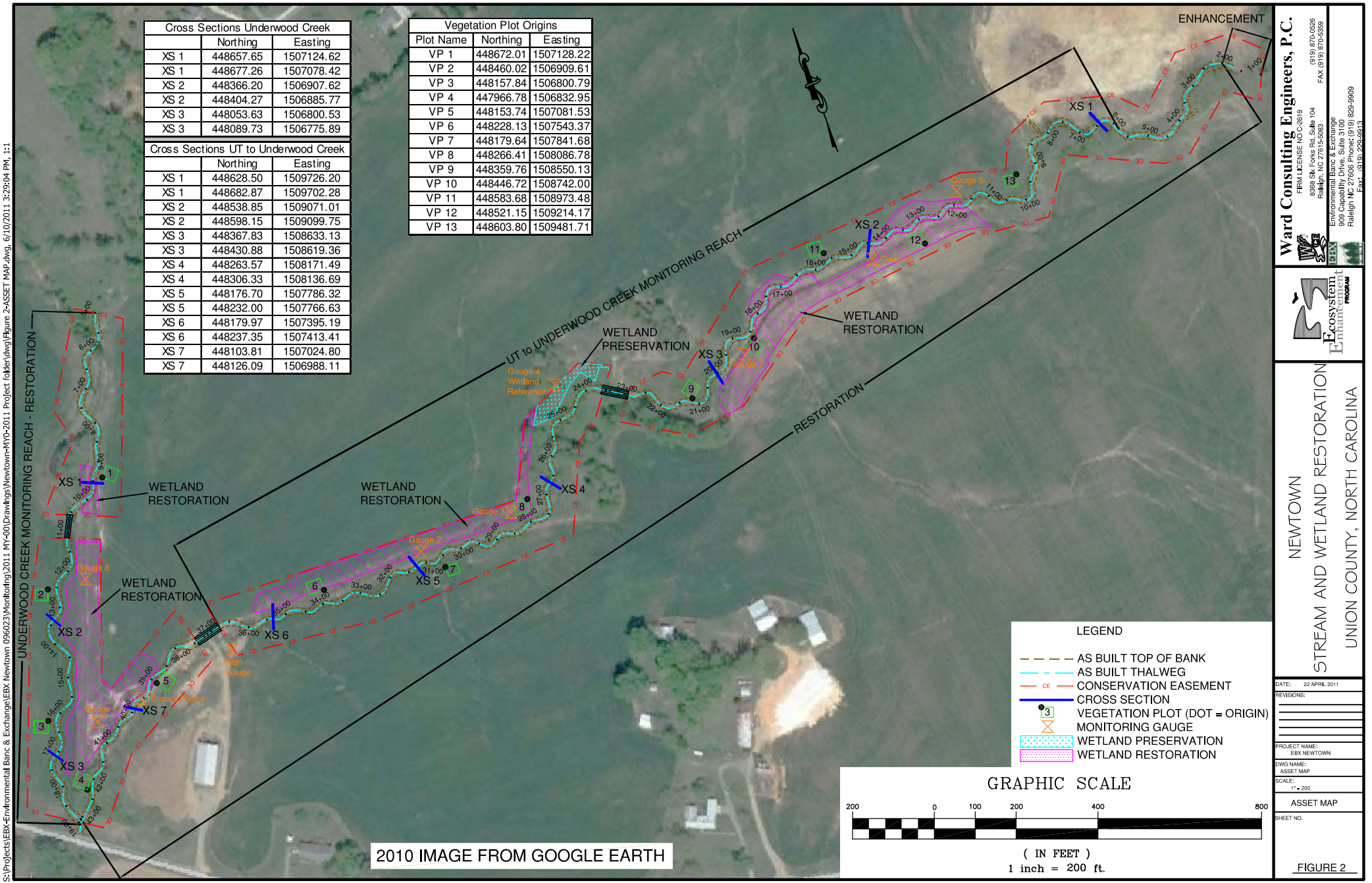
FIGURE 1
NEWTOWN STREAM AND WETLAND RESTORATION AERIAL VICINITY MAP

DATE: APRIL 29, 2011



WARD CONSULTING ENGINEERS, PC

8368 Six Forks Rd. Suite 104 (919) 870-0526
Raleigh, NC 27615-5088 FAX (919) 870-5359



Cross Sections Underwood Creek		
	Northing	Easting
XS 1	448657.65	1507124.62
XS 1	448677.26	1507078.42
XS 2	448366.20	1506907.62
XS 2	448404.27	1506885.77
XS 3	448053.63	1506800.53
XS 3	448089.73	1506775.89

Cross Sections UT to Underwood Creek		
	Northing	Easting
XS 1	448628.50	1509726.20
XS 1	448682.87	1509702.28
XS 2	448538.85	1509071.01
XS 2	448598.15	1509099.75
XS 3	448367.83	1508633.13
XS 3	448430.88	1508619.36
XS 4	448263.57	1508171.49
XS 4	448306.33	1508136.69
XS 5	448176.70	1507786.32
XS 5	448232.00	1507766.63
XS 6	448179.97	1507395.19
XS 6	448237.35	1507413.41
XS 7	448103.81	1507024.80
XS 7	448126.09	1506988.11

Vegetation Plot Origins		
Plot Name	Northing	Easting
VP 1	448672.01	1507128.22
VP 2	448460.02	1506909.61
VP 3	448157.84	1506800.79
VP 4	447966.78	1506832.95
VP 5	448153.74	1507081.53
VP 6	448228.13	1507543.37
VP 7	448179.64	1507841.68
VP 8	448266.41	1508086.78
VP 9	448359.76	1508550.13
VP 10	448446.72	1508742.00
VP 11	448583.68	1508973.48
VP 12	448521.15	1509214.17
VP 13	448603.80	1509481.71

LEGEND

- AS BUILT TOP OF BANK
- AS BUILT THALWEG
- CE — CONSERVATION EASEMENT
- CROSS SECTION
- 3 — VEGETATION PLOT (DOT = ORIGIN)
- MONITORING GAUGE
- WETLAND PRESERVATION
- WETLAND RESTORATION

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft.

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Ecosystem Enhancement Program

NEWTOWN
STREAM AND WETLAND RESTORATION
UNION COUNTY, NORTH CAROLINA

DATE: 22 APRIL 2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: ASSET MAP
SCALE: 1" = 200
ASSET MAP
SHEET NO.

FIGURE 2

S:\Projects\EBX-Environmental Banc & Exchange\EBX Newtown 096023\Monitoring\2011 MY-00\Drawings\Newtown-MY0-2011 Project folder\dwg\Figure 2-ASSET MAP.dwg, 6/10/2011 3:29:04 PM, 1:1

Table 1a. Project Components

Table 1. Project Components Newtown Stream and Wetland Restoration									
Project Component or Reach ID	**Existing Feet/Acres**	**Restoration Level**	**Approach**	**Footage or Acreage**	**Stationing**	**Mitigation Ratio**	**Mitigation Units**	**BMP Elements1**	**Comment**
Underwood Creek	520	R	P2	558	5+00 - 10+58	1:1	558		
Underwood Creek	625	R	P1	715	11+16 - 19+06	1:1	715		58 LF easement exclusion for Stream Crossing
UT to Underwood Creek	3923	R	P1	3975	2+00 - 43+07	1:1	3975		125 LF easement exclusion for two (2) Stream Crossings
UT to Underwood Creek	100	E2		100	1+00 - 2+00	2.5:1	40		
Wetland	3.38	R	-	3.38		1:1	3.38		
Wetland	0.15	P	-	0.15		5:1	0.03		

1 = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; Grassed Swale = S; LS = Level Spreader; NI = Natural Infiltration Area, O = Other; CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

Table 1b. Component Summations

Table 1b. Component Summations Newtown Stream and Wetland Restoration							
Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	5248	3.38					
Enhancement							
Enhancement I							
Enhancement II	100						
Creation							
Preservation		0.15					
HQ Preservation							
Totals (Feet/Acres)	**5248**	**3.53**		**0**	**0**		
MU Totals	**5288**	**3.41**					
	Non-Applicable						

Table 2. Project Activity and Reporting History

Table 2. Project Activity and Reporting History

Newtown Stream and Wetland Restoration

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	June 2010	June 2010
Final Design – Construction Plans	July 2010	July 2010
Construction	-	April 2011
Bare root and livestake planting	-	April 2011
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	April 2011	May 2011
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Bolded items are examples of those items that are not standard, but may come up and should be included. Non-bolded items represent events that are standard components over the course of a typical project.

Table 3. Project Contacts Table

Table 3. Project Contacts Table Newtown Stream and Wetland Restoration	
Designer Primary project design POC	Ward Consulting Engineers, P.C. 8368 Six Forks Rd, Suite 104 Raleigh, NC 27615 Becky Ward 919-870-0526
Construction Contractor Construction contractor POC	RFG Construction 1907 Cambridge Dr Kinston, NC 28504 Robert Grady 252-559-6954
Survey Contractor Survey contractor POC	R.B. Pharr & Associates 420 Hawthorne Ln Charlotte, NC 28204 Justin Cloninger 704-376-2186
Planting Contractor Planting contractor POC	New Forest Services P.O. Box 255 Manistee, MI 49660 Brian Jarvinen 910-512-6754
Seeding Contractor Contractor point of contact	RFG Construction 1907 Cambridge Dr Kinston, NC 28504 Robert Grady 252-559-6954
Seed Mix Sources	Evergreen Seed - Fuquay Varina, NC 919-567-1333
Nursery Stock Suppliers	Arbor Gen - Blenheim, SC - South Carolina SuperTree Nursery 800-222-1290
Monitoring Performers	Ward Consulting Engineers, P.C. 8368 Six Forks Rd, Suite 104 Raleigh, NC 27615
Stream Monitoring POC	Zack Pitts 919-870-0526
Vegetation Monitoring POC	Chris Sheats - The Catena Group - 919-732-1300
Wetland Monitoring POC	Chris Sheats - The Catena Group - 919-732-1300

Table 4. Project Attribute Table

Table 4. Project Attribute Table Newtown Stream and Wetland Restoration		
Project County	Union	
Physiographic Region	Piedmont	
Ecoregion	Carolina Slate Belt	
Project River Basin	Catawba River Basin	
USGS HUC for Project (14 digit)	3050103030020	
NCDWQ Sub-basin for Project	03-08-38	
Within extent of EEP Watershed Plan?	No	
WRC Hab Class (Warm, Cool, Cold)	-	
% of project easement fenced or demarcated	100%	
Beaver activity observed during design phase?	No	
Restoration Component Attribute Table		
	Underwood Creek	**UT to Underwood Creek**
Drainage area	0.72 sq mi	0.74 sq mi
Stream order	-	-
Restored length (feet)	1273	3975
Perennial or Intermittent	Perennial	Perennial
Watershed type (Rural, Urban, Developing etc.)	Rural	Rural
Watershed LULC Distribution (e.g.)		
Residential	14%	
Ag-Row Crop	66%	
Ag-Livestock	-	
Forested	20%	
Etc.	-	
Watershed impervious cover (%)	-	
NCDWQ AU/Index number	11-138-2-3-1	N/A
NCDWQ classification	C	N/A
303d listed?	N	N
Upstream of a 303d listed segment?	N	N
Reasons for 303d listing or stressor	N/A	N/A
Total acreage of easement	16.43 Ac	
Total vegetated acreage within the easement	0.17 Ac	0.53 Ac
Total planted acreage as part of the restoration	15.73 Ac	
Rosgen classification of pre-existing	incised C4/E4	incised C4/E4 w/sections of G4
Rosgen classification of As-built	C4	C4
Valley type		
Valley slope	0.64%	0.63%
Valley side slope range (e.g. 2-3.%)	-	-
Valley toe slope range (e.g. 2-3.%)	-	-
Cowardin classification	-	-
Trout waters designation	N	N
Species of concern, endangered etc.? (Y/N)	N	N
Dominant soil series and characteristics		
Series	Chewacla	Chewacla
Depth	-	-
Clay%	-	-
K	-	-
T	-	-

Use N/A for items that may not apply. Use "-" for items that are unavailable and "U" for items that are unknown

Appendix B. Morphological Summary Data and Plots

Table 10a. Baseline Stream Data Summary
Newtown Stream and Wetland Restoration - Underwood Creek: 1273 feet

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					8.3	11.72		16.3			10	12.2		14.3				16		15.27	15.88	15.67	16.69	0.734	3
Floodprone Width (ft)					12	58		107									130	140	250	110	158.3	140	225	59.65	3
Bankfull Mean Depth (ft)					0.93	1.16		1.29			0.92	1.12		1.34				1.06		1.028	1.049	1.035	1.084	0.031	3
[1]Bankfull Max Depth (ft)					1.02	1.58		2.05										1.6		1.66	1.717	1.74	1.75	0.049	3
Bankfull Cross Sectional Area (ft^2)					10.5	13.3		19.6			12.2	13		13.4				17		15.81	16.67	16.11	18.1	1.246	3
Width/Depth Ratio					6.5	10.42		16.8			7.7	11.3		15.6				15		14.76	15.13	15.24	15.4	0.334	3
Entrenchment Ratio					1.47	4.65		7.71			2.9	6.5		8.6			8	9	16	7.203	9.872	8.936	13.48	3.241	3
[1]Bank Height Ratio					1.61	1.83		2.28			0.9	1		1.2				1		1	1	1	1	0	3
Profile																									
Riffle Length (ft)					6.33	37.84		106.9			4.03	14.18		23.61			10	21.7	58	7.36	20.81	20.51	31.54	5.577	22
Riffle Slope (ft/ft)					0.0001	0.054		0.238			0	0.02		0.082			0.007	0.013	0.017	0.003	0.013	0.013	0.029	0.005	22
Pool Length (ft)					19.07	55.73		119.9			18.51	32.11		58.03			19	35.96	54	17.45	34.81	34.92	52.82	7.611	24
Pool Max depth (ft)					2	2.31		3.1			1.7	2.47		3.1			2.4	3.5	4.5	2.76	3.402	3.43	4.04	0.374	24
Pool Spacing (ft)					34	91		245			29	48		84			37	63	110	31.47	55.97	54.57	78.46	10.48	22
Pattern																									
Channel Beltwidth (ft)					35	47.8		56			25	40		65			34	53	86	34		53	86		
Radius of Curvature (ft)					7	47		173			20	31		122			26	41	59	26		41	59		
Rc:Bankfull width (ft/ft)					0.06	0.04		0.148			0.016	0.026		0.037			0.016	0.026	0.037	0.016		0.026	0.037		
Meander Wavelength (ft)					55	113.6		245			62	85.5		99			82	112	130	82		112	130		
Meander Width Ratio					1.84	2.52		2.95			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2						0.45												0.43				0.43			
Max part size (mm) mobilized at bankfull																		60				60			
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification						incised C4/E4						E4/C4						C4				C4			
Bankfull Velocity (fps)						4.05												3.3				3.3			
Bankfull Discharge (cfs)						55																			
Valley length (ft)						1110						542													
Channel Thalweg length (ft)						1149						650						1331				1331			
Sinuosity (ft)						1.04						1.2						1.3				1.3			
Water Surface Slope (Channel) (ft/ft)						0.006						0.0065						0.0048				0.0048			
BF slope (ft/ft)						0.0071						0.0114						0.0048				0.0048			
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Newtown Stream and Wetland Restoration - UT to Underwood Creek: 3000 feet

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					6.3	11.75		16			10	12.2		14.3				14		12.32	13.98	13.62	16.52	1.465	7
Floodprone Width (ft)					19	109		352									95	160	220	95	172.9	135	280	76.1	7
Bankfull Mean Depth (ft)					0.73	1.12		1.56			0.92	1.12		1.34				0.98		0.81	0.951	0.963	1.06	0.077	7
[1]Bankfull Max Depth (ft)					1.1	1.92		2.6										1.4		1.46	1.637	1.61	1.98	0.173	7
Bankfull Cross Sectional Area (ft^2)					7.3	12.9		18.8			12.2	13		13.4				13.7		11.59	13.22	13.06	15.22	1.089	7
Width/Depth Ratio					5.4	11.21		19.8			7.7	11.3		15.6				14.3		11.63	14.87	14.37	20.38	2.683	7
Entrenchment Ratio					2	9.04		29.3			2.9	6.5		8.6			6.8	11	16	6.973	12.44	8.845	22.72	5.768	7
[1]Bank Height Ratio					1.26	1.31		1.99			0.9	1		1.2				1		0.942	0.979	0.985	1	0.025	7
Profile																									
Riffle Length (ft)					1.64	38.85		290			4.03	14.18		23.61			10	16.45	80	9.19	16.29	15.51	34.04	4.46	64
Riffle Slope (ft/ft)					0.0002	0.021		0.121			0	0.02		0.082			0.007	0.016	0.057	8E-04	0.018	0.016	0.056	0.011	60
Pool Length (ft)					8.87	54.34		435			18.51	32.11		58.03			14	30.24	53	19.68	30.25	28.74	51.91	7.748	65
Pool Max depth (ft)					1.3	2.57		4.8			1.7	2.47		3.1			2.1	2.8	3.9	2.42	2.965	2.92	3.68	0.275	65
Pool Spacing (ft)					8.5	105		752			29	48		84			32	55	97	31.79	46.17	44.57	80.51	9.696	63
Pattern																									
Channel Beltwidth (ft)					40	43.75		51			25	40		65			30	46	76	30		46	76		
Radius of Curvature (ft)					2.4	23		169			20	31		122			23	36	52	23		36	52		
Rc:Bankfull width (ft/ft)					0.002	0.02		0.144			0.016	0.026		0.037			0.016	0.026	0.037	0.016		0.026	0.037		
Meander Wavelength (ft)					80	126.5		190			62	85.5		99			72	98	113	72		98	113		
Meander Width Ratio					7.71	1.87		2.18			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					0.41												0.28			0.28					
Max part size (mm) mobilized at bankfull																	38			38					
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					incised C4/E4 w/sections of G4						E4/C4						C4			C4					
Bankfull Velocity (fps)					3.19												3.07			3.07					
Bankfull Discharge (cfs)					42																				
Valley length (ft)					3506						542														
Channel Thalweg length (ft)					4097						650						4100			4100					
Sinuosity (ft)					1.17						1.2						1.3			1.3					
Water Surface Slope (Channel) (ft/ft)					0.0054						0.0065						0.0048			0.0048					
BF slope (ft/ft)					0.0063						0.0114						0.0048			0.0048					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Newtown Stream and Wetland Restoration - Underwood Creek: 1273 feet

Parameter	Pre-Existing Condition							Reference Reach(es) Data						
[1]Ri% / Ru% / P% / G% / S%	38%	6%	48%	8%				28%	4%	60%	8%			
[1]SC% / Sa% / G% / C% / B% / Be%	2.16%	4.95%	81.62%	9.12%	0.43%	1.72%		0.91%	3%	81.59%	14%	0%	0.50%	
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	8.15	19.25	27.75	58.65	105.10			11.59	20.73	29.25	60.76	82.68		
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

Parameter	Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	36%		59%		2%			24%		43%		2%		
[1]SC% / Sa% / G% / C% / B% / Be%														
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)														
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary. The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions. ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distrib

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Newtown Stream and Wetland Restoration - UT to Underwood Creek: 3000 feet

Parameter	Pre-Existing Condition							Reference Reach(es) Data						
[1]Ri% / Ru% / P% / G% / S%	39%	2%	53%	4%				28%	4%	60%	8%			
[1]SC% / Sa% / G% / C% / B% / Be%	0%	2%	92.81%	4.72%	0.47%	0%		0.9%	3%	81.6%	14.0%	0%	0.5%	
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	12.70	19.80	24.50	43.05	60.50			11.59	20.73	29.25	60.76	82.68		
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

Parameter	Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	34%		64%		1%			34%		64%		1%		
[1]SC% / Sa% / G% / C% / B% / Be%														
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)														
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10														
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0														

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary. The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions. ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-constrution distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Newtown Stream and Wetland Restoration - Underwood Creek: 1273 feet

	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	594.36							592.56							590.75						
Bankfull Width (ft)	15.67							16.69							15.27						
Floodprone Width (ft)	140							225							110						
Bankfull Mean Depth (ft)	1.03							1.08							1.03						
Bankfull Max Depth (ft)	1.74							1.75							1.66						
Bankfull Cross Sectional Area (ft^2)	16.11							18.10							15.81						
Bankfull Width/Depth Ratio	15.24							15.40							14.76						
Bankfull Entrenchment Ratio	8.94							13.48							7.20						
Bankfull Bank Height Ratio	1.00							1.00							1.00						
Based on current/developing bankfull feature[2]																					
Record elevation (datum) used																					
Bankfull Width (ft)																					
Floodprone Width (ft)																					
Bankfull Mean Depth (ft)																					
Bankfull Max Depth (ft)																					
Bankfull Cross Sectional Area (ft^2)																					
Bankfull Width/Depth Ratio																					
Bankfull Entrenchment Ratio																					
Bankfull Bank Height Ratio																					
Cross Sectional Area between end pins (ft^2)																					
d50 (mm)																					

These cells may or may not require population in any given year. See footnote 2 below

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline bankfull datum then this should be tracked and quantified in these cells.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Newtown Stream and Wetland Restoration - UT to Underwood Creek: 3000 feet

	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	609.86							604.51							601.91							598.86						
Bankfull Width (ft)	12.32							16.52							13.99							13.42						
Floodprone Width (ft)	280							245							230							115						
Bankfull Mean Depth (ft)	1.06							0.81							0.97							0.96						
Bankfull Max Depth (ft)	1.98							1.72							1.58							1.50						
Bankfull Cross Sectional Area (ft^2)	13.06							13.38							13.61							12.92						
Bankfull Width/Depth Ratio	11.63							20.38							14.37							13.93						
Bankfull Entrenchment Ratio	22.72							14.83							16.45							8.57						
Bankfull Bank Height Ratio	0.98							0.94							1.00							1.00						
Based on current/developing bankfull feature[2]																												
Record elevation (datum) used																												
Bankfull Width (ft)																												
Floodprone Width (ft)																												
Bankfull Mean Depth (ft)																												
Bankfull Max Depth (ft)																												
Bankfull Cross Sectional Area (ft^2)																												
Bankfull Width/Depth Ratio																												
Bankfull Entrenchment Ratio																												
Bankfull Bank Height Ratio																												
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

These cells may or may not require population in any given year. See footnote 2 below

	Cross Section 5 (Riffle)							Cross Section 6 (Riffle)							Cross Section 7 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	596.67							594.85							592.00						
Bankfull Width (ft)	12.71							13.62							15.26						
Floodprone Width (ft)	110							95							135						
Bankfull Mean Depth (ft)	0.91							0.94							1.00						
Bankfull Max Depth (ft)	1.61							1.46							1.61						
Bankfull Cross Sectional Area (ft^2)	11.59							12.80							15.22						
Bankfull Width/Depth Ratio	13.95							14.50							15.31						
Bankfull Entrenchment Ratio	8.65							6.97							8.84						
Bankfull Bank Height Ratio	1.00							0.95							0.98						
Based on current/developing bankfull feature[2]																					
Record elevation (datum) used																					
Bankfull Width (ft)																					
Floodprone Width (ft)																					
Bankfull Mean Depth (ft)																					
Bankfull Max Depth (ft)																					
Bankfull Cross Sectional Area (ft^2)																					
Bankfull Width/Depth Ratio																					
Bankfull Entrenchment Ratio																					
Bankfull Bank Height Ratio																					
Cross Sectional Area between end pins (ft^2)																					
d50 (mm)																					

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline bankfull datum then this should be tracked and quantified in these cells.

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Newtown Stream and Wetland Restoration - Underwood Creek: 1273 feet

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	15.27	15.88	15.67	16.69	0.734	3																														
Floodprone Width (ft)	110	158.3	140	225	59.65	3																														
Bankfull Mean Depth (ft)	1.028	1.049	1.035	1.084	0.031	3																														
[1]Bankfull Max Depth (ft)	1.66	1.717	1.74	1.75	0.049	3																														
Bankfull Cross Sectional Area (ft^2)	15.81	16.67	16.11	18.1	1.246	3																														
Width/Depth Ratio	14.76	15.13	15.24	15.4	0.334	3																														
Entrenchment Ratio	7.203	9.872	8.936	13.48	3.241	3																														
[1]Bank Height Ratio	1	1	1	1	0	3																														
Profile																																				
Riffle Length (ft)	7.36	20.81	20.51	31.54	5.577	22																														
Riffle Slope (ft/ft)	0.003	0.013	0.013	0.029	0.005	22																														
Pool Length (ft)	17.45	34.81	34.92	52.82	7.611	24																														
Pool Max depth (ft)	2.76	3.402	3.43	4.04	0.374	24																														
Pool Spacing (ft)	31.47	55.97	54.57	78.46	10.48	22																														
Pattern																																				
Channel Beltwidth (ft)	34		53	86																																
Radius of Curvature (ft)	26		41	59																																
Rc:Bankfull width (ft/ft)	0.016		0.026	0.037																																
Meander Wavelength (ft)	82		112	130																																
Meander Width Ratio	2.1		3.3	5.4																																
Additional Reach Parameters																																				
Rosgen Classification	C4																																			
Channel Thalweg length (ft)	1331																																			
Sinuosity (ft)	1.3																																			
Water Surface Slope (Channel) (ft/ft)	0.0048																																			
BF slope (ft/ft)	0.0048																																			
[3]Ri% / Ru% / P% / G% / S%	24%		43%		2%																															
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

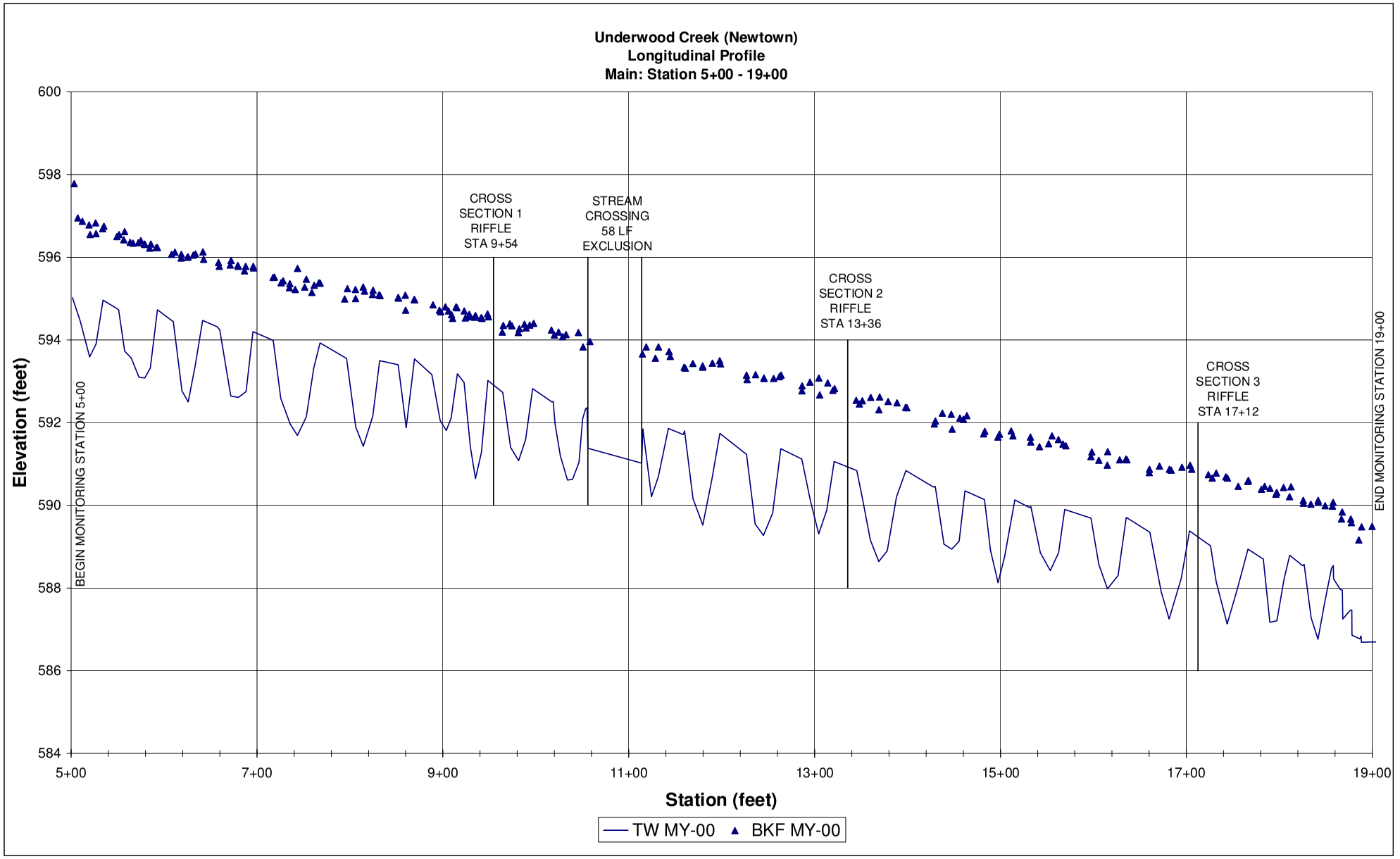
Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

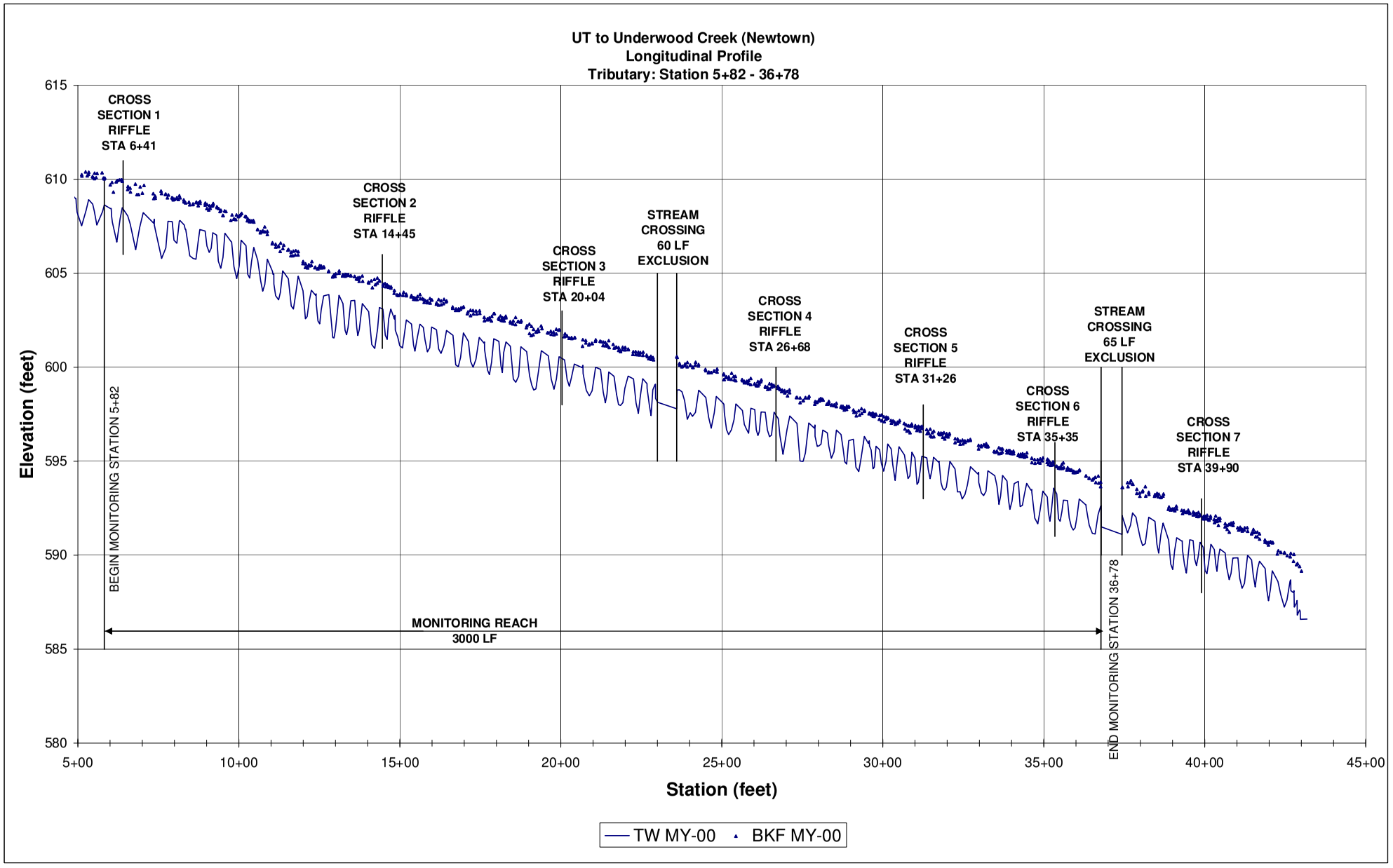
Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Newtown Stream and Wetland Restoration - UT to Underwood Creek: 3000 feet

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	12.32	13.98	13.62	16.52	1.465	7																														
Floodprone Width (ft)	95	172.9	135	280	76.1	7																														
Bankfull Mean Depth (ft)	0.81	0.951	0.963	1.06	0.077	7																														
[1]Bankfull Max Depth (ft)	1.46	1.637	1.61	1.98	0.173	7																														
Bankfull Cross Sectional Area (ft^2)	11.59	13.22	13.06	15.22	1.089	7																														
Width/Depth Ratio	11.63	14.87	14.37	20.38	2.683	7																														
Entrenchment Ratio	6.973	12.44	8.845	22.72	5.768	7																														
[1]Bank Height Ratio	0.942	0.979	0.985	1	0.025	7																														
Profile																																				
Riffle Length (ft)	9.19	16.29	15.51	34.04	4.46	64																														
Riffle Slope (ft/ft)	8E-04	0.018	0.016	0.056	0.011	60																														
Pool Length (ft)	19.68	30.25	28.74	51.91	7.748	65																														
Pool Max depth (ft)	2.42	2.965	2.92	3.68	0.275	65																														
Pool Spacing (ft)	31.79	46.17	44.57	80.51	9.696	63																														
Pattern																																				
Channel Beltwidth (ft)	30		46	76																																
Radius of Curvature (ft)	23		36	52																																
Rc:Bankfull width (ft/ft)	0.016		0.026	0.037																																
Meander Wavelength (ft)	72		98	113																																
Meander Width Ratio	2.1		3.3	5.4																																
Additional Reach Parameters																																				
Rosgen Classification	C4																																			
Channel Thalweg length (ft)	4100																																			
Sinuosity (ft)	1.3																																			
Water Surface Slope (Channel) (ft/ft)	0.0048																																			
BF slope (ft/ft)	0.0048																																			
[3]Ri% / Ru% / P% / G% / S%	34%		64%		1%																															
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3


Underwood Creek (Newtown)
Longitudinal Profile
Main: Station 5+00 - 19+00
Elevation (feet)
600
598
596
594
592
590
588
586
584
5+00
7+00
9+00
11+00
13+00
15+00
17+00
19+00
Station (feet)
CROSS SECTION 1 RIFFLE STA 9+54
STREAM CROSSING 58 LF EXCLUSION
CROSS SECTION 2 RIFFLE STA 13+36
CROSS SECTION 3 RIFFLE STA 17+12
BEGIN MONITORING STATION 5+00
END MONITORING STATION 19+00
TW MY-00
BKF MY-00


UT to Underwood Creek (Newtown)
Longitudinal Profile
Tributary: Station 5+82 - 36+78
Elevation (feet)
615
610
605
600
595
590
585
580
5+00
10+00
15+00
20+00
25+00
30+00
35+00
40+00
45+00
Station (feet)
CROSS SECTION 1 RIFFLE STA 6+41
CROSS SECTION 2 RIFFLE STA 14+45
CROSS SECTION 3 RIFFLE STA 20+04
STREAM CROSSING 60 LF EXCLUSION
CROSS SECTION 4 RIFFLE STA 26+68
CROSS SECTION 5 RIFFLE STA 31+26
CROSS SECTION 6 RIFFLE STA 35+35
STREAM CROSSING 65 LF EXCLUSION
CROSS SECTION 7 RIFFLE STA 39+90
BEGIN MONITORING STATION 5+82
MONITORING REACH 3000 LF
END MONITORING STATION 36+78
TW MY-00
BKF MY-00

Project:	Underwood Creek
Cross Section:	Cross Section 1
Feature	Riffle
Station:	9+54.47
Date:	4/22/11
Crew:	ZAP

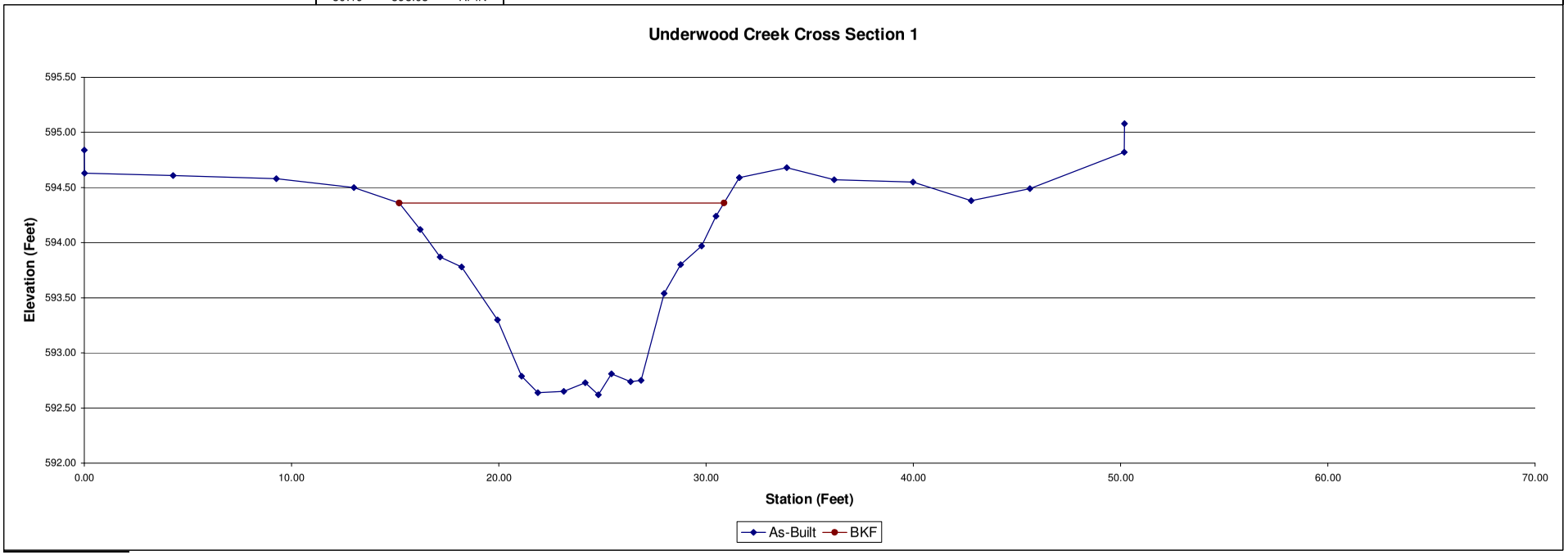
Summary (bankfull)

	MY0
A (BKF)	16.1
W (BKF)	15.7
Max d	1.7
Mean d	1.0
W/D	15.2

MY00-2011

Station	Elevation	Notes
0.00	594.84	LPIN
0.01	594.63	
4.29	594.61	
9.27	594.58	
13.01	594.50	
15.20	594.36	BKF L
16.21	594.12	
17.17	593.87	
18.21	593.78	
19.94	593.30	
21.10	592.79	TOE L
21.89	592.64	
23.14	592.65	
24.17	592.73	
24.80	592.62	TW
25.43	592.81	
26.36	592.74	
26.87	592.75	TOE R
27.98	593.54	
28.77	593.80	
29.79	593.97	
30.48	594.24	
31.61	594.59	BKF R
33.90	594.68	
36.18	594.57	
39.99	594.55	
42.80	594.38	
45.62	594.49	
50.18	594.82	
50.19	595.08	RPIN

Photo of XS-1, looking in the downstream direction



Project:	Underwood Creek
Cross Section:	Cross Section 2
Feature	Riffle
Station:	13+35.70
Date:	4/22/11
Crew:	ZAP

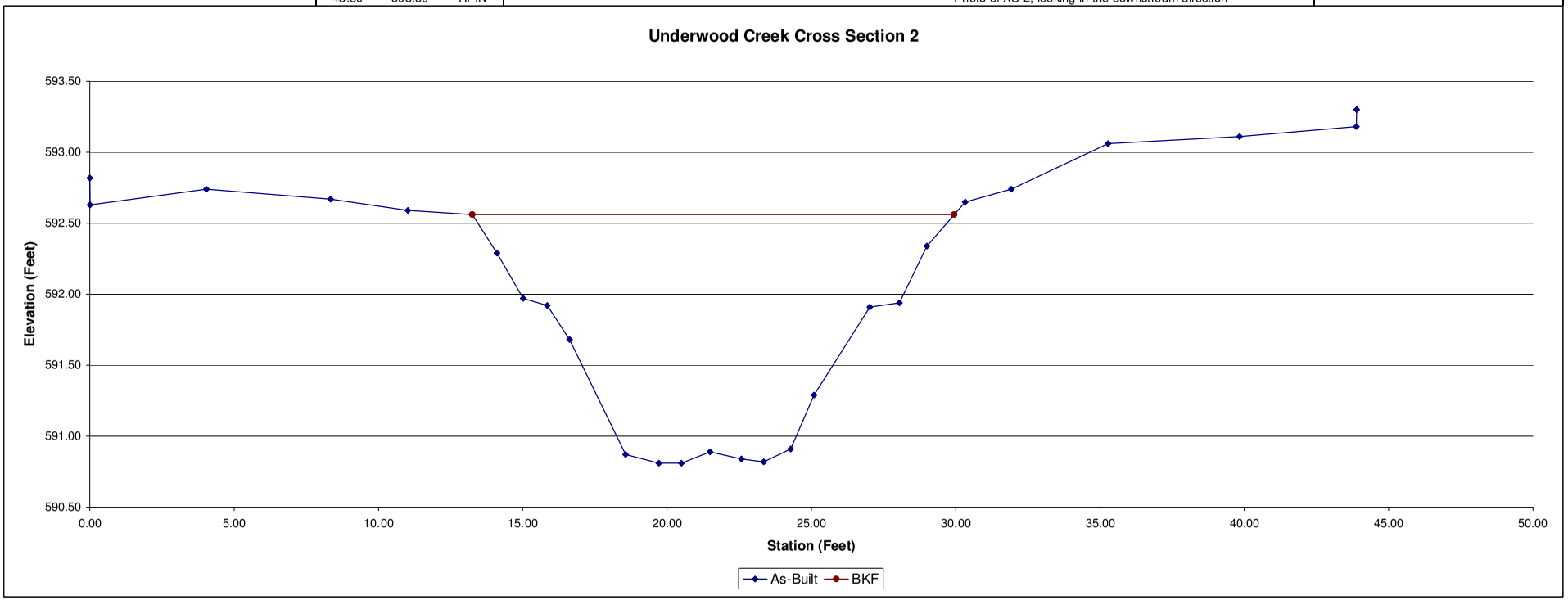
Summary (bankfull)

	MY0
A (BKF)	18.1
W (BKF)	16.7
Max d	1.8
Mean d	1.1
W/D	15.4

MY00-2011

Station	Elevation	Notes
0.00	592.82	LPIN
0.01	592.63	
4.04	592.74	
8.34	592.67	
11.02	592.59	
13.25	592.56	BKF L
14.11	592.29	
15.01	591.97	
15.85	591.92	
16.62	591.68	
18.56	590.87	TOE L
19.72	590.81	
20.50	590.81	TW
21.49	590.89	
22.58	590.84	
23.35	590.82	
24.28	590.91	TOE R
25.09	591.29	
27.02	591.91	
28.05	591.94	
29.00	592.34	
30.33	592.65	BKF R
31.93	592.74	
35.28	593.06	
39.83	593.11	
43.88	593.18	
43.89	593.30	RPIN

Photo of XS-2, looking in the downstream direction



Project:	Underwood Creek
Cross Section:	Cross Section 3
Feature	Riffle
Station:	17+12.49
Date:	4/22/11
Crew:	ZAP

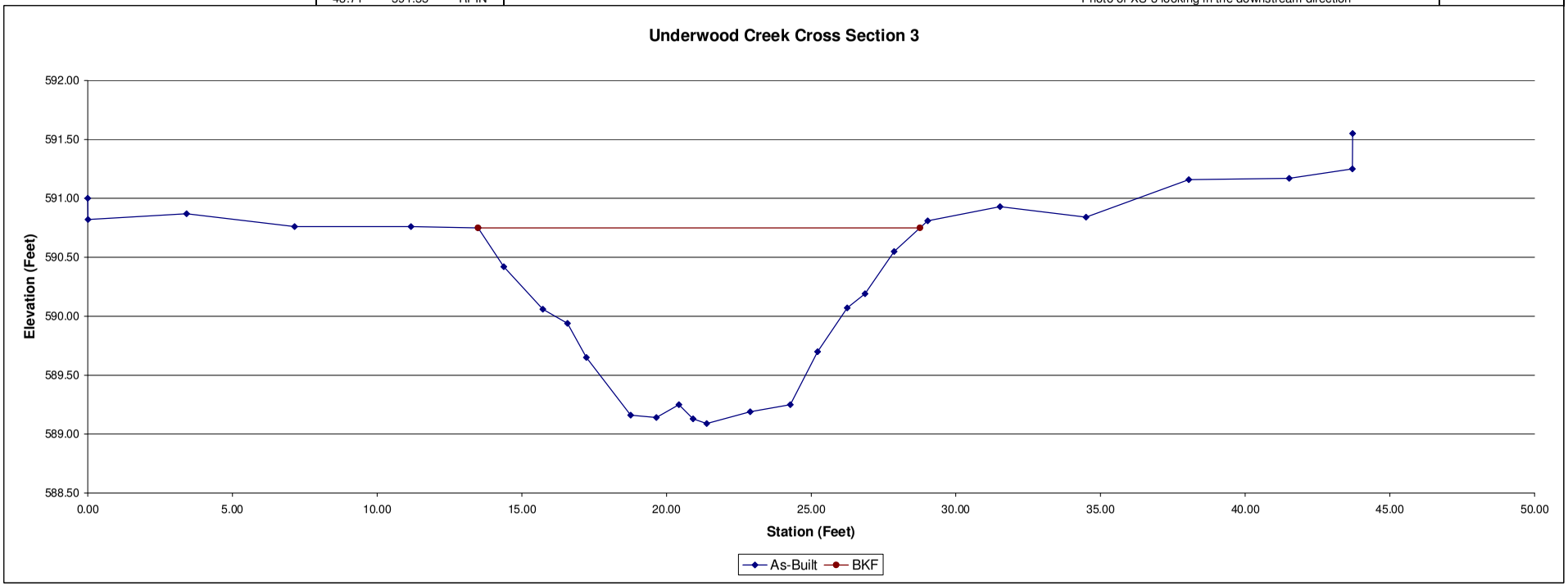
Summary (bankfull)

	MY0
A (BKF)	15.8
W (BKF)	15.3
Max d	1.7
Mean d	1.0
W/D	14.8

MY00-2011

Station	Elevation	Notes
0.00	591.00	LPIN
0.01	590.82	
3.42	590.87	
7.15	590.76	
11.17	590.76	
13.49	590.75	BKF L
14.38	590.42	
15.73	590.06	
16.58	589.94	
17.23	589.65	
18.76	589.16	TOE L
19.65	589.14	
20.43	589.25	
20.92	589.13	
21.39	589.09	TW
22.89	589.19	
24.28	589.25	TOE R
25.22	589.70	
26.25	590.07	
26.86	590.19	
27.87	590.55	
29.03	590.81	BKF R
31.53	590.93	
34.50	590.84	
38.05	591.16	
41.52	591.17	
43.70	591.25	
43.71	591.55	RPIN

Photo of XS-3 looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 1
Feature	Riffle
Station:	6+40.50
Date:	4/22/11
Crew:	ZAP

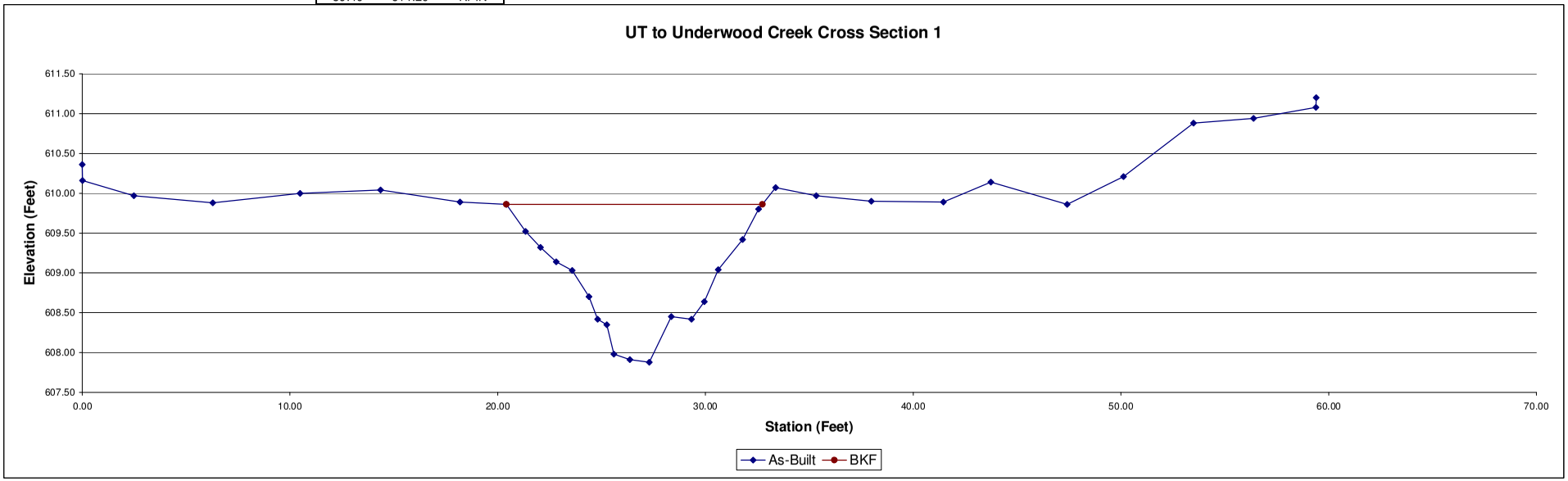
Summary (bankfull)

	MY0
A (BKF)	13.1
W (BKF)	12.3
Max d	2.0
Mean d	1.1
W/D	11.6

MY00-2011

Station	Elevation	Notes
0.00	610.36	LPIN
0.01	610.16	
2.48	609.97	
6.28	609.88	
10.49	610.00	
14.36	610.04	
18.19	609.89	
20.42	609.86	BKF L
21.34	609.52	
22.06	609.32	
22.82	609.14	
23.59	609.03	
24.39	608.70	
24.81	608.42	TOE L
25.25	608.35	
25.59	607.98	
26.36	607.91	TW
27.30	607.88	
28.35	608.45	
29.33	608.42	
29.95	608.64	TOE R
30.62	609.04	
31.79	609.42	
32.56	609.80	
33.38	610.07	BKF R
35.33	609.97	
37.99	609.90	
41.46	609.89	
43.74	610.14	
47.41	609.86	
50.12	610.21	
53.50	610.88	
56.38	610.94	
59.39	611.08	
59.40	611.20	RPIN

Photo of XS-1, looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 2
Feature	Riffle
Station:	14+45.49
Date:	4/22/11
Crew:	ZAP

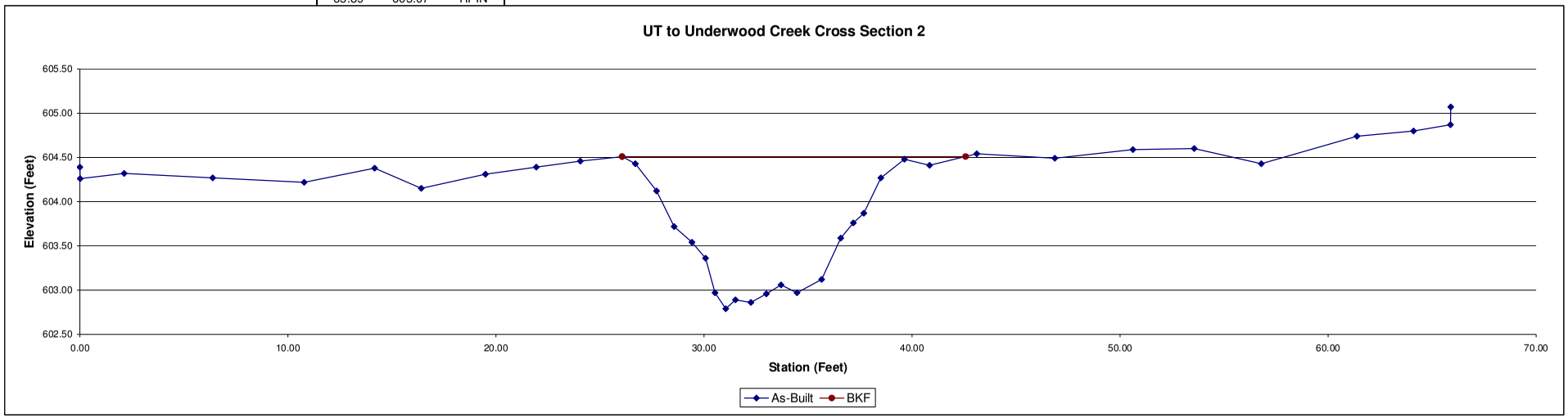
Summary (bankfull)

	MY0
A (BKF)	13.4
W (BKF)	16.5
Max d	1.7
Mean d	0.8
W/D	20.4

MY00-2011

Station	Elevation	Notes
0.00	604.39	LPIN
0.01	604.26	
2.13	604.32	
6.38	604.27	
10.78	604.22	
14.17	604.38	
16.41	604.15	
19.49	604.31	
21.94	604.39	
24.06	604.46	
26.07	604.51	BKF L
26.70	604.43	
27.72	604.12	
28.56	603.72	
29.42	603.54	
30.07	603.36	
30.53	602.97	TOE L
31.04	602.79	
31.51	602.89	
32.26	602.86	TW
33.00	602.96	
33.70	603.06	
34.47	602.97	
35.66	603.12	TOE R
36.57	603.59	
37.18	603.76	
37.68	603.87	
38.50	604.27	
39.63	604.48	BKF R
40.84	604.41	
43.11	604.54	
46.87	604.49	
50.62	604.59	
53.56	604.60	
56.79	604.43	
61.38	604.74	
64.10	604.80	
65.88	604.87	
65.89	605.07	RPIN

Photo of XS-2, looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 3
Feature	Riffle
Station:	20+03.76
Date:	4/22/11
Crew:	ZAP

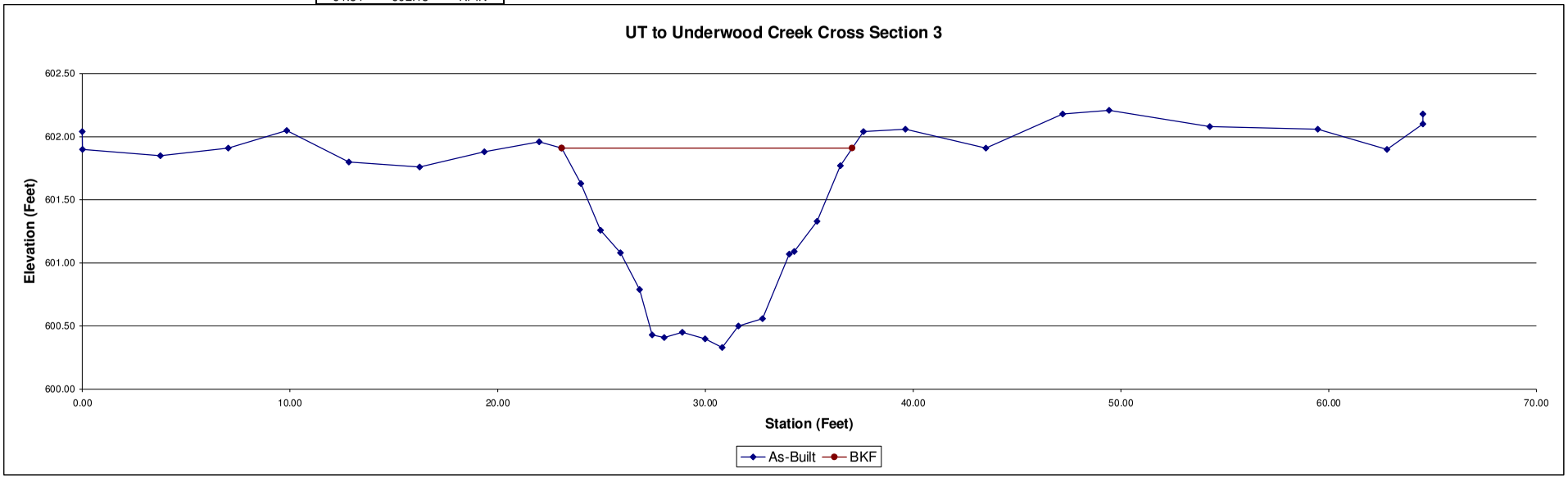
Summary (bankfull)

	MY0
A (BKF)	13.6
W (BKF)	14.0
Max d	1.6
Mean d	1.0
W/D	14.4

MY00-2011

Station	Elevation	Notes
0.00	602.04	LPIN
0.01	601.90	
3.76	601.85	
7.03	601.91	
9.84	602.05	
12.83	601.80	
16.24	601.76	
19.36	601.88	
21.99	601.96	
23.08	601.91	BKF L
24.00	601.63	
24.95	601.26	
25.91	601.08	
26.83	600.79	
27.43	600.43	TOE L
28.02	600.41	
28.88	600.45	
29.99	600.40	
30.80	600.33	TW
31.59	600.50	
32.75	600.56	TOE R
34.04	601.07	
34.27	601.09	
35.37	601.33	
36.49	601.77	
37.60	602.04	BKF R
39.63	602.06	
43.50	601.91	
47.20	602.18	
49.43	602.21	
54.28	602.08	
59.47	602.06	
62.81	601.90	
64.53	602.10	
64.54	602.18	RPIN

Photo of XS-3 looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 4
Feature	Riffle
Station:	26+68.31
Date:	4/22/11
Crew:	ZAP

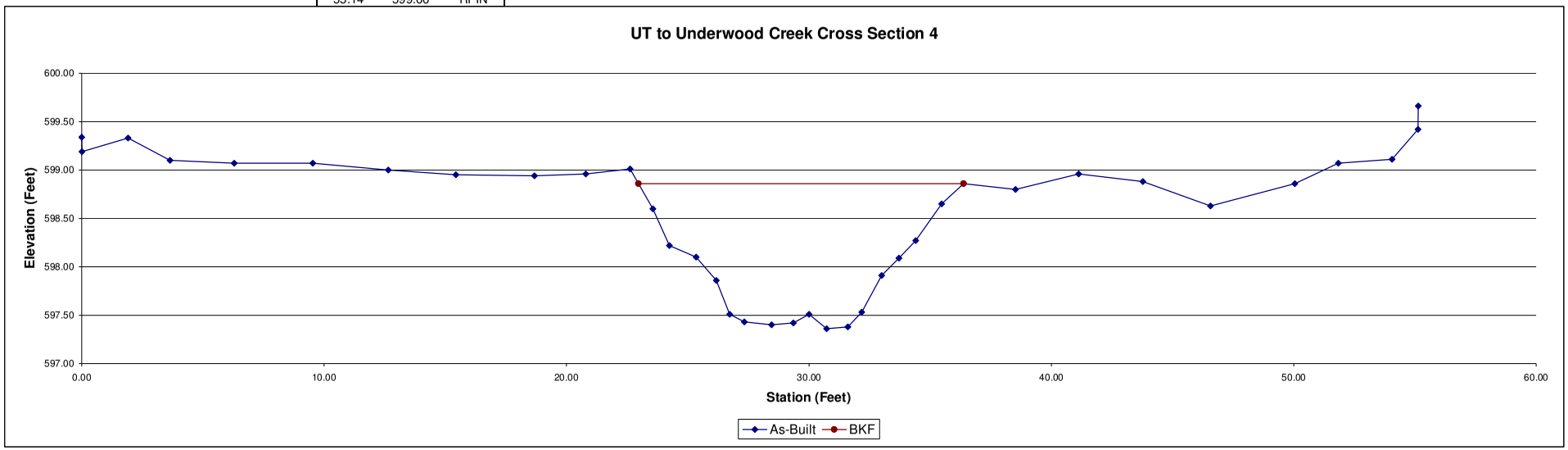
Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	12.9					
W (BKF)	13.4					
Max d	1.5					
Mean d	1.0					
W/D	13.9					

MY00-2011

Station	Elevation	Notes
0.00	599.34	LPIN
0.01	599.19	
1.91	599.33	
3.64	599.10	
6.29	599.07	
9.53	599.07	
12.65	599.00	
15.43	598.95	
18.68	598.94	
20.80	598.96	
22.62	599.01	BKF L
23.56	598.60	
24.24	598.22	
25.35	598.10	
26.18	597.86	
26.73	597.51	TOE L
27.34	597.43	
28.46	597.40	
29.36	597.42	
30.01	597.51	
30.73	597.36	TW
31.61	597.38	
32.18	597.53	TOE R
33.00	597.91	
33.71	598.09	
34.41	598.27	
35.47	598.65	
36.38	598.86	BKF R
38.52	598.80	
41.13	598.96	
43.78	598.88	
46.56	598.63	
50.05	598.86	
51.84	599.07	
54.06	599.11	
55.13	599.42	
55.14	599.66	RPIN

Photo of XS-4, looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 5
Feature	Riffle
Station:	31+25.66
Date:	4/22/11
Crew:	ZAP

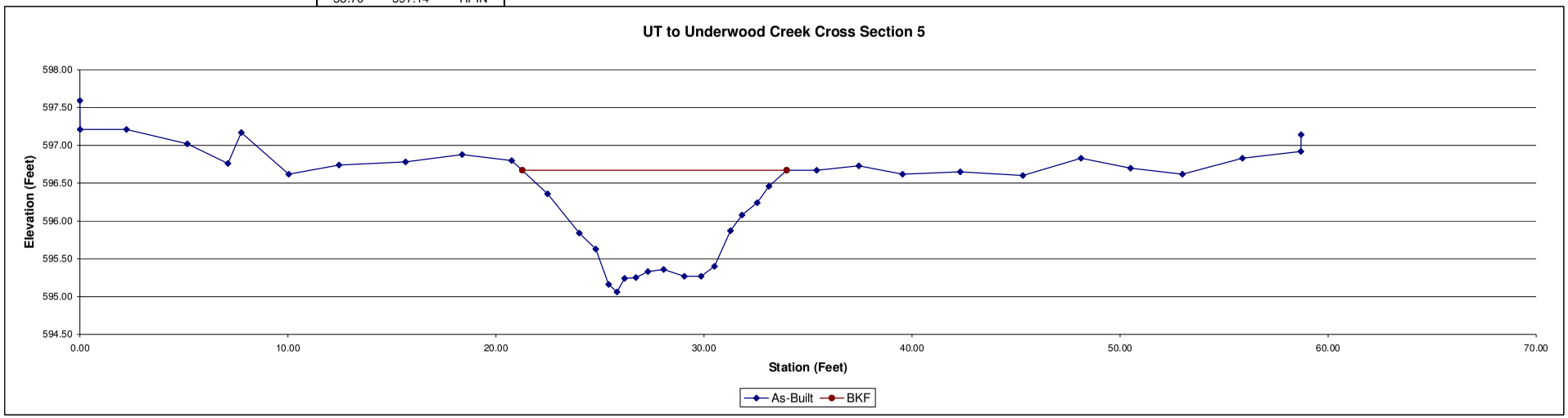
Summary (bankfull)

	MY0
A (BKF)	11.6
W (BKF)	12.7
Max d	1.6
Mean d	0.9
W/D	13.9

MY00-2011

Station	Elevation	Notes
0.00	597.59	LPIN
0.01	597.21	
2.24	597.21	
5.17	597.02	
7.12	596.76	
7.76	597.17	
10.04	596.62	
12.46	596.74	
15.65	596.78	
18.38	596.88	
20.76	596.80	BKF L
22.48	596.36	
24.00	595.84	
24.80	595.63	
25.41	595.16	TOE L
25.82	595.06	TW
26.19	595.24	
26.73	595.25	
27.31	595.33	
28.06	595.36	
29.06	595.27	
29.86	595.27	
30.51	595.40	TOE R
31.27	595.87	
31.83	596.08	
32.56	596.24	
33.12	596.46	
33.98	596.67	BKF R
35.42	596.67	
37.44	596.73	
39.55	596.62	
42.32	596.65	
45.33	596.60	
48.12	596.83	
50.51	596.70	
53.00	596.62	
55.88	596.83	
58.69	596.92	
58.70	597.14	RPIN

Photo of XS-5, looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 6
Feature	Riffle
Station:	35+34.55
Date:	4/22/11
Crew:	ZAP

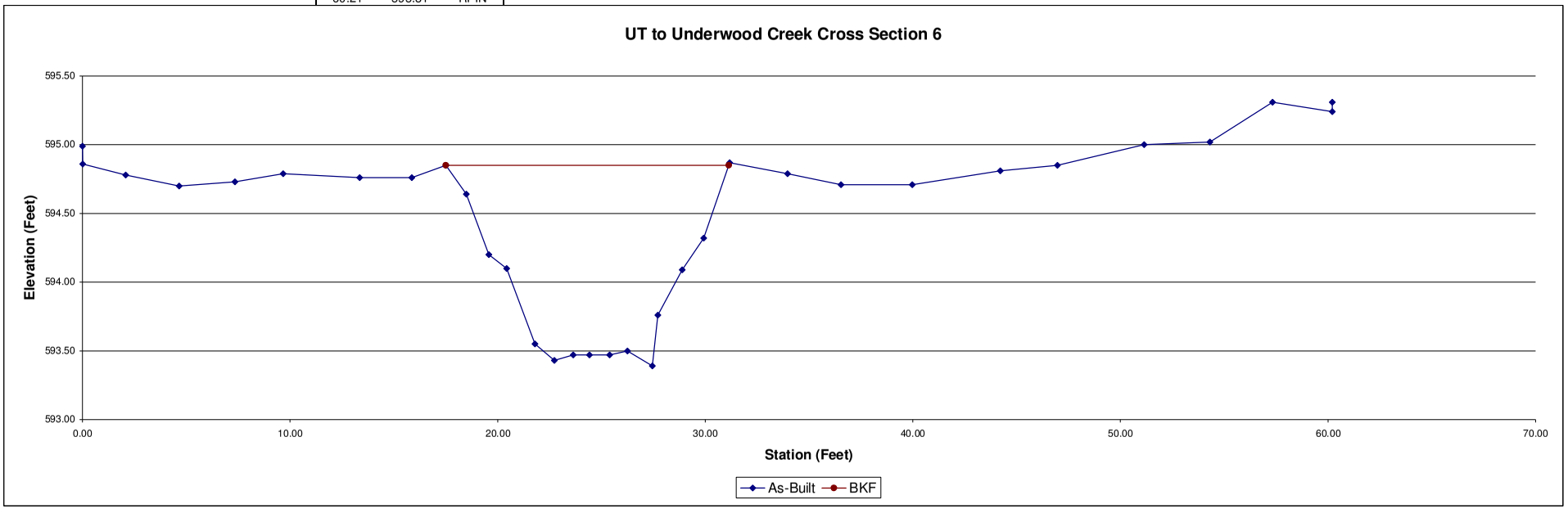
Summary (bankfull)

	MY0
A (BKF)	12.8
W (BKF)	13.6
Max d	1.5
Mean d	0.9
W/D	14.5

MY00-2011

Station	Elevation	Notes
0.00	594.99	LPIN
0.01	594.86	
2.08	594.78	
4.66	594.70	
7.34	594.73	
9.67	594.79	
13.36	594.76	
15.87	594.76	
17.51	594.85	BKF L
18.49	594.64	
19.57	594.20	
20.43	594.10	
21.80	593.55	TOE L
22.73	593.43	
23.64	593.47	
24.42	593.47	TW
25.40	593.47	
26.25	593.50	
27.45	593.39	TOE R
27.72	593.76	
28.89	594.09	
29.93	594.32	
31.18	594.87	BKF R
33.96	594.79	
36.54	594.71	
39.97	594.71	
44.21	594.81	
46.97	594.85	
51.14	595.00	
54.31	595.02	
57.33	595.31	
60.20	595.24	
60.21	595.31	RPIN

Photo of XS-6, looking in the downstream direction



Project:	UT to Underwood Creek
Cross Section:	Cross Section 7
Feature	Riffle
Station:	39+90.06
Date:	4/22/11
Crew:	ZAP

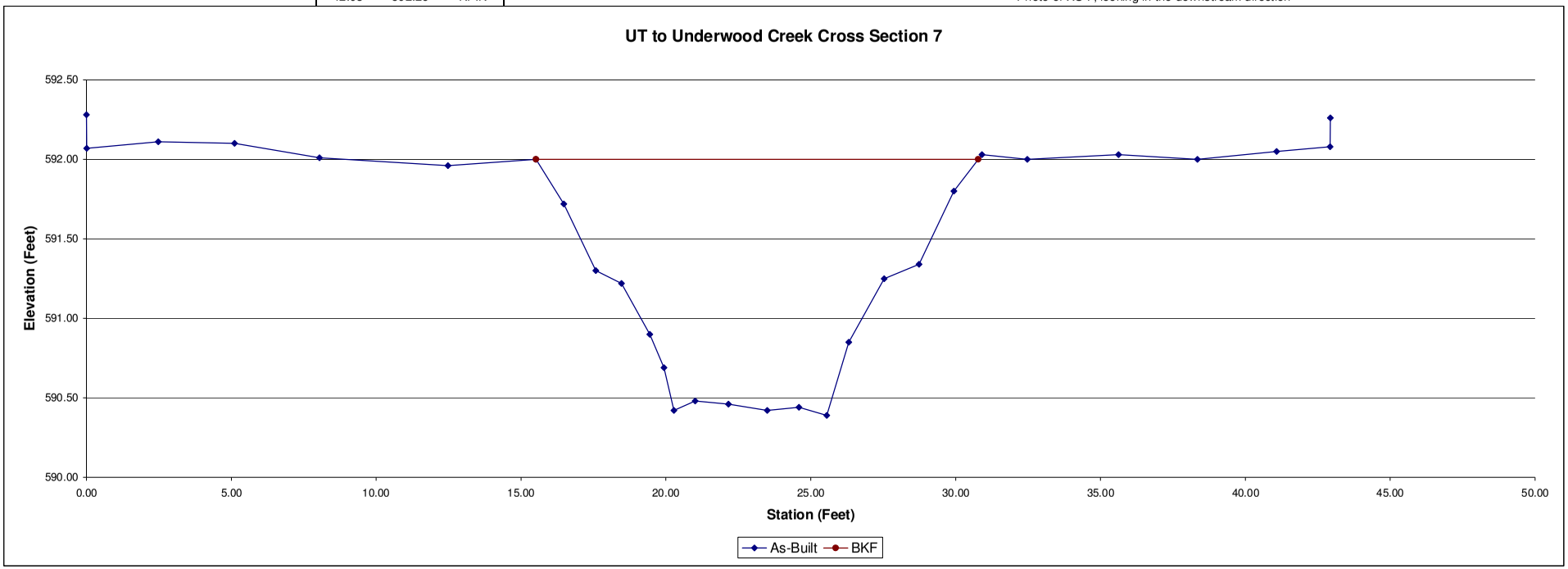
Summary (bankfull)

	MY0
A (BKF)	15.2
W (BKF)	15.3
Max d	1.6
Mean d	1.0
W/D	15.3

MY00-2011

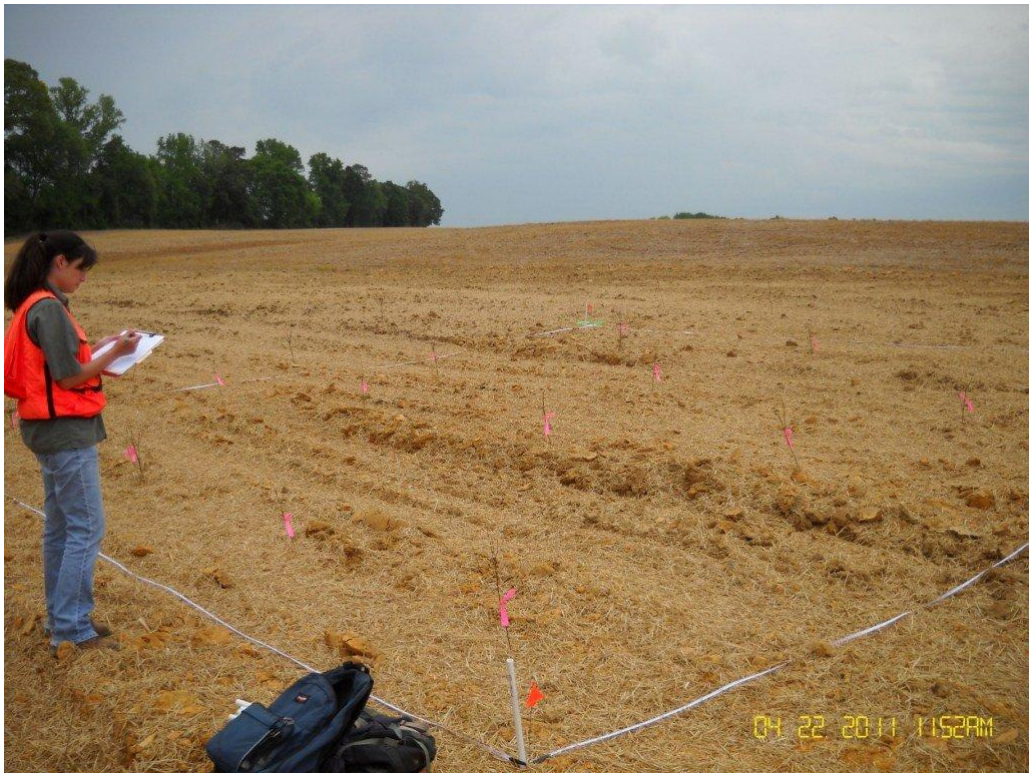
Station	Elevation	Notes
0.00	592.28	LPIN
0.01	592.07	
2.48	592.11	
5.11	592.10	
8.04	592.01	
12.48	591.96	
15.52	592.00	BKF L
16.48	591.72	
17.58	591.30	
18.47	591.22	
19.44	590.90	
19.93	590.69	
20.28	590.42	TOE L
21.01	590.48	
22.16	590.46	
23.50	590.42	TW
24.59	590.44	
25.55	590.39	TOE R
26.31	590.85	
27.53	591.25	
28.74	591.34	
29.94	591.80	
30.91	592.03	BKF R
32.47	592.00	
35.62	592.03	
38.35	592.00	
41.08	592.05	
42.92	592.08	
42.93	592.26	RPIN

Photo of XS-7, looking in the downstream direction



Appendix C. Vegetation Data

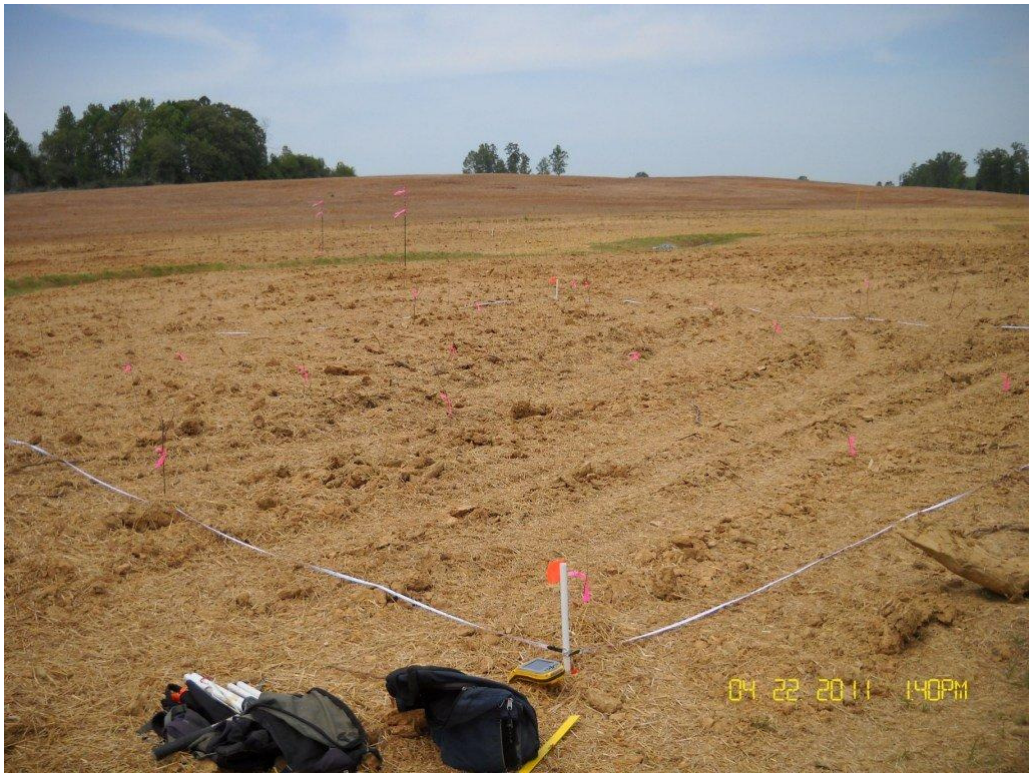
Vegetation Plot Photos



Veg Plot 1

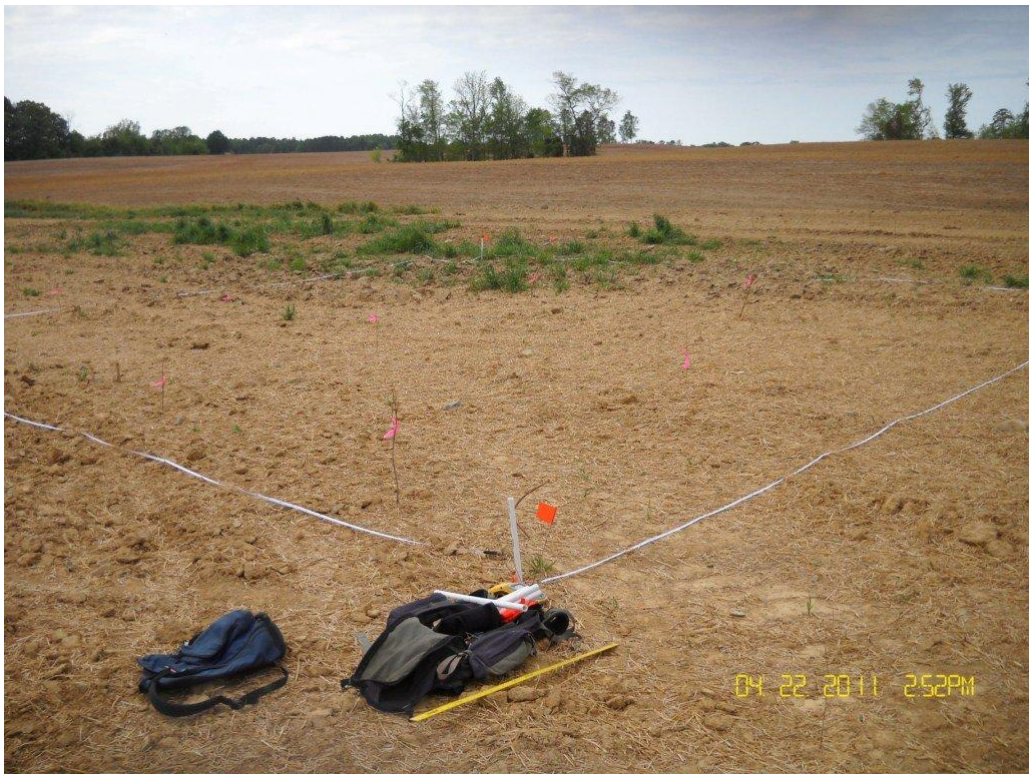
Veg Plot 2

Veg Plot 3



Veg Plot 4

Veg Plot 5



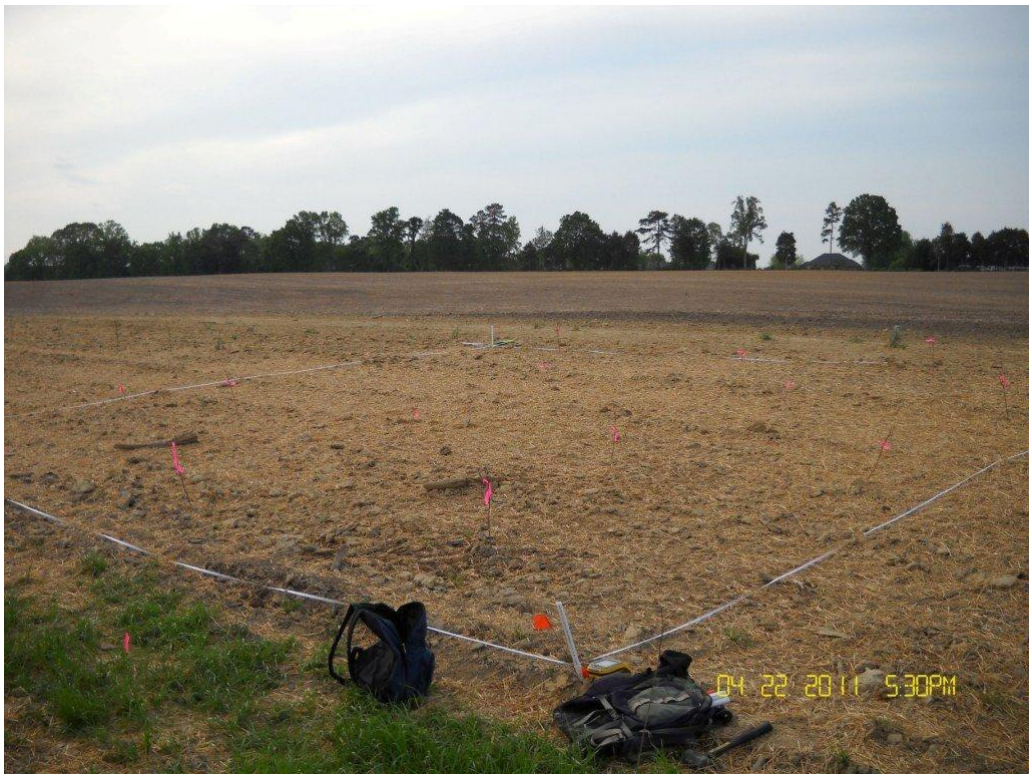
Veg Plot 6

Veg Plot 7

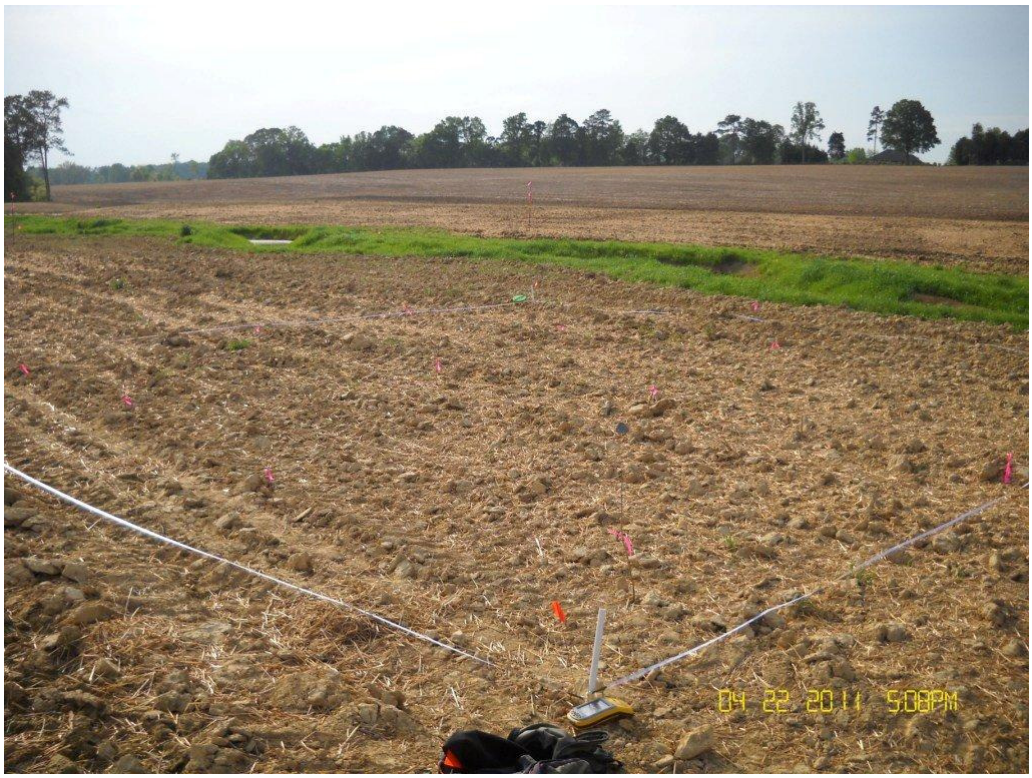
Veg Plot 8

Veg Plot 9

Veg Plot 10



Veg Plot 11



Veg Plot 12

Veg Plot 13

Table 7. Planted and Total Stem Counts (Species by Plot with Annual Means)

EEP Project Code 4143. Project Name: Newtown Stream and Wetland Restoration

Current Plot Data (MY0 2011)

Scientific Name	Common Name	Species Type	4143-01-0001			4143-01-0002			4143-01-0003			4143-01-0004			4143-01-0005			4143-01-0006			4143-01-0007		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba	pawpaw	Shrub Tree				1		1										1	1	1	6	6	6
Betula nigra	river birch	Tree	7	7	7	3	3	3	6	6	6							3	3	3	1	1	1
Carpinus caroliniana	American hornbeam	Shrub Tree										2	2	2							1	1	1
Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	Shrub Tree										3	3	3									
Carya	hickory	Tree																					
Celtis laevigata	sugarberry	Shrub Tree																1	1	1			
Cornus amomum	silky dogwood	Shrub																					
Diospyros virginiana	common persimmon	Tree	3	3	3	2	2	2				6	6	6									
Fraxinus pennsylvanica	green ash	Tree							2	2	2							5	5	5	3	3	3
Platanus occidentalis	American sycamore	Tree				5	5	5				2	2	2									
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree													16	16	16				1	1	1
Quercus	oak	Shrub Tree	3	3	3	10	10	10	6	6	6	6	6	6	5	5	5	2	2	2	1	1	1
Quercus michauxii	swamp chestnut oak	Tree	1	1	1																		
Unknown	unknown								6	6	6							1	1	1			
	Stem count		14	14	14	21	21	21	20	20	20	19	19	19	21	21	21	13	13	13	13	13	13
	size (ares)		1			1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		4	4	4	5	5	5	4	4	4	5	5	5	2	2	2	6	6	6	6	6	6
	Stems per ACRE		566.6	566.6	566.6	849.8	849.8	849.8	809.4	809.4	809.4	768.9	768.9	768.9	849.8	849.8	849.8	526.1	526.1	526.1	526.1	526.1	526.1

Current Plot Data (MY0 2011)

Scientific Name	Common Name	Species Type	4143-01-0008			4143-01-0009			4143-01-0010			4143-01-0011			4143-01-0012			4143-01-0013			Annual Means MY0 (2011)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba	pawpaw	Shrub Tree	8	8	8																16	16	16
Betula nigra	river birch	Tree										3	3	3				1	1	1	24	24	24
Carpinus caroliniana	American hornbeam	Shrub Tree																			2	2	2
Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	Shrub Tree							1	1	1	1	1	1							6	6	6
Carya	hickory	Tree													2	2	2				2	2	2
Celtis laevigata	sugarberry	Shrub Tree										2	2	2	1	1	1	1	1	1	5	5	5
Cornus amomum	silky dogwood	Shrub										2	2	2				1	1	1	3	3	3
Diospyros virginiana	common persimmon	Tree				1	1	1	4	4	4	1	1	1	2	2	2	7	7	7	26	26	26
Fraxinus pennsylvanica	green ash	Tree	1	1	1	3	3	3	2	2	2				2	2	2	2	2	2	20	20	20
Platanus occidentalis	American sycamore	Tree																			7	7	7
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree	2	2	2	2	2	2													21	21	21
Quercus	oak	Shrub Tree	2	2	2	8	8	8	6	6	6	6	6	6	7	7	7	3	3	3	65	65	65
Quercus michauxii	swamp chestnut oak	Tree																			1	1	1
Unknown	unknown		1	1	1				2	2	2										10	10	10
	Stem count		14	14	14	14	14	14	15	15	15	15	15	15	14	14	14	15	15	15	208	208	208
	size (ares)		1			1			1			1			1			1			13		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.32		
	Species count		5	5	5	4	4	4	5	5	5	6	6	6	5	5	5	6	6	6	14	14	14
	Stems per ACRE		566.6	566.6	566.6	566.6	566.6	566.6	607	607	607	607	607	607	566.6	566.6	566.6	607	607	607	647.5	647.5	647.5

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

CVS Metadata

Report Prepared By	Chris Sheats
Date Prepared	5/11/2011 17:19

database name	TheCatenaGroup-2011-A-Newtownbaseline.mdb
database location	C:\Users\csheats\Desktop
computer name	CHRIS-PC
file size	37355520

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

- **Metadata** Description of database file, the report worksheets, and a summary of project(s) and project data.
- **Proj, planted** Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
- **Proj, total stems** Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
- **Plots** List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
- **Vigor** Frequency distribution of vigor classes for stems for all plots.
- **Vigor by Spp** Frequency distribution of vigor classes listed by species.
- **Damage** List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
- **Damage by Spp** Damage values tallied by type for each species.
- **Damage by Plot** Damage values tallied by type for each plot.
- **Planted Stems by Plot and Spp** A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	4143
project Name	Newtown Stream and Wetland Restoration
Description	Underwood Creek Stream Restoration in Union County southwest of Monroe, NC.
River Basin	Catawba
length(ft)	5317
stream-to-edge width (ft)	50
area (sq m)	49391.55
Required Plots (calculated)	13
Sampled Plots	13

CVS Proj, planted

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 0 (baseline)
4143	Newtown Stream and Wetland Restoration	Catawba	647.50

CVS Proj, total stems

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code	Project Name	River Basin	Year 0 (baseline)
4143	Newtown Stream and Wetland Restoration	Catawba	647.4970288

CVS Vigor

vigor	Count	Percent
3	208	100

CVS Vigor by Spp

	Species	CommonName	4	3	2	1	0	Missing	Unk.
	Asimina triloba	pawpaw		16					
	Betula nigra	river birch		24					
	Carpinus caroliniana var. caroliniana	Coastal American Hornbeam		6					
	Celtis laevigata	sugarberry		5					
	Cornus amomum	silky dogwood		3					
	Diospyros virginiana	common persimmon		26					
	Fraxinus pennsylvanica	green ash		20					
	Platanus occidentalis var. occidentalis	Sycamore, Plane-tree		21					
	Quercus michauxii	swamp chestnut oak		1					
	Carpinus caroliniana	American hornbeam		2					
	Quercus	oak		65					
	Carya	hickory		2					
	Platanus occidentalis	American sycamore		7					
	Unknown			10					
TOT:	**14**	**13**		**208**					

CVS Damage

Damage	Count	Percent Of Stems
(no damage)	208	100

CVS Damage by Spp

	Species	CommonName	Count of Damage Categories	(other damage)
	Asimina triloba	pawpaw	0	16
	Betula nigra	river birch	0	24
	Carpinus caroliniana	American hornbeam	0	2
	Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	0	6
	Carya	hickory	0	2
	Celtis laevigata	sugarberry	0	5
	Cornus amomum	silky dogwood	0	3
	Diospyros virginiana	common persimmon	0	26
	Fraxinus pennsylvanica	green ash	0	20
	Platanus occidentalis	American sycamore	0	7
	Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	0	21
	Quercus	oak	0	65
	Quercus michauxii	swamp chestnut oak	0	1
	Unknown		0	10
TOT:	**14**	**13**	**0**	**208**

CVS Damage by Plot

	plot	Count of Damage Categories	(other damage)
	4143-01-0001	0	14
	4143-01-0002	0	21
	4143-01-0003	0	20
	4143-01-0004	0	19
	4143-01-0005	0	21
	4143-01-0006	0	13
	4143-01-0007	0	13
	4143-01-0008	0	14
	4143-01-0009	0	14
	4143-01-0010	0	15
	4143-01-0011	0	15
	4143-01-0012	0	14
	4143-01-0013	0	15
TOT:	**13**	**0**	**208**

CVS Planted Stems by Plot and Spp

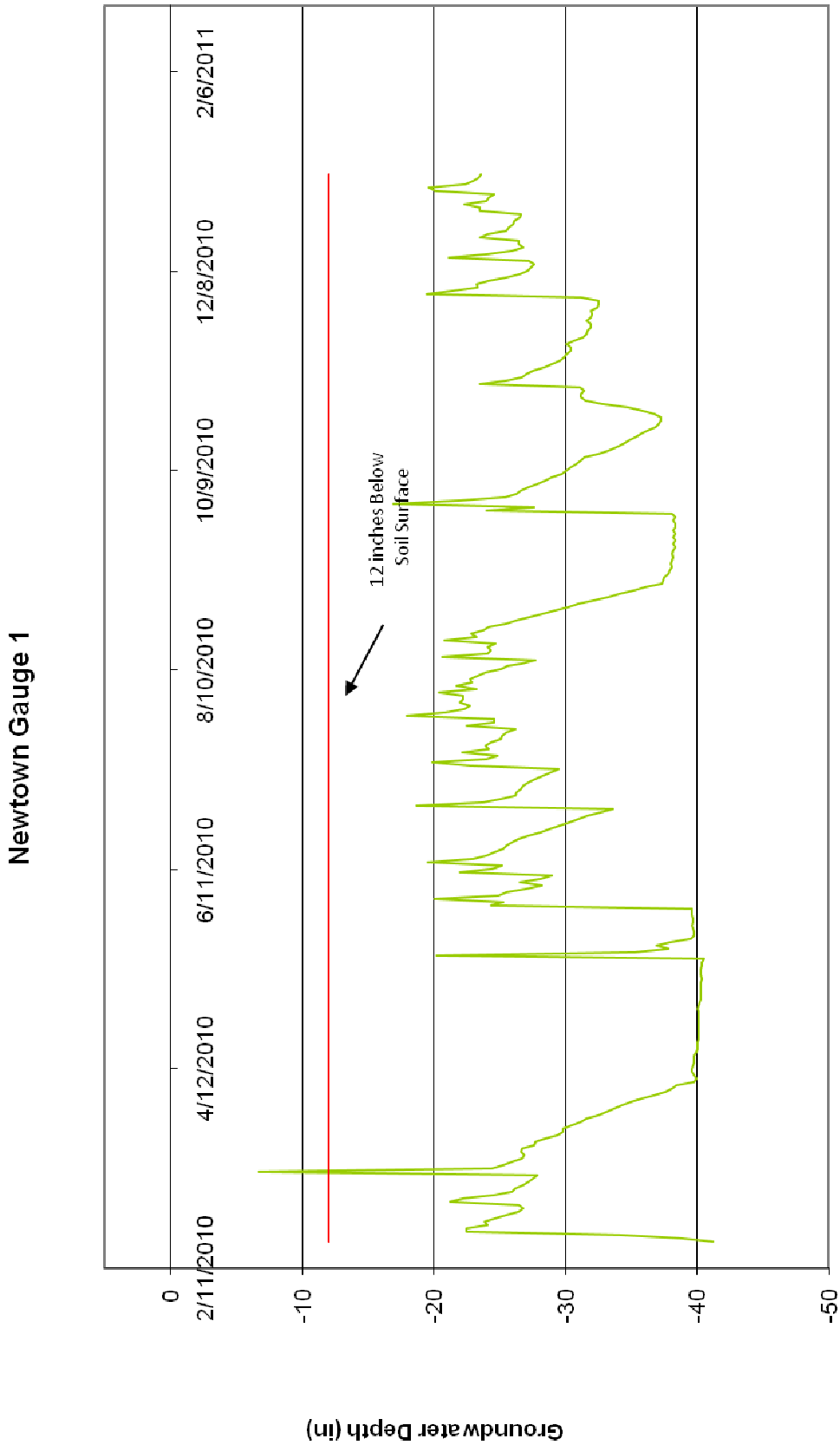
	Comment	Species	CommonName	Total Planted Stems	# plots	avg# stems	plot 4143-01-0001	plot 4143-01-0002	plot 4143-01-0003	plot 4143-01-0004	plot 4143-01-0005
		Asimina triloba	pawpaw	16	4	4		1			
		Betula nigra	river birch	24	7	3.43	7	3	6		
		Carpinus caroliniana	American hornbeam	2	1	2				2	
		Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	6	4	1.5				3	
		Carya	hickory	2	1	2					
		Celtis laevigata	sugarberry	5	4	1.25					
		Cornus amomum	silky dogwood	3	2	1.5					
		Diospyros virginiana	common persimmon	26	8	3.25	3	2		6	
		Fraxinus pennsylvanica	green ash	20	8	2.5			2		
		Platanus occidentalis	American sycamore	7	2	3.5		5		2	
		Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	21	4	5.25					16
		Quercus	oak	65	13	5	3	10	6	6	5
		Quercus michauxii	swamp chestnut oak	1	1	1	1				
		Unknown		10	4	2.5			6		
TOT:	**0**	**14**	**13**	**208**	**14**		**14**	**21**	**20**	**19**	**21**

CVS Plots

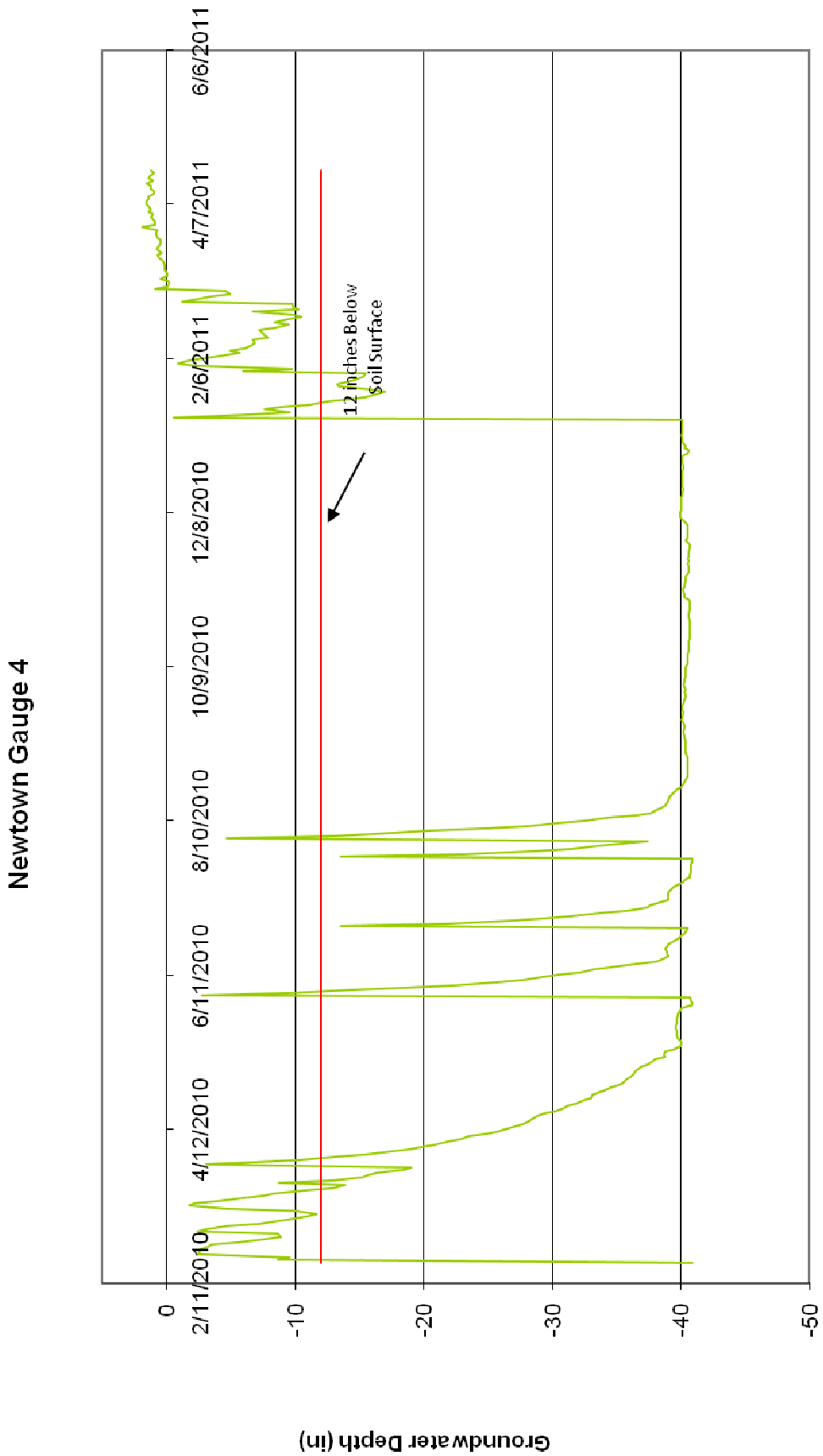
plot	Plot Level	Year	Latitude/ Northing	Longitude/ Easting	Zone	Datum	Date Sampled	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes
4143-01-0001	1	0	34.9716	-80.6453		NAD83/WGS84	4/21/2011	14	14	0	0	14	14
4143-01-0010	1	0	34.9710	-80.6399	17	NAD83/WGS84	4/21/2011	15	15	0	0	15	15
4143-01-0011	1	0	34.9714	-80.6392	17	NAD83/WGS84	4/21/2011	15	15	0	0	15	15
4143-01-0012	1	0	34.9713	-80.6384	17	NAD83/WGS84	4/21/2011	14	14	0	0	14	14
4143-01-0013	1	0	34.9715	-80.6375	17	NAD83/WGS84	4/21/2011	15	15	0	0	15	15
4143-01-0002	1	0	34.9710	-80.6461	17	NAD83/WGS84	4/21/2011	21	21	0	0	21	21
4143-01-0003	1	0	34.9702	-80.6464	17	NAD83/WGS84	4/21/2011	20	20	0	0	20	20
4143-01-0004	1	0	34.9696	-80.6463	17	NAD83/WGS84	4/21/2011	19	19	0	0	19	19
4143-01-0005	1	0	34.9702	-80.6455	17	NAD83/WGS84	4/21/2011	21	21	0	0	21	21
4143-01-0006	1	0	34.9704	-80.6439	17	NAD83/WGS84	4/21/2011	13	13	0	0	13	13
4143-01-0007	1	0	34.9703	-80.6429	17	NAD83/WGS84	4/21/2011	13	13	0	0	13	13
4143-01-0008	1	0	34.9705	-80.6421	17	NAD83/WGS84	4/21/2011	14	14	0	0	14	14
4143-01-0009	1	0	34.9708	-80.6406	17	NAD83/WGS84	4/21/2011	14	14	0	0	14	14

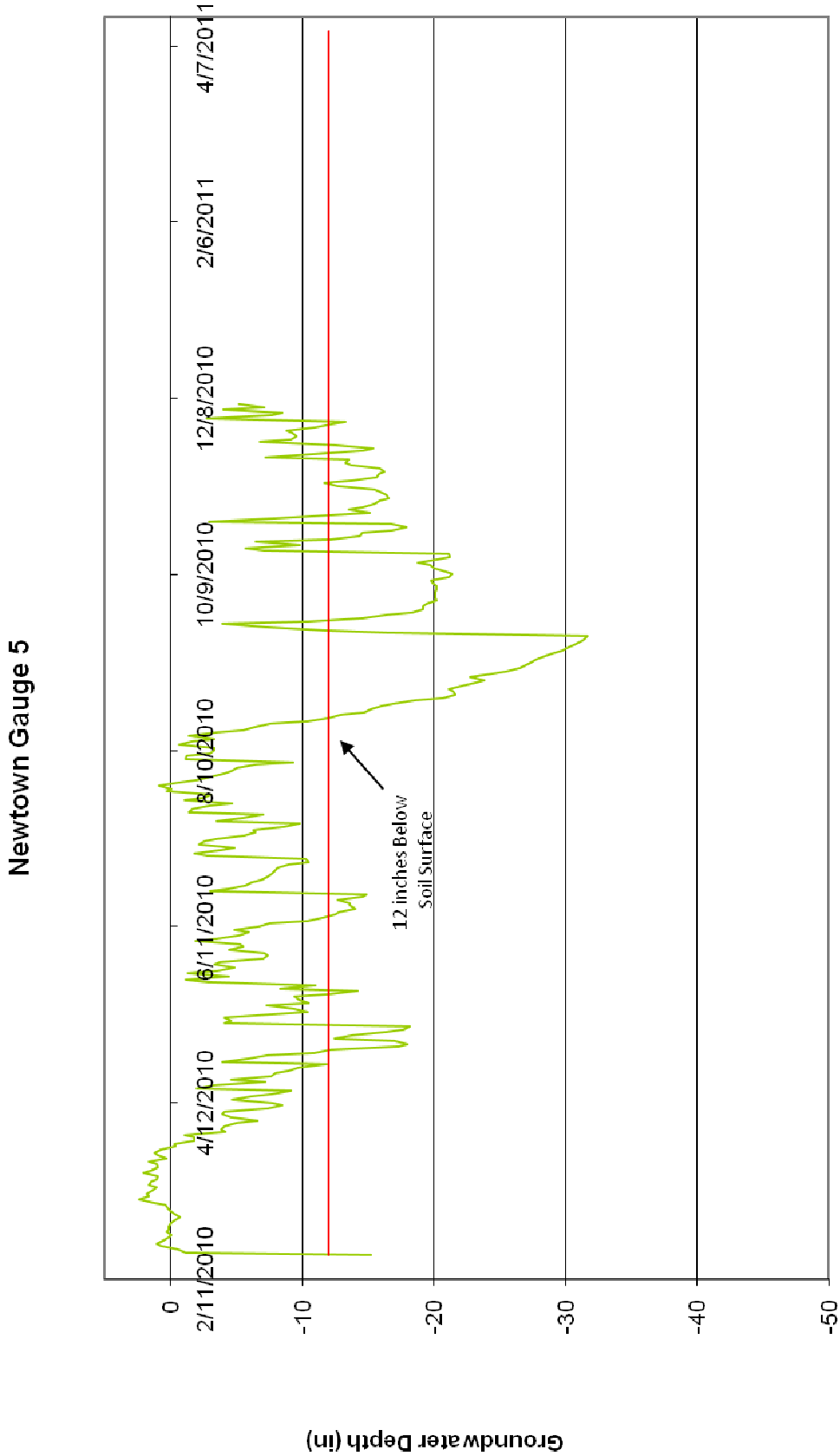
plot	Plot Level	Year	Latitude/ Northing	Longitude/E asting	Zone	Datum	Date Sampled	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
4143-01-0001	1	0	34.9716	-80.6453		NAD83/WGS84	4/21/2011	566.5599002	566.5599002	0	566.5599002	566.5599002	4
4143-01-0010	1	0	34.9710	-80.6399	17	NAD83/WGS84	4/21/2011	607.0284645	607.0284645	0	607.0284645	607.0284645	5
4143-01-0011	1	0	34.9714	-80.6392	17	NAD83/WGS84	4/21/2011	607.0284645	607.0284645	0	607.0284645	607.0284645	6
4143-01-0012	1	0	34.9713	-80.6384	17	NAD83/WGS84	4/21/2011	566.5599002	566.5599002	0	566.5599002	566.5599002	5
4143-01-0013	1	0	34.9715	-80.6375	17	NAD83/WGS84	4/21/2011	607.0284645	607.0284645	0	607.0284645	607.0284645	6
4143-01-0002	1	0	34.9710	-80.6461	17	NAD83/WGS84	4/21/2011	849.8398503	849.8398503	0	849.8398503	849.8398503	5
4143-01-0003	1	0	34.9702	-80.6464	17	NAD83/WGS84	4/21/2011	809.371286	809.371286	0	809.371286	809.371286	4
4143-01-0004	1	0	34.9696	-80.6463	17	NAD83/WGS84	4/21/2011	768.9027217	768.9027217	0	768.9027217	768.9027217	5
4143-01-0005	1	0	34.9702	-80.6455	17	NAD83/WGS84	4/21/2011	849.8398503	849.8398503	0	849.8398503	849.8398503	2
4143-01-0006	1	0	34.9704	-80.6439	17	NAD83/WGS84	4/21/2011	526.0913359	526.0913359	0	526.0913359	526.0913359	6
4143-01-0007	1	0	34.9703	-80.6429	17	NAD83/WGS84	4/21/2011	526.0913359	526.0913359	0	526.0913359	526.0913359	6
4143-01-0008	1	0	34.9705	-80.6421	17	NAD83/WGS84	4/21/2011	566.5599002	566.5599002	0	566.5599002	566.5599002	5
4143-01-0009	1	0	34.9708	-80.6406	17	NAD83/WGS84	4/21/2011	566.5599002	566.5599002	0	566.5599002	566.5599002	4

Appendix D. Goundwater Gauge Charts


Newtown Gauge 1
12 inches Below Soil Surface
2/11/2010
4/12/2010
6/11/2010
8/10/2010
10/9/2010
12/8/2010
2/6/2011
0
-10
-20
-30
-40
-50
Groundwater Depth (in)


Newtown Gauge 2
12 inches Below Soil Surface
Groundwater Depth (in)
0
-10
-20
-30
-40
-50
2/11/2010
4/12/2010
6/11/2010
8/10/2010
10/9/2010
12/8/2010
2/6/2011

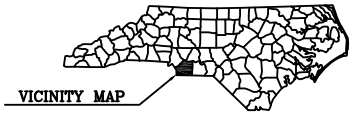

Newtown Gauge 4
Groundwater Depth (in)
0
-10
-20
-30
-40
-50
2/11/2010
4/12/2010
6/11/2010
8/10/2010
10/9/2010
12/8/2010
2/6/2011
4/7/2011
6/6/2011
12 Inches Below Soil Surface

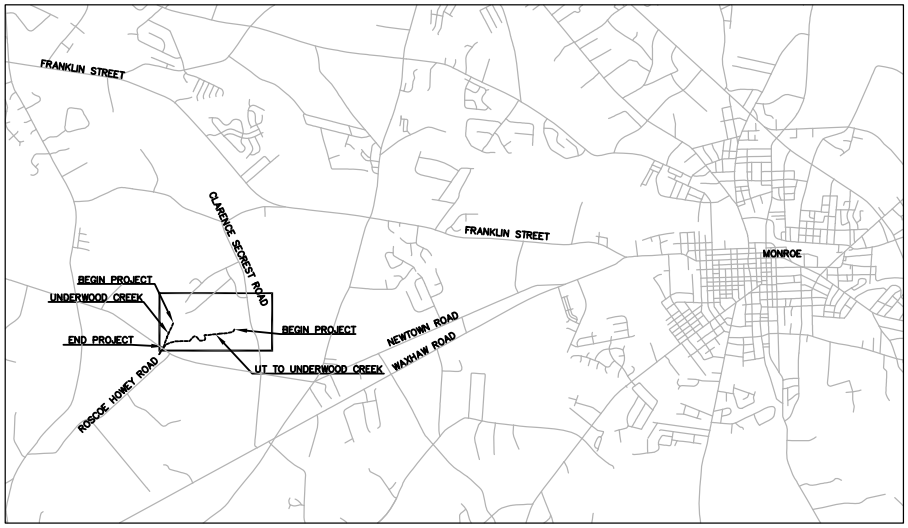

Newtown Gauge 5
Groundwater Depth (in)
0
-10
-20
-30
-40
-50
2/11/2010
4/12/2010
6/11/2010
8/10/2010
10/9/2010
12/8/2010
2/6/2011
4/7/2011
12 inches Below Soil Surface


Newtown Gauge 6
Groundwater Depth (in)
0
-10
-20
-30
-40
-50
2/11/2010
4/12/2010
6/11/2010
8/10/2010
10/9/2010
12/8/2010
2/6/2011
4/7/2011
6/6/2011
12 inches Below Soil Surface

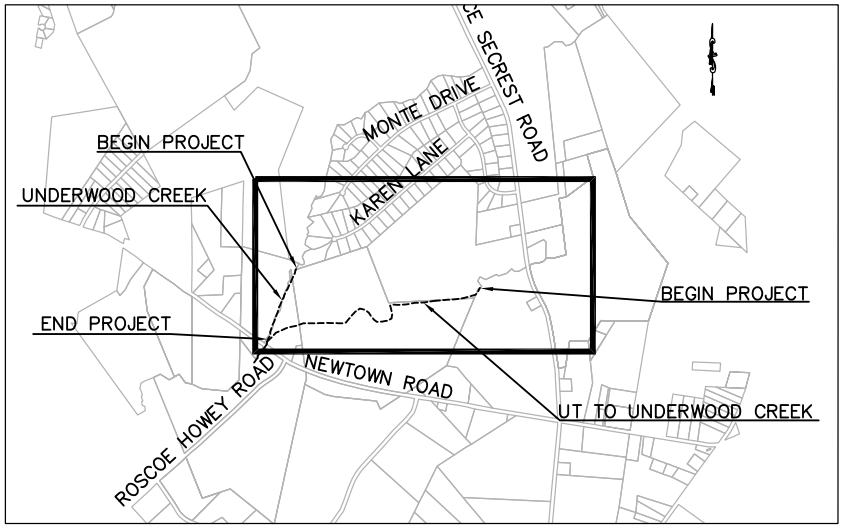
Appendix E. Record Drawings

RECORD DRAWINGS FOR
NEWTOWN
STREAM AND WETLAND RESTORATION PROJECT
UNION COUNTY, NORTH CAROLINA
STATE CONTRACT NO:002025
RFP 16-001117





VICINITY MAP



LOCATION MAP

INDEX OF SHEETS

SHEET NO.	DESCRIPTION
T1	TITLE SHEET
L1	LEGENDS SYMBOLS AND SHEET KEY
TCS1	TYPICAL CONSTRUCTED CROSS SECTIONS
PLN1-PLN2	STREAM PLAN UNDERWOOD CREEK
PLN3-PLN6	STREAM PLAN UT TO UNDERWOOD CREEK
PRO1	PROFILE UNDERWOOD CREEK
PRO2-PRO3	PROFILES UT TO UNDERWOOD CREEK
PRO4	PROFILE TABLES
VP1	PLANT QUANTITIES
VP2	PLANTING PLAN LEGENDS AND KEY
VP3-VP8	PLANTING PLAN
ABF1-ABF5	UNDERWOOD CREEK FEMA AS-BUILT SURVEY AND CROSS SECTIONS

SURVEY DATA PROVIDED BY: R.B. Pharr & Associates
420 Hawthorne Lane
Charlotte NC 28204
PHONE: 704-376-2186
FAX: 704-333-8724

NATURAL SYSTEMS INVESTIGATION:

The Catena Group Inc.
410-B Millstone Drive
Hillsborough, NC 27278
PH: 919-732-1300
FAX: 919-732-1303

NCEEP CONTACT: GUY PEARCE (919) 715-1656
WARD CONSULTING ENGINEERS CONTACT: BECKY WARD, PE (919) 870-0526
ENVIRONMENTAL BANC AND EXCHANGE CONTACT: NORTON WEBSTER (919) 829-9909

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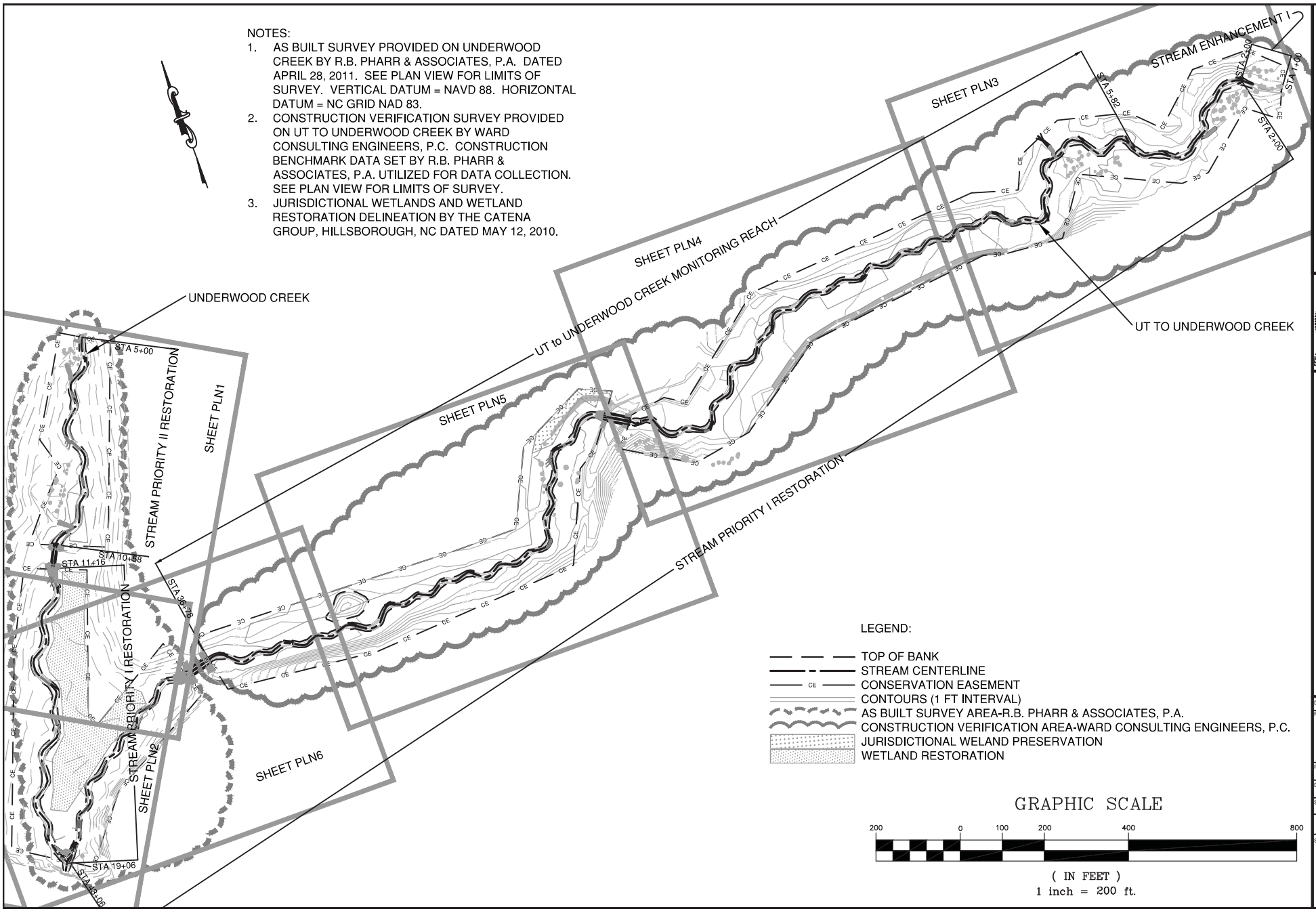
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 229-9913

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 1344 BECKY LYNN WARD

NEWTOWN
TITLE SHEET
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: Newtown Creek
DWG NAME: Construction Cover Sheet
SCALE: NTS
RECORD DRAWINGS
SHEET NO.

T1



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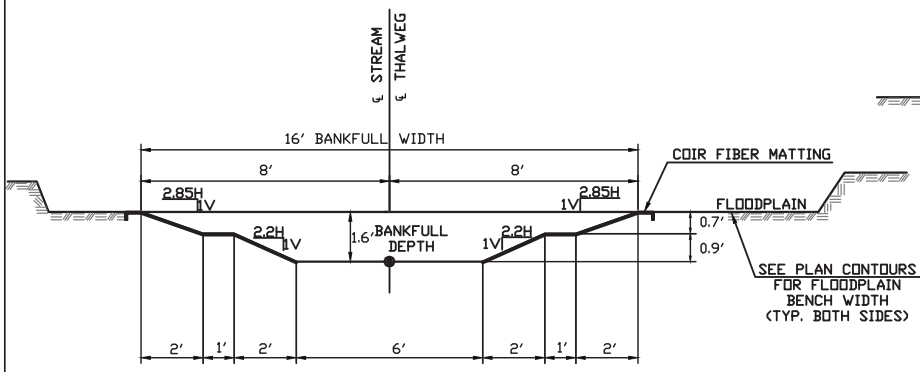
SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 15344 BECKY L'NINE WARD

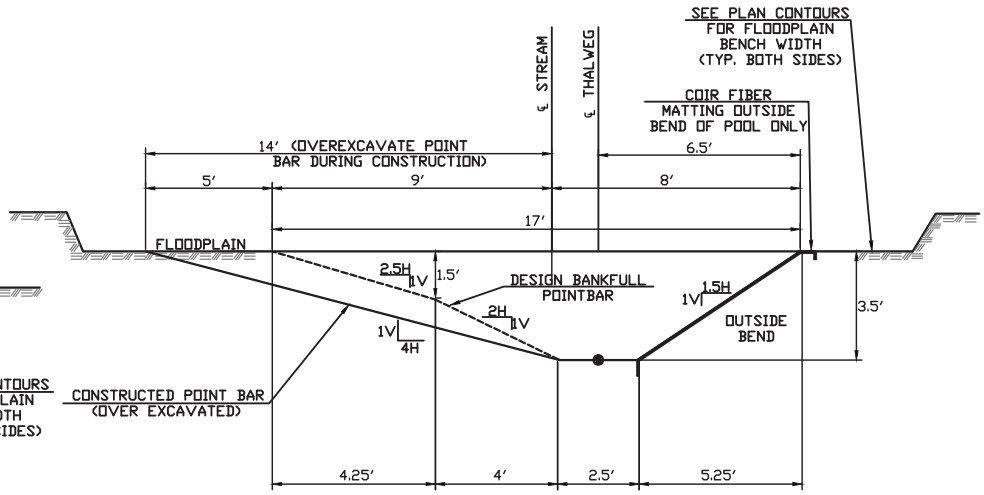
NEWTOWN
LEGENDS, SYMBOLS AND SHEET KEY
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: AS-BUILT
SCALE: 1" = 200
RECORD DRAWINGS
SHEET NO.
L1

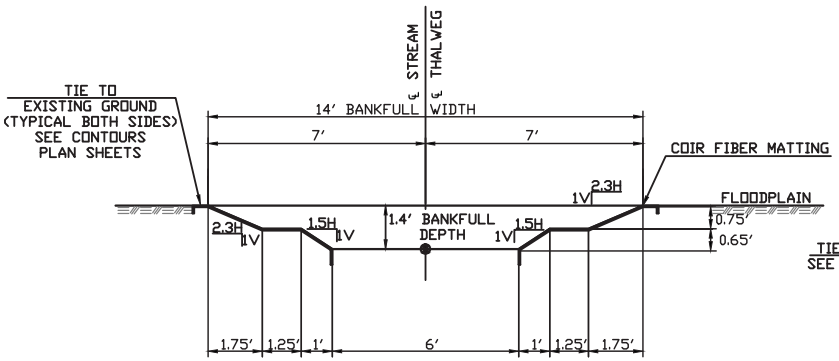
NOTES:
1. POOLS TO BE EXCAVATED BYCONTRACTOR ONE FOOT DEEPER TO ALLOW FOR SEDIMENTATION.
2. CONTRACTOR TO PROVIDE A SMOOTH TRANSITION BETWEEN THE RIFFLE AND POOL SECTIONS SHOWN BELOW.
3. ℄ CENTER LINE THALWEG. SEE STAKING PLAN SHEETS(SP) FOR VERTICAL ELEVATIONS AND HORIZONTAL LAYOUTS.
4. ℄ OF STREAM FOR HORIZONTAL LAYOUT AND ℄ OF THALWEG ARE AT DIFFERENT LOCATIONS IN POOL SECTIONS.
5. USE 700 GRAM COIR FIBER MATTING BLANKET WESTERN EXCELSIOR CORPORATION COIR MAT 700 OR APPROVED EQUAL.



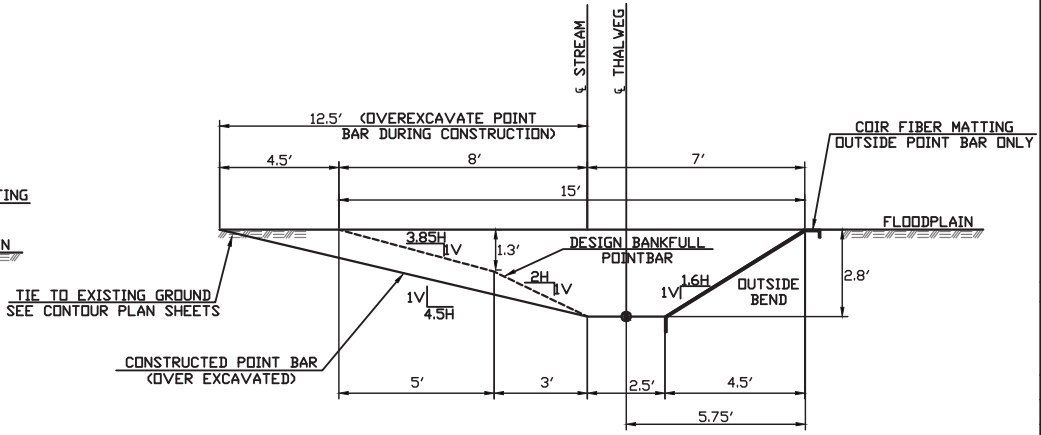
1 PROPOSED RIFFLE SECTION (UNDERWOOD CREEK)
SCALE: NOT TO SCALE (PRIORITY TWO RESTORATION)



2 PROPOSED POOL SECTION (UNDERWOOD CREEK)
SCALE: NOT TO SCALE (PRIORITY TWO RESTORATION)



3 PROPOSED RIFFLE SECTION (UT-UNDERWOOD CREEK)
SCALE: NOT TO SCALE (PRIORITY ONE RESTORATION)



4 PROPOSED POOL SECTION (UT-UNDERWOOD CREEK)
SCALE: NOT TO SCALE (PRIORITY ONE RESTORATION)

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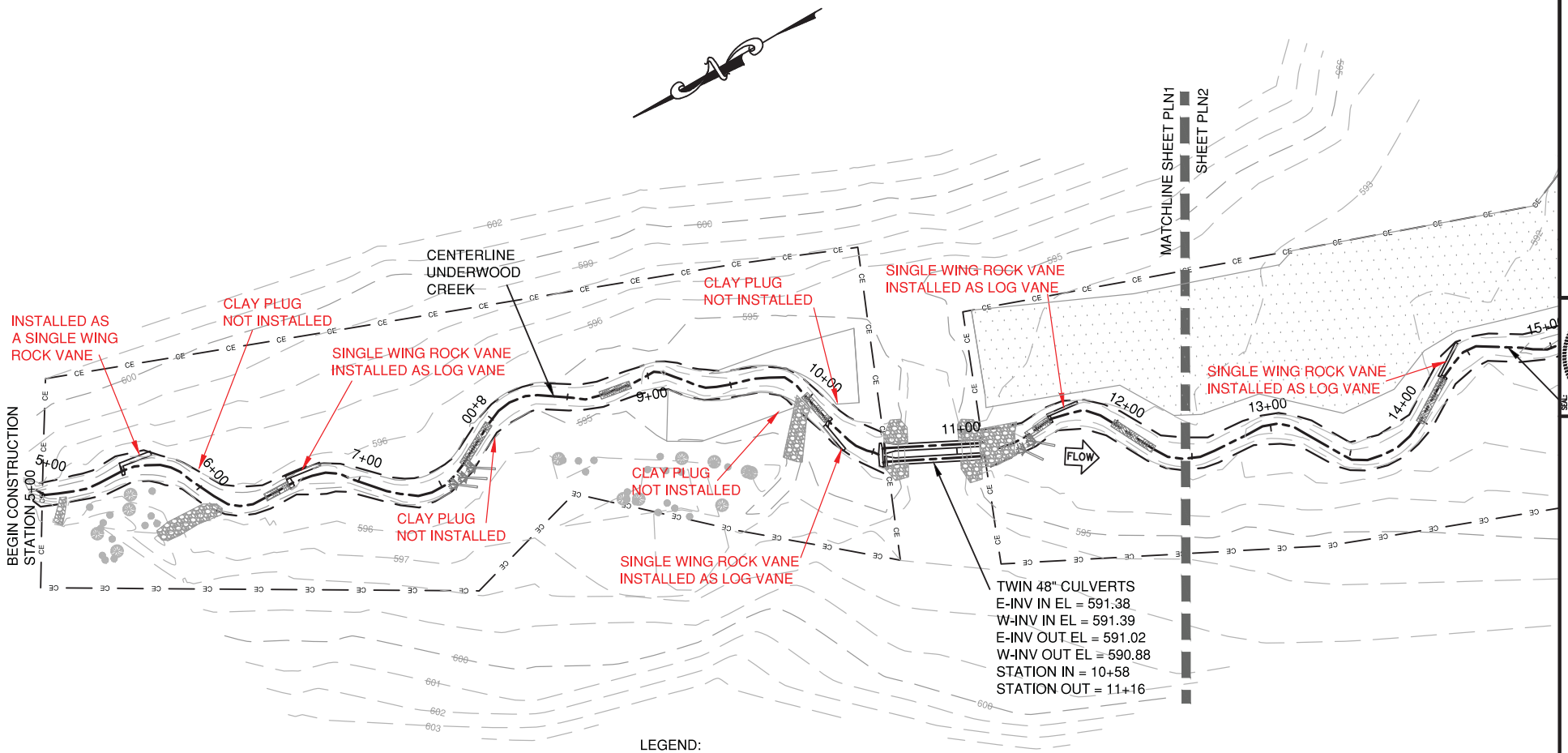
SEAL: NORTH CAROLINA PROFESSIONAL SEAL 13344 ENGINEER BECKY L. LYNNE

NEWTOWN
TYPICAL CONSTRUCTED CROSS SECTIONS WITH LEGENDS
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: Newtown Creek
DWG NAME: Typical Cross Sections
SCALE: NTS
RECORD DRAWINGS
SHEET NO.
TCS1



NOTE: ASBUILT SURVEY DATA THIS SHEET PROVIDED BY R.B. PHARR & ASSOCIATES, P.A.

LEGEND:

- AS-BUILT CONTOURS RBPA (1 FT INTERVALS)
- AS-BUILT TOP OF BANK
- AS-BUILT THALWEG
- DESIGN CENTERLINE STATIONING
- CONSERVATION EASEMENT
- WETLAND RESTORATION
- WETLAND PRESERVATION
- AS-BUILT STRUCTURE
- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT GRADE TRANSITION STRUCTURE
- ROOT WADS
- ROCK TOE
- BRUSH TOE
- EARTHEN BERM
- BRUSH WETLAND EDGE
- RIP RAP PROTECTION

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)
1 inch = 60 ft.

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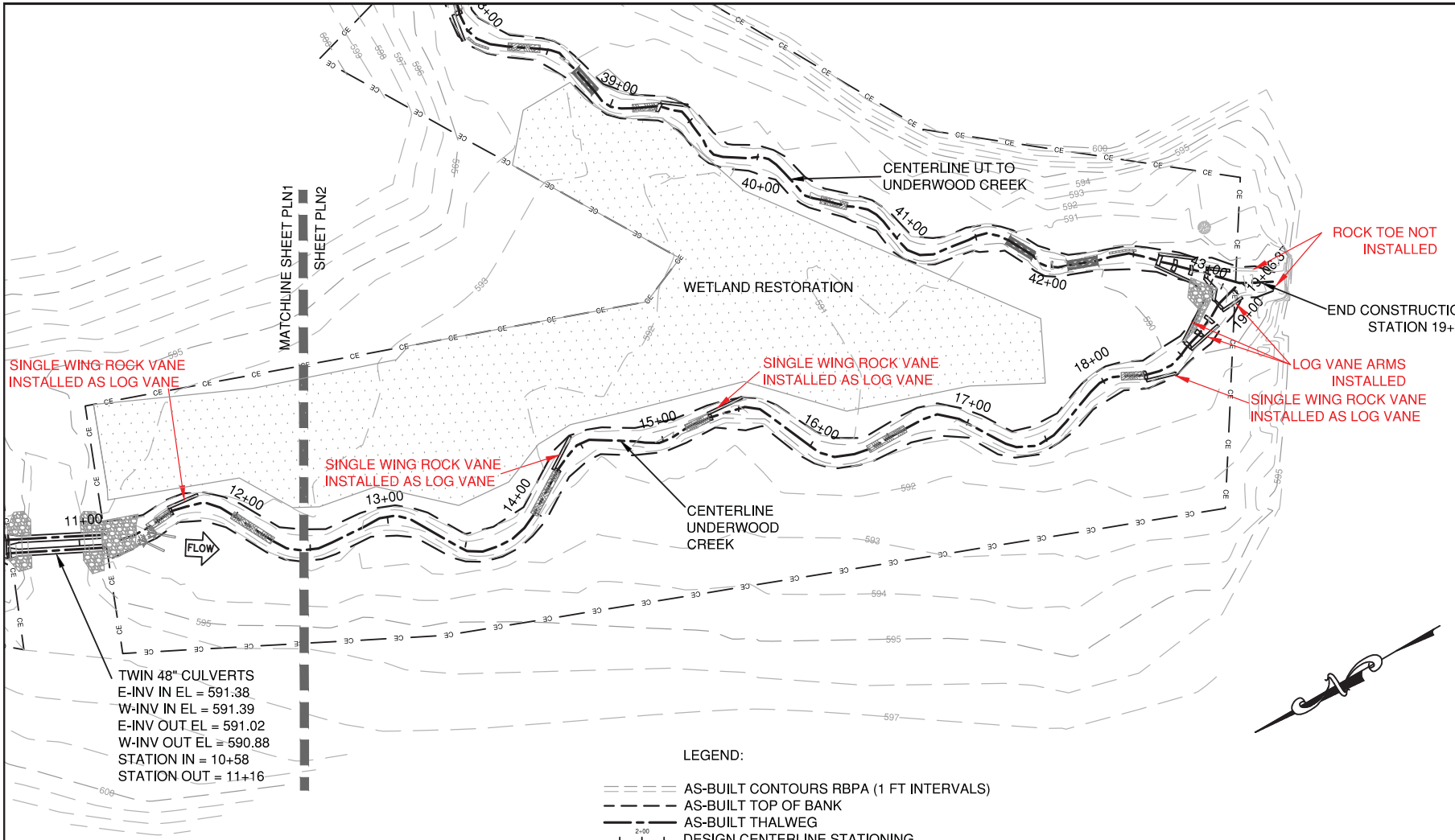
Fax: (919) 229-9913

NORTH CAROLINA PROFESSIONAL SEAL 13344 ENGINEER BECKY L'YNNE WARD

NEWTOWN
UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: AS-BUILT
SCALE: 1" = 60'
RECORD DRAWINGS
SHEET NO.
PLN1



LEGEND:

- AS-BUILT CONTOURS RBPA (1 FT INTERVALS)
- AS-BUILT TOP OF BANK
- AS-BUILT THALWEG
- DESIGN CENTERLINE STATIONING
- CONSERVATION EASEMENT
- WETLAND RESTORATION
- WETLAND PRESERVATION
- AS-BUILT STRUCTURE
- AS-BUILT CONSTRUCTED RIFFLE
- AS-BUILT GRADE TRANSITION STRUCTURE
- ROOT WADS
- ROCK TOE
- BRUSH TOE
- EARTHEN BERM
- BRUSH WETLAND EDGE
- RIP RAP PROTECTION

NOTE: ASBUILT SURVEY DATA THIS SHEET PROVIDED BY R.B. PHARR & ASSOCIATES, P.A.

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)
1 inch = 60 ft.

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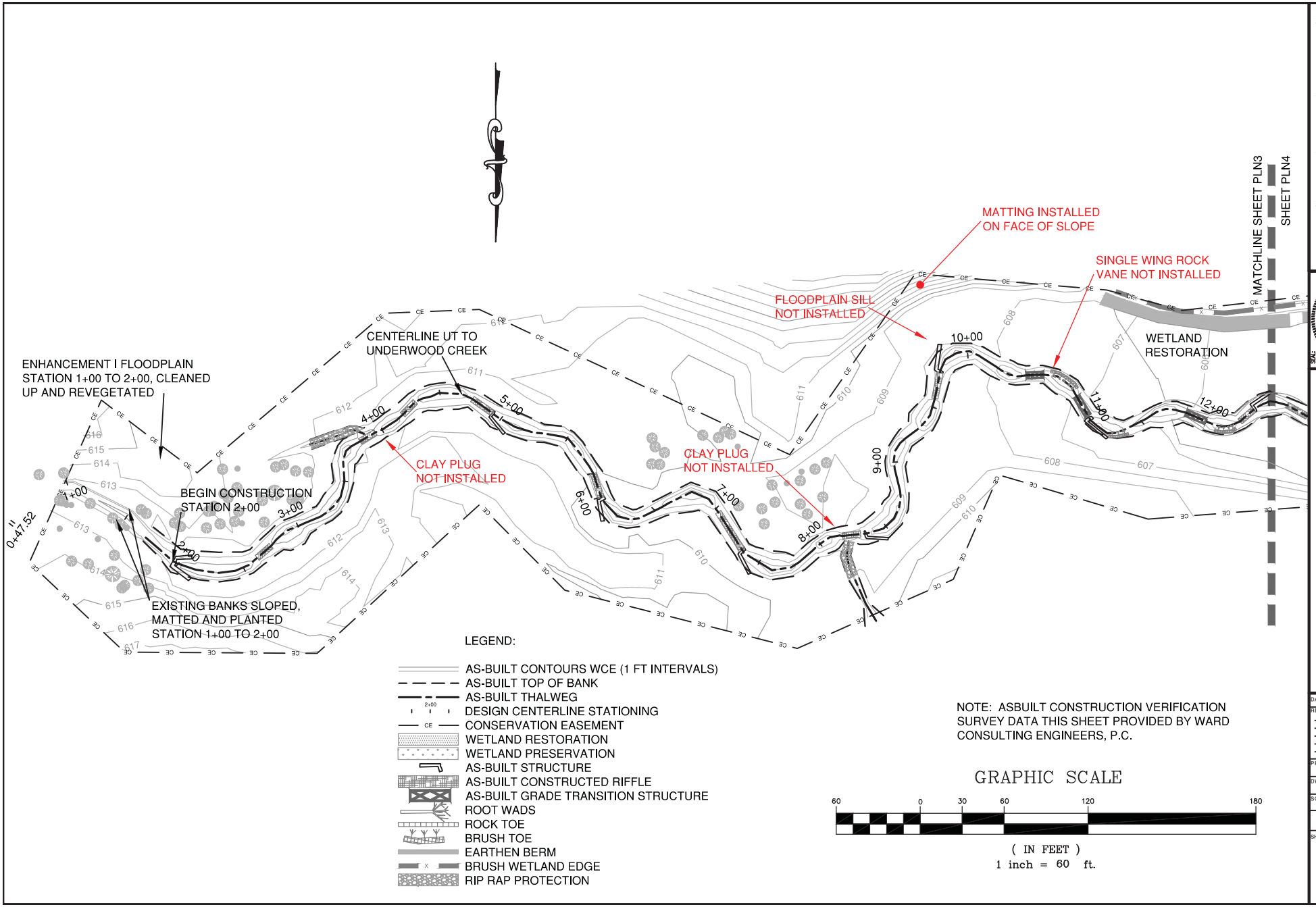
SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 15344 BECKY L'NINE

NEWTOWN
UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: AS-BUILT
SCALE: 1" = 60'
RECORD DRAWINGS
SHEET NO.

PLN2



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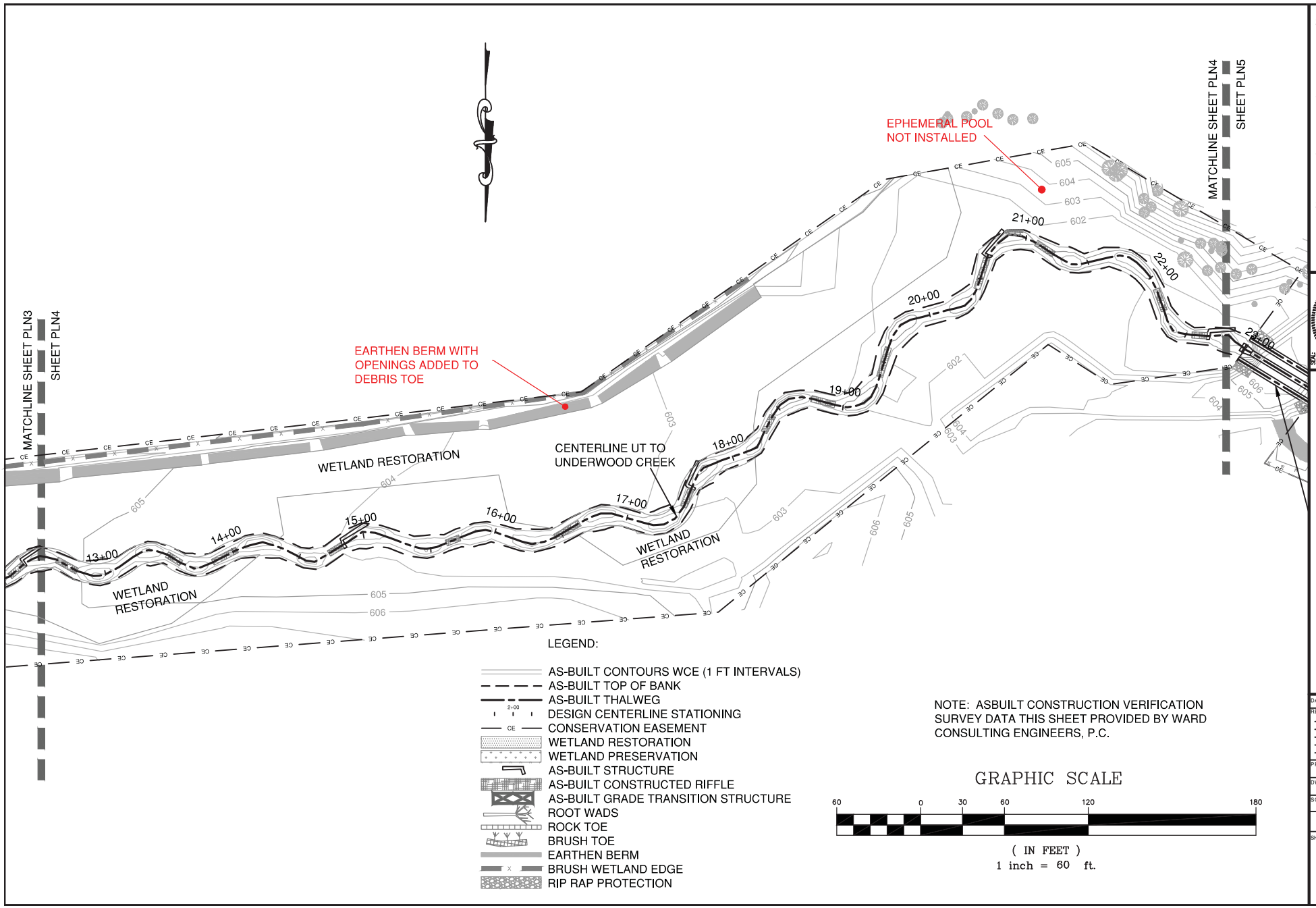
SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 15344 BECKY L'NINE

NEWTOWN
UT to UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: AS-BUILT
SCALE: 1" = 60'
RECORD DRAWINGS
SHEET NO.
PLN3



NOTE: ASBUILT CONSTRUCTION VERIFICATION SURVEY DATA THIS SHEET PROVIDED BY WARD CONSULTING ENGINEERS, P.C.

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)

1 inch = 60 ft.

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 15344 BECKY L'NINE

NEWTOWN
UT to UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011

REVISIONS:

PROJECT NAME: EBX NEWTOWN

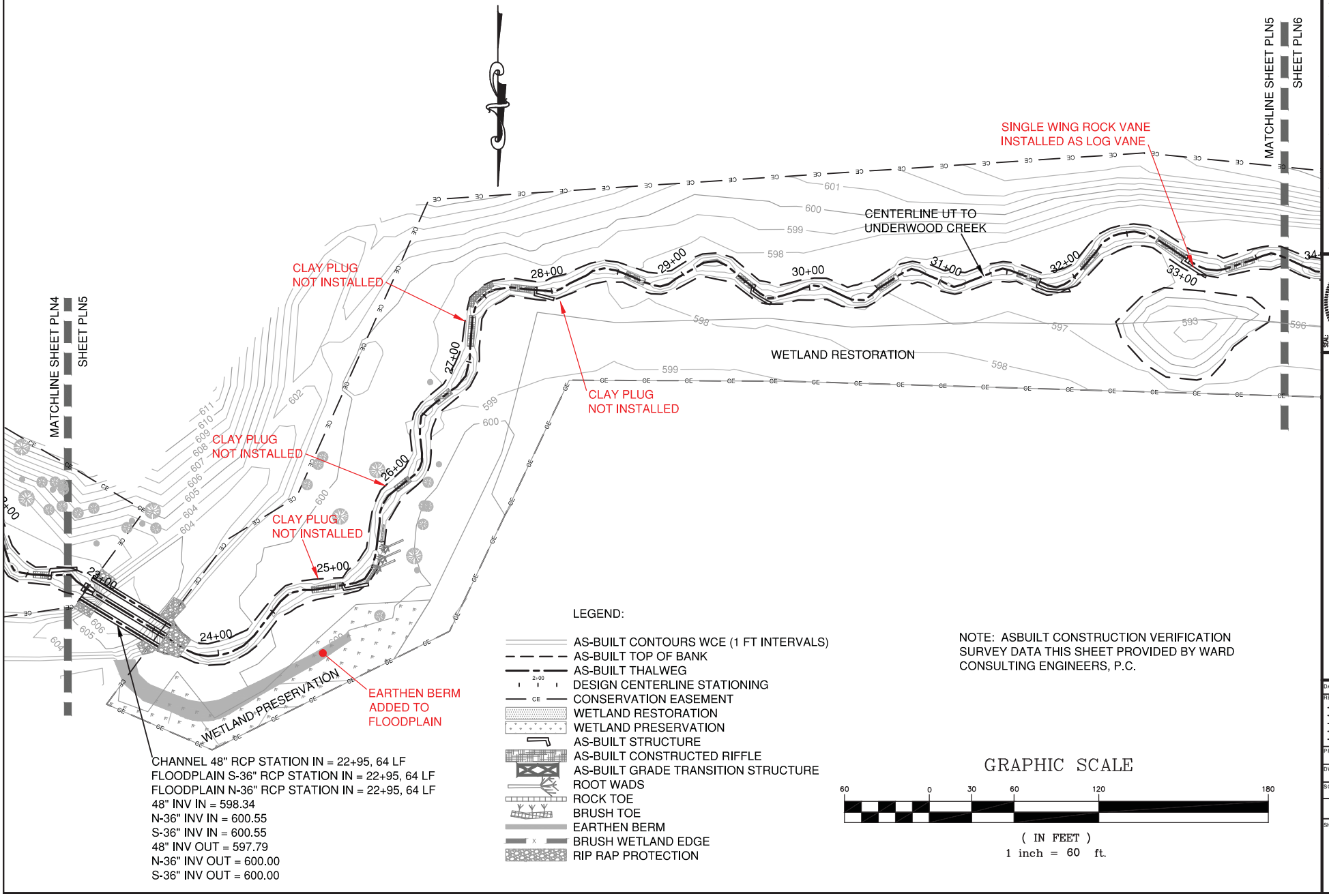
DWG NAME: AS-BUILT

SCALE: 1" = 60'

RECORD DRAWINGS

SHEET NO.

PLN4



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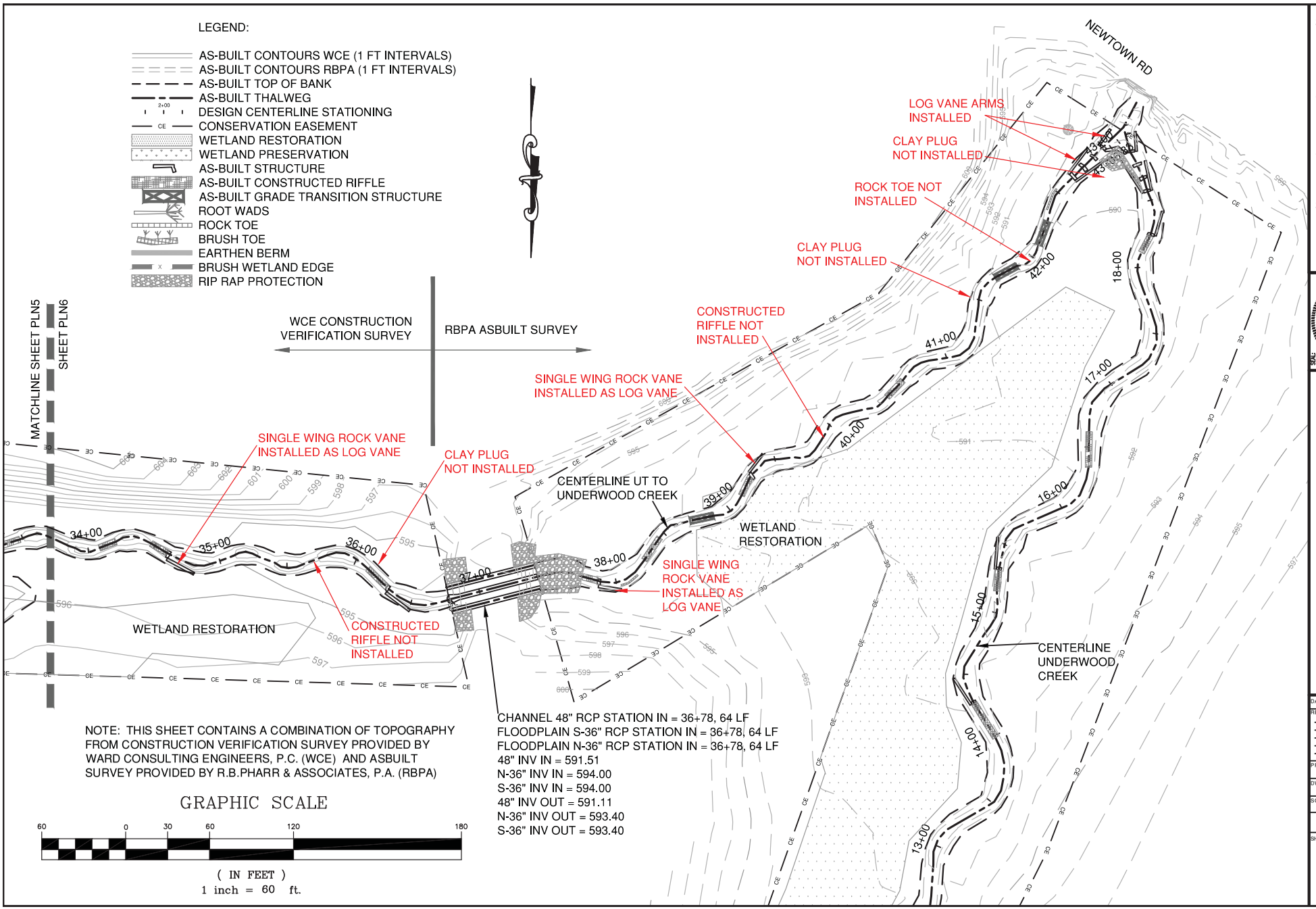
NORTH CAROLINA PROFESSIONAL SEAL 15344 ENGINEER BECKY L. NINO

NEWTOWN
UT to UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: AS-BUILT
SCALE: 1" = 60'
RECORD DRAWINGS
SHEET NO.
PLN5



NOTE: THIS SHEET CONTAINS A COMBINATION OF TOPOGRAPHY FROM CONSTRUCTION VERIFICATION SURVEY PROVIDED BY WARD CONSULTING ENGINEERS, P.C. (WCE) AND ASBUILT SURVEY PROVIDED BY R.B.PHARR & ASSOCIATES, P.A. (RBPA)

CHANNEL 48" RCP STATION IN = 36+78, 64 LF
FLOODPLAIN S-36" RCP STATION IN = 36+78, 64 LF
FLOODPLAIN N-36" RCP STATION IN = 36+78, 64 LF
48" INV IN = 591.51
N-36" INV IN = 594.00
S-36" INV IN = 594.00
48" INV OUT = 591.11
N-36" INV OUT = 593.40
S-36" INV OUT = 593.40

GRAPHIC SCALE

60 0 30 60 120 180

(IN FEET)
1 inch = 60 ft.

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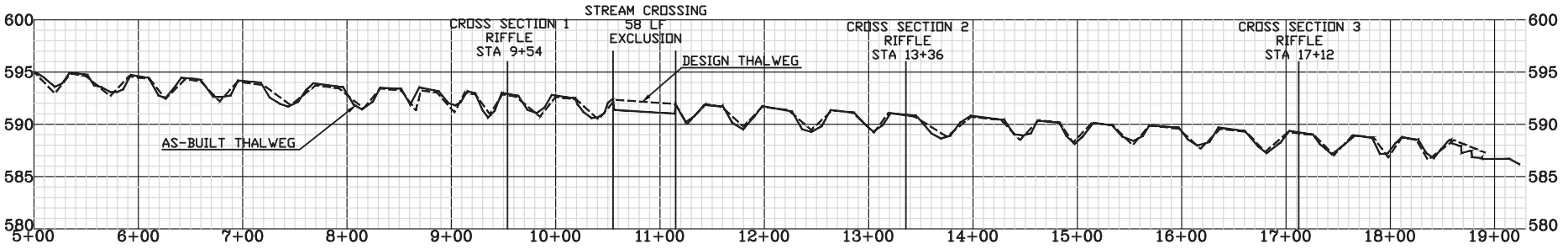
SEAL: NORTH CAROLINA PROFESSIONAL SEAL 13344 ENGINEER BECKY L'NINE

NEWTOWN UT to UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: AS-BUILT
SCALE: 1" = 60'
RECORD DRAWINGS
SHEET NO.
PLN6

AS-BUILT UNDERWOOD CREEK (NEWTOWN)
LONGITUDINAL PROFILE
MAIN CHANNEL



SCALE:
HORIZONTAL – 1" = 100'
VERTICAL – 1" = 10'

LEGEND
———AS-BUILT TW
------DESIGN TW

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

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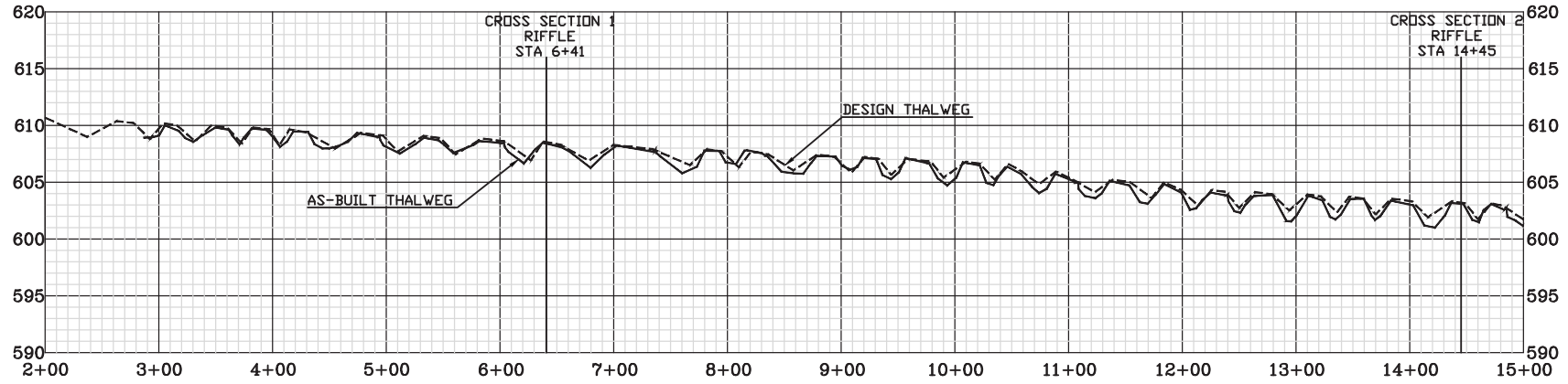
Ecosystem Enhancement Program

NEWTOWN
AS-BUILT PROFILE
UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: ASBUILT PROFILES
SCALE: 1" = 100
RECORD DRAWINGS
SHEET NO.

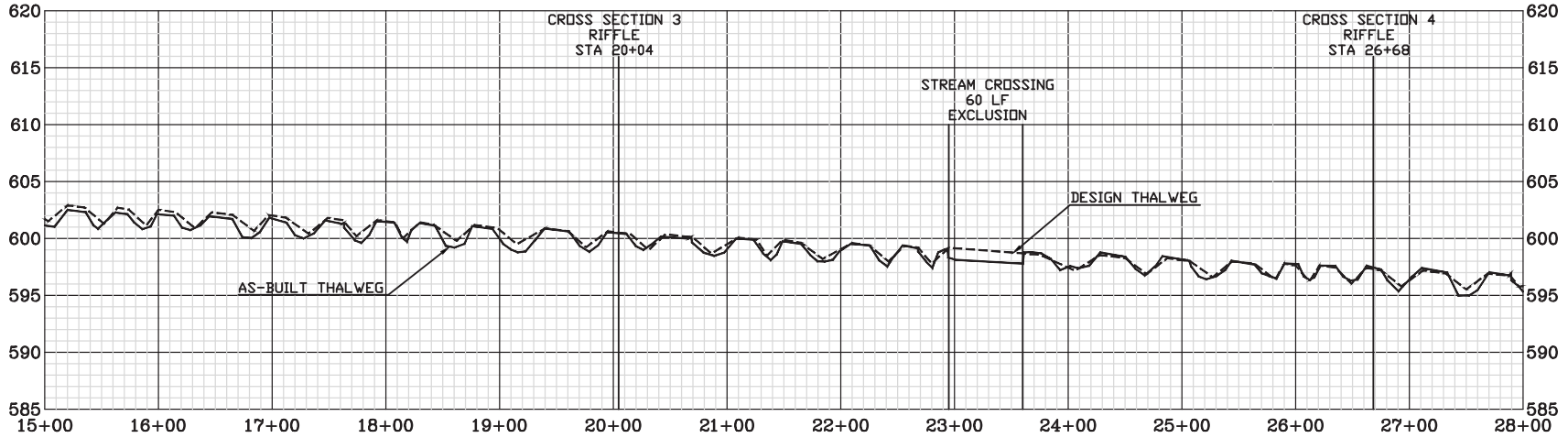
PRO1

AS-BUILT UT TO UNDERWOOD CREEK (NEWTOWN)
LONGITUDINAL PROFILE
TRIBUTARY CHANNEL



SCALE:
HORIZONTAL – 1" = 100'
VERTICAL – 1" = 10'

LEGEND
——— AS-BUILT TW
------ DESIGN TW



SCALE:
HORIZONTAL – 1" = 100'
VERTICAL – 1" = 10'

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

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Ecosystem Enhancement Program

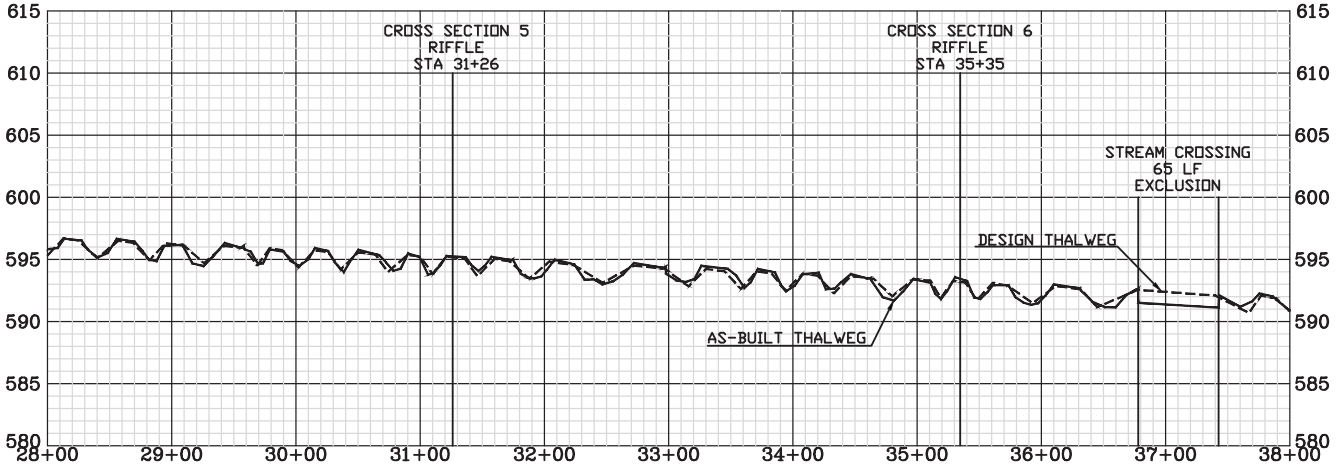
NEWTOWN
AS-BUILT PROFILES
UT TO UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:

PROJECT NAME:
EBX NEWTOWN
DWG NAME:
ASBUILT PROFILES
SCALE:
1" = 100
RECORD DRAWINGS
SHEET NO.

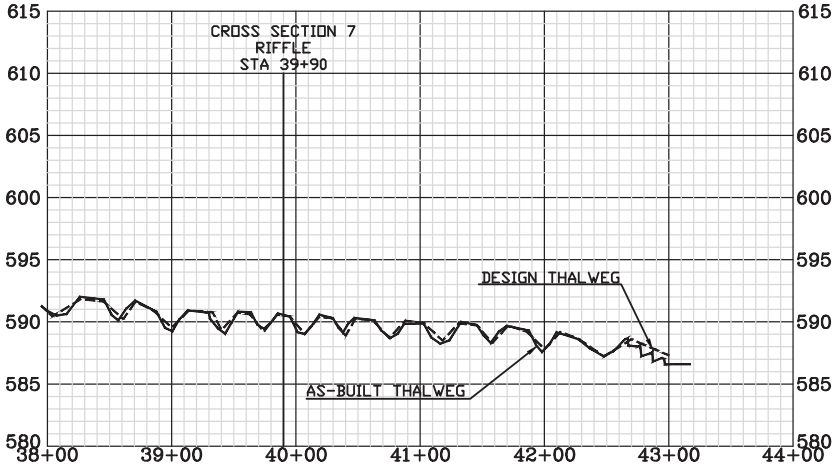
PRO2

AS-BUILT UT TO UNDERWOOD CREEK (NEWTOWN)
LONGITUDINAL PROFILE
TRIBUTARY CHANNEL



SCALE:
HORIZONTAL – 1" = 100'
VERTICAL – 1" = 10'

LEGEND
AS-BUILT TW
DESIGN TW



SCALE:
HORIZONTAL – 1" = 100'
VERTICAL – 1" = 10'

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

Ward Consulting Engineers, P.C.
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Ecosystem Enhancement Program

NEWTOWN
AS-BUILT PROFILES
UT TO UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: EBX NEWTOWN
DWG NAME: ASBUILT PROFILES
SCALE: 1" = 100
RECORD DRAWINGS
SHEET NO.

PRO3

AS-BUILT
UNDERWOOD CREEK TABLE

ASBUILT		
Station	TW Elevation	Description
501.44	595.02	TIE IN
520	593.59	CP
534.38	594.96	HR
551.19	594.73	ER
572.94	593.1	CP
592.93	594.73	HR
610.05	594.44	ER
625.94	592.5	CP
641.48	594.47	HR
659.86	594.25	ER
679.9	592.61	CP
695.73	594.2	HR
717.47	593.99	ER
743.58	591.69	CP
767.79	593.93	HR
796.45	593.55	ER
814.41	591.43	CP
831.96	593.5	HR
852	593.4	ER
860.53	591.88	CP
869.45	593.54	HR
888.09	593.16	ER
903.64	591.61	CP
915.55	593.18	HR
922.91	592.97	ER
935.11	590.65	CP
948.48	593.02	HR
964.35	592.73	ER
981.59	591.08	CP
996.52	592.82	HR
1018.65	592.51	ER
1034.14	590.61	CP

ASBUILT		
Station	TW Elevation	Description
1053.58	592.33	HR
1056.08	591.38	FES
1113.99	591.02	CI
1115.91	591.85	ER
1142.62	591.86	HR
1160.09	591.8	ER
1179.68	589.52	CP
1198.08	591.74	HR
1226.78	591.23	ER
1244.95	589.27	CP
1263.66	591.37	HR
1286.18	591.12	ER
1304.4	589.31	CP
1321.1	591.06	HR
1345.42	590.84	ER
1369.07	588.64	CP
1398.24	590.84	HR
1429.78	590.46	ER
1447.53	588.94	CP
1461.86	590.35	HR
1482.83	590.14	ER
1497.46	588.13	CP
1515.5	590.13	HR
1532.77	589.97	ER
1553.59	588.42	CP
1569.13	589.9	HR
1597.36	589.69	ER
1615.02	587.98	CP
1635.31	589.71	HR
1660.76	589.35	ER
1681.47	587.25	CP
1703.4	589.38	HR
1725.97	589.02	ER
1743.91	587.13	CP
1766.37	588.94	HR
1782.82	588.7	ER
1797.4	587.21	CP
1811.27	588.79	HR
1826.8	588.57	ER
1841.68	586.76	CP
1858.12	588.54	A-VANE
1867.82	587.95	CENTER
1877.97	587.47	A-VANE
1887.99	586.84	CENTER
1924.15	586.15	TIE IN

AS-BUILT
UT TO UNDERWOOD CREEK TABLES

ASBUILT		
Station	TW Elevation	Description
292.2	608.5	CP
305.38	610.01	HR
317.71	609.51	ER
330.16	608.56	CP
349.99	609.82	HR
361.7	609.61	ER
370.82	608.33	CP
381.92	609.74	HR
394.72	609.6	ER
406.51	608.12	CP
418.44	609.49	HR
431.35	609.43	ER
449.58	607.97	CP
474.57	609.35	HR
494.23	608.98	ER
511.83	607.53	CP
533.31	608.92	HR
546.11	608.68	ER
582.15	608.64	HR
603.44	608.45	ER
621.01	606.66	CP
637.87	608.49	HR
654.96	608.05	ER
679.61	606.26	CP
702.92	608.23	HR
736.96	607.88	ER
760.12	605.79	CP
779.83	607.77	HR
792.95	607.75	ER
807.41	606.6	CP
817.23	607.81	HR
834.94	607.34	ER
858.04	605.79	CP
878.82	607.33	HR
895.21	607.25	ER
907.94	606.11	CP
919.16	607.16	HR
930.97	607.03	ER
943.72	605.27	CP
956.7	607.13	HR
977.45	606.67	ER
993.25	604.72	CP
1007.16	606.76	HR
1022.07	606.47	ER
1033.77	604.75	CP
1046.25	606.38	HR
1058.48	605.7	ER
1074.02	604.95	CP
1088.49	605.75	HR
1104.51	605.1	ER
1123.37	603.59	CP
1136.24	605.13	HR
1153.75	604.71	ER
1169.44	603.1	CP
1184.24	604.85	HR
1199.3	604.07	ER
1212.06	602.7	CP
1225.22	604.1	HR
1239.84	603.91	ER
1251.06	602.31	CP
1263.19	603.8	HR
1279.56	603.87	ER
1295.63	601.56	CP
1311.05	603.83	HR
1323.36	603.39	ER
1334.57	601.73	CP
1347.91	603.54	HR
1359.72	603.59	ER
1369.54	601.69	CP
1383.59	603.39	HR

ASBUILT		
Station	TW Elevation	Description
1403.2	602.96	ER
1422.07	601	CP
1436.58	603.18	HR
1447.42	603.09	ER
1460.71	601.48	CP
1471.82	603.1	HR
1485.19	602.77	ER
1499.7	601.15	CP
1520.18	602.52	HR
1536.09	602.3	ER
1546.7	600.86	CP
1562.3	602.29	HR
1572.87	602.12	ER
1585.71	600.82	CP
1598.72	602.14	HR
1613.7	602	ER
1627.69	600.74	CP
1644.82	601.96	HR
1665.1	601.7	ER
1681.42	600.03	CP
1697.52	601.83	HR
1712.73	601.38	ER
1727.44	600	CP
1746.71	601.59	HR
1762.96	601.35	ER
1778.21	599.61	CP
1791.79	601.52	HR
1807.64	601.38	ER
1818.4	599.72	CP
1829.69	601.35	HR
1843.22	601.12	ER
1860.05	599.2	CP
1875.94	601.09	HR
1893.86	600.83	ER
1915.74	598.79	CP
1939.51	600.88	HR
1961.11	600.61	ER
1978.7	598.83	CP
1994.53	600.56	HR
2011.72	600.39	ER
2026.31	598.99	CP
2041.87	600.17	HR
2068.58	600.11	ER
2088.52	598.48	CP
2108.09	600	HR
2123.32	599.89	ER
2138.27	598.11	CP
2148.85	599.75	HR
2165.19	599.52	ER
2185.38	597.97	CP
2209.02	599.53	HR
2225.65	599.38	ER
2240.85	597.55	CP
2254.46	599.39	HR
2267.7	599.13	ER
2280.37	597.43	CP
2291.79	599.05	HR
2294.36	598.34	FES
2300.34	598.14	CI
2359.95	597.79	CI
2361.15	598.79	ER
2401.97	597.58	CP
2428.38	598.78	HR
2450.31	598.39	ER
2467.06	596.76	CP
2482.96	598.45	HR
2506.47	598.03	ER
2521.18	596.42	CP
2543.72	598.05	HR
2564.03	597.7	ER
2576.33	596.72	CP
2590.25	597.82	HR
2602.32	597.75	ER
2612.15	596.37	CP
2622	597.62	HR
2634.92	597.61	ER

ASBUILT		
Station	TW Elevation	Description
2648.17	596.31	CP
2662.49	597.61	HR
2675.21	597.27	ER
2690.25	595.37	CP
2711.05	597.41	HR
2733.35	597.01	ER
2752.34	594.99	CP
2770.32	597.04	HR
2789.34	596.93	ER
2801.91	595.82	CP
2813.66	596.66	HR
2827.63	596.51	ER
2840.29	595.16	CP
2855.98	596.66	HR
2870.32	596.42	ER
2881.81	594.97	CP
2894.23	596.1	HR
2908.65	596.17	ER
2925.46	594.45	CP
2942.79	596.32	HR
2958.02	596.09	ER
2969.66	594.6	CP
2979.13	595.8	HR
2990.23	595.61	ER
3002.6	594.47	CP
3015.43	595.92	HR
3026.09	595.66	ER
3038.47	593.98	CP
3050.32	595.77	HR
3067.33	595.33	ER
3078.43	594.08	CP
3090.52	595.48	HR
3099.71	595.17	ER
3110.65	593.88	CP
3121.36	595.27	HR
3136.69	595.18	ER
3146.9	594.07	CP
3157.65	595.21	HR
3174.67	595	ER
3191.65	593.47	CP
3208.42	594.99	HR
3224.18	594.59	ER
3246.62	592.99	CP
3272.22	594.71	HR
3297.73	594.41	ER
3313.18	593.17	CP
3326.47	594.49	HR
3347.88	594.23	ER
3360.9	592.7	CP
3372	594.24	HR
3385.72	593.95	ER
3394.72	592.44	CP
3408.02	593.81	HR
3420.87	593.93	ER
3433.54	592.65	CP
3446.88	593.82	HR
3462.57	593.5	ER
3481.31	591.67	CP
3497.08	593.41	HR
3510.84	593.1	ER
3519.17	591.81	CP
3530.82	593.57	HR
3540.28	593.26	ER
3550.96	591.81	CP
3561.08	592.93	HR
3573.69	592.91	ER
3591.56	591.34	CP
3610.26	592.99	HR
3631.02	592.69	ER
3651.08	591.16	CP
3676.14	592.57	HR
3678.08	591.51	FES
3742.72	591.11	CI
3743.32	592.11	ER
3760.08	591.19	CP

ASBUILT		
Station	TW Elevation	Description
3775.78	592.25	HR
3788.93	591.79	ER
3807.03	590.51	CP
3826.15	592.02	HR
3845.41	591.8	ER
3856.87	590.11	CP
3870.73	591.71	HR
3887.89	590.8	ER
3900.5	589.24	CP
3912.91	590.93	HR
3929.94	590.76	ER
3942.91	589.05	CP
3953.46	590.82	HR
3963.77	590.78	ER
3974.16	589.45	CP
3985.48	590.69	HR
3995.22	590.42	ER
4006.74	589.01	CP
4019.06	590.58	HR
4029.77	590.3	ER
4037.74	589.14	CP
4047	590.33	HR
4063.37	590.12	ER
4075.9	588.7	CP
4087.31	589.85	HR
4102.98	589.86	ER
4115.99	588.24	CP
4132.95	590	HR
4145.53	589.75	ER
4156.64	588.31	CP
4169.94	589.68	HR
4187.55	589.29	ER
4197.98	587.58	CP
4209.81	589.17	HR
4227.4	588.6	ER
4247.24	587.24	CP
4267.06	588.69	A-VANE
4277.09	588.11	CENTER
4286.95	587.59	A-VANE
4296.41	587.02	CENTER

NOTE: ELEVATION IN CHART IS THALWEG ELEVATION (TW)

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Fax (919) 229-9913

SEAL: NORTH CAROLINA PROFESSIONAL SEAL 1344 ENGINEER BECKY L. LYNN WARD

PROFILE TABLES
UNDERWOOD CREEK AND
UT TO UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011

REVISIONS:

PROJECT NAME: Newtown Creek

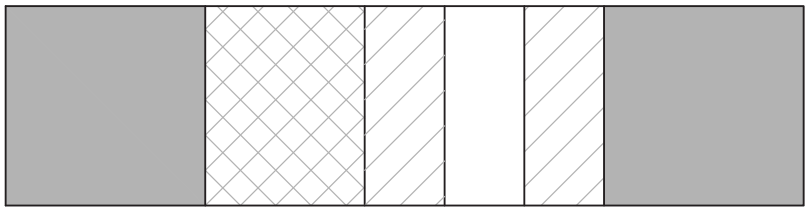
DWG NAME: Profile Tables

SCALE: NTS

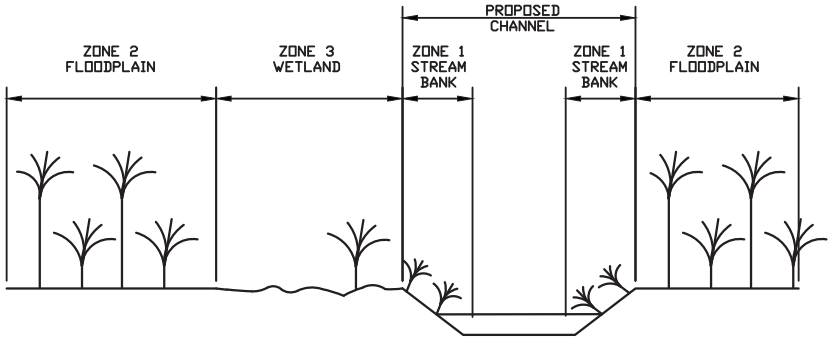
RECORD DRAWINGS

SHEET NO.

PR04



PLAN VIEW



PLANTING ZONE PROFILE SCHEMATIC
NOT TO SCALE

GENERAL NOTES:

1. TEMPORARY PLANTING WILL OCCUR IMMEDIATELY AFTER CONSTRUCTION TO STABILIZE AREAS OF BARE SOIL. PERMANENT PLANTING AND SEEDINGS SHALL BEGIN IN SEASON OPTIMALY BETWEEN NOVEMBER 15 AND APRIL 15.
2. PRIOR TO PERMANENT PLANTINGS AND SEEDINGS, THE SITE SOILS SHALL BE PREPARED FOR PLANTING. WHERE NEEDED THE SOILS SHOULD BE PLOWED OR RIPPED TO IMPROVE COMPACTED SOILS AND ELIMINATE CHANNELIZED FLOW FROM NON-TARGET AREAS. IF NECESSARY SOILS SHALL BE AMENDED WITH STORED SITE TOPSOIL TO FACILITATE VIGOROUS PLANT GROWTH. EXOTIC AND INVASIVE PLANTS SHALL BE TREATED AND REMOVED.
3. SUMMARY OF PLANT QUANTITIES CHART SIZE REFERS TO THE SIZE OF THE PLANTS AT INSTALLATION.
4. THE SPACING OF THE PLANTS SHALL BE 3' ON CENTER FOR SMALL PLANTS, WETLAND FORBES, AND ON STREAM BANK ZONES FOR TREES AND SHRUBS. SPACING SHALL BE 10 FEET ALONG ROWS WITH 10 FOOT ROW SPACING. FOR TREES AND SHRUBS PLANTING DENSITY IS TO BE 640 PLANTS /ACRE.
5. PLANTS WILL BE KEPT SHADED AND WELL WATERED TO MAINTAIN HEALTHY, VIGOROUS CONDITION PRIOR TO PLANTING.
6. PERMANENT SEED MIX REQUIRES ADVANCE PRE-ORDER AND SHIPMENT.
7. ALL PLANT MATERIAL SHALL CONFORM TO OR EXCEED THE AMERICAN STANDARD FOR NURSERY STOCK (LATEST EDITION) AS PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN.
8. THE SITE SHALL BE PLANTED BY THE ZONES DEPICTED IN THE PLANTING PLAN SHEETS WITH SPECIES LISTED IN THE PLANTING TABLES.
9. PLANTING ZONE DESCRIPTIONS:
   - ZONE 1- STREAM BANK
     THE STREAM BANK ZONE INCLUDED THE STREAM CHANNEL FROM BASE FLOW TO THE BANKFULL ELEVATION.
   - ZONE 2- STREAM BUFFER
     THE STREAM BUFFER INCLUDES THE AREA FROM THE BANKFULL ELEVATION TO THE CONSERVATION EASEMENT LIMIT.
   - ZONE 3- WETLAND
     THE WETLAND ZONES INCLUDE POCKETS OF RESTORED WETLAND AREAS WITHIN ZONE 2.

Plant Table

Bare Roots	Zone 1 (Stream banks)	Zone 2 (Buffer)	Zone 3 (Wetland)
Willow Oak (Quercus phellos)		1500	500
Swamp Chestnut Oak (Quercus michauxii)		2000	500
Hackberry (Celtis laevigata)		500	
Paw Paw (Asimina triloba)		500	
American Sycamore (Platanus occidentalis)		1300	300
Green Ash (Fraxinus Pennsylvanica)		1500	300
American Hornbeam/Ironwood (Carpinus caroliniana)		500	
Silky Dogwood (Comus amomum)			200
Buttonbush (Cephalanthus occidentalis)			300
Persimmon (Diospyros virginiana)		500	200
River Birch (Betula nigra)		300	300
Bare Root Total =	**0**	**8600**	**2600**
Live Stakes			
Silky Dogwood (Comus amomum)	2000		
Black Willow (Salix nigra)	3700		

Wetland Planting Zones - Permanent Seed Mix

Recommended application rate: 20 lbs. per acre		
Species	**Common Name**	**Percent**
Agrostis stolonifera	Creeping bentgrass	33
Carex vulpinoidea	Fox sedge	20
Elymus virginicus	Virginia wild rye	25
Helenium autumnale VA ecotype	Sneezeweed	5
Iris versicolor	Blue flag	5
Juncus effusus	Showy tick trefoil	4
Rudbeckia hirta	Black-eyed susan	4
Verbena hastata	Blue vervain	4
	Total:	100
3.38	Total Acres	
20	**lbs./acre**	
67.6	***Total lbs.***	

Stream Buffer and Stream Banks Planting Zones-Permanent Seed Mix

Recommended application rate: 20 lbs. per acre		
Scientific Name	**Common Name**	**Percent**
Elymus virginicus	Virginia wild rye	20
Panicum virgatum	Switchgrass	20
Agrostis stolonifera	Creeping bentgrass	15
Coreopsis lanceolata	Coreopsis	10
Panicum clandestinum	Deer tongue	10
Andropogon gerardii	Big bluestem	5
Juncus effusus	Soft rush	5
Polygonum pensylvanicum	Penn. Smartweed	5
Schizachyrium scoparium	Little bluestem	5
Sorghastrum nutans	Indian grass	5
		100
13.86	Total Acres	
20	**lbs./acre**	
277.2	***Total lbs.***	

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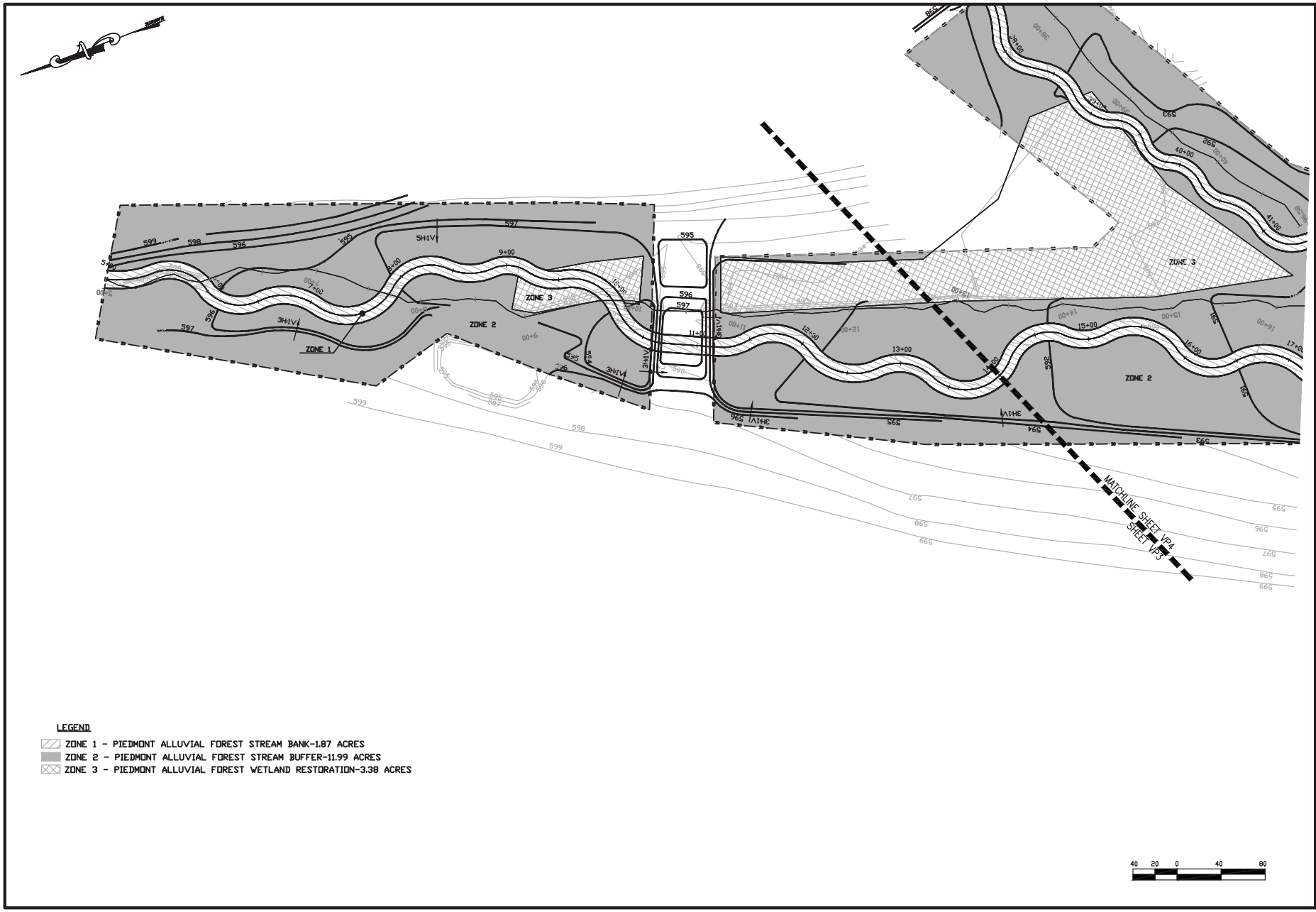
SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 1344 BECKY L. LYNN WARD

NEWTOWN
PLANT QUANTITIES
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: Newtown Creek
DWG NAME: Planting Notes
SCALE: NTS
RECORD DRAWINGS
SHEET NO.
VP1



LEGEND

- ZONE 1 - PIEDMONT ALLUVIAL FOREST STREAM BANK-1.87 ACRES
- ZONE 2 - PIEDMONT ALLUVIAL FOREST STREAM BUFFER-11.99 ACRES
- ZONE 3 - PIEDMONT ALLUVIAL FOREST WETLAND RESTORATION-3.38 ACRES

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NORTH CAROLINA PROFESSIONAL SEAL 13441 ENGINEER BECKY L. LYNN WARD

SEAL:

NEWTOWN PLANTING PLAN
STATION 5+00 TO 14+00
UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011

REVISIONS:

PROJECT NAME: Newtown Creek

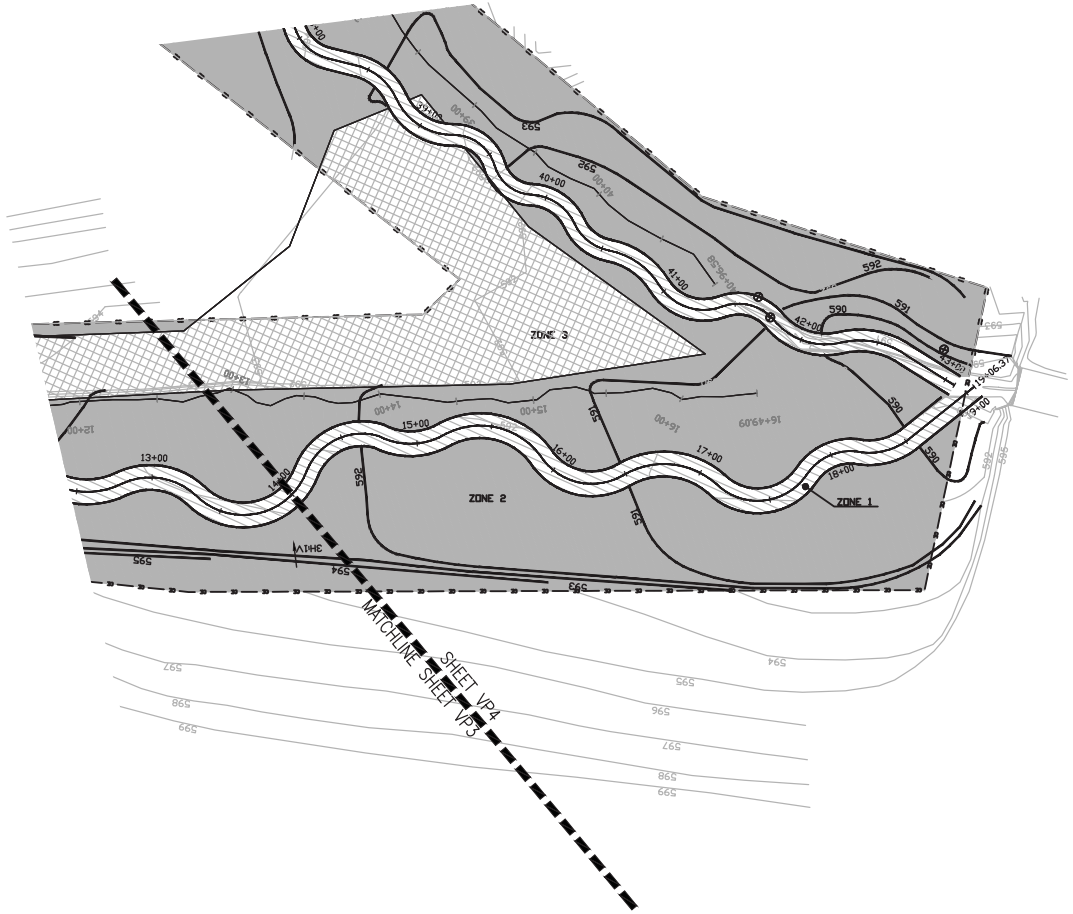
DWG NAME: Planting Plan

SCALE: 1"=40'

RECORD DRAWINGS

SHEET NO.

VP3



LEGEND

- ZONE 1 - PIEDMONT ALLUVIAL FOREST STREAM BANK
- ZONE 2 - PIEDMONT ALLUVIAL FOREST STREAM BUFFER
- ZONE 3 - PIEDMONT ALLUVIAL FOREST WETLAND RESTORATION

40 20 0 40 80

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SEAL: NORTH CAROLINA PROFESSIONAL SEAL 1344 ENGINEER BECKY L. WARD

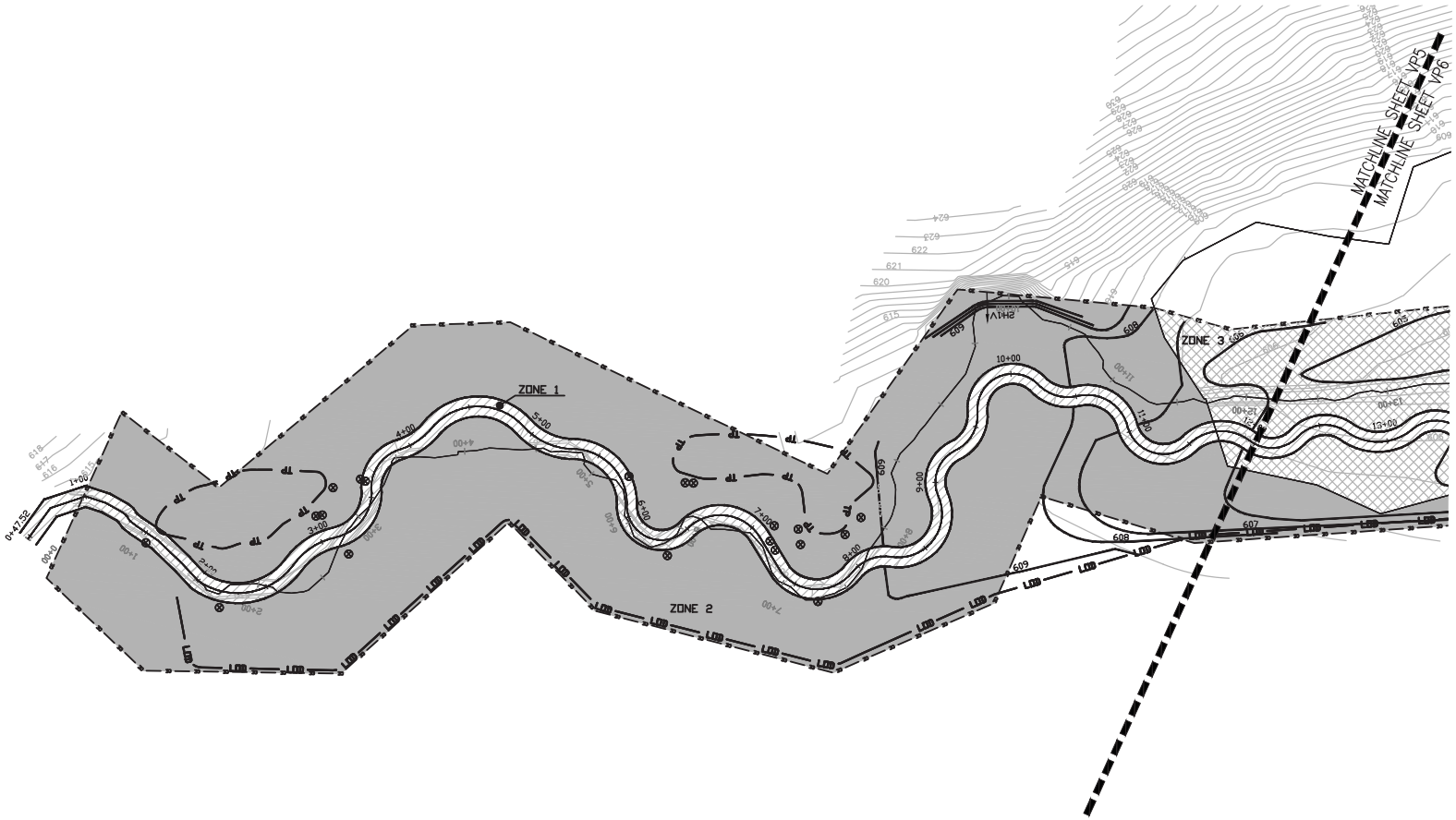
NEWTOWN PLANTING PLAN
STATION 14+00 TO 19+06.37
UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:

PROJECT NAME: Newtown Creek
DWG NAME: Planting Plan
SCALE: 1"=40'

RECORD DRAWINGS

SHEET NO.
VP4



LEGEND

ZONE 1 - PIEDMONT ALLUVIAL FOREST STREAM BANK
ZONE 2 - PIEDMONT ALLUVIAL FOREST STREAM BUFFER
ZONE 3 - PIEDMONT ALLUVIAL FOREST WETLAND RESTORATION

40 20 0 40 80

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 1344 BECKY L. LYNN WARD

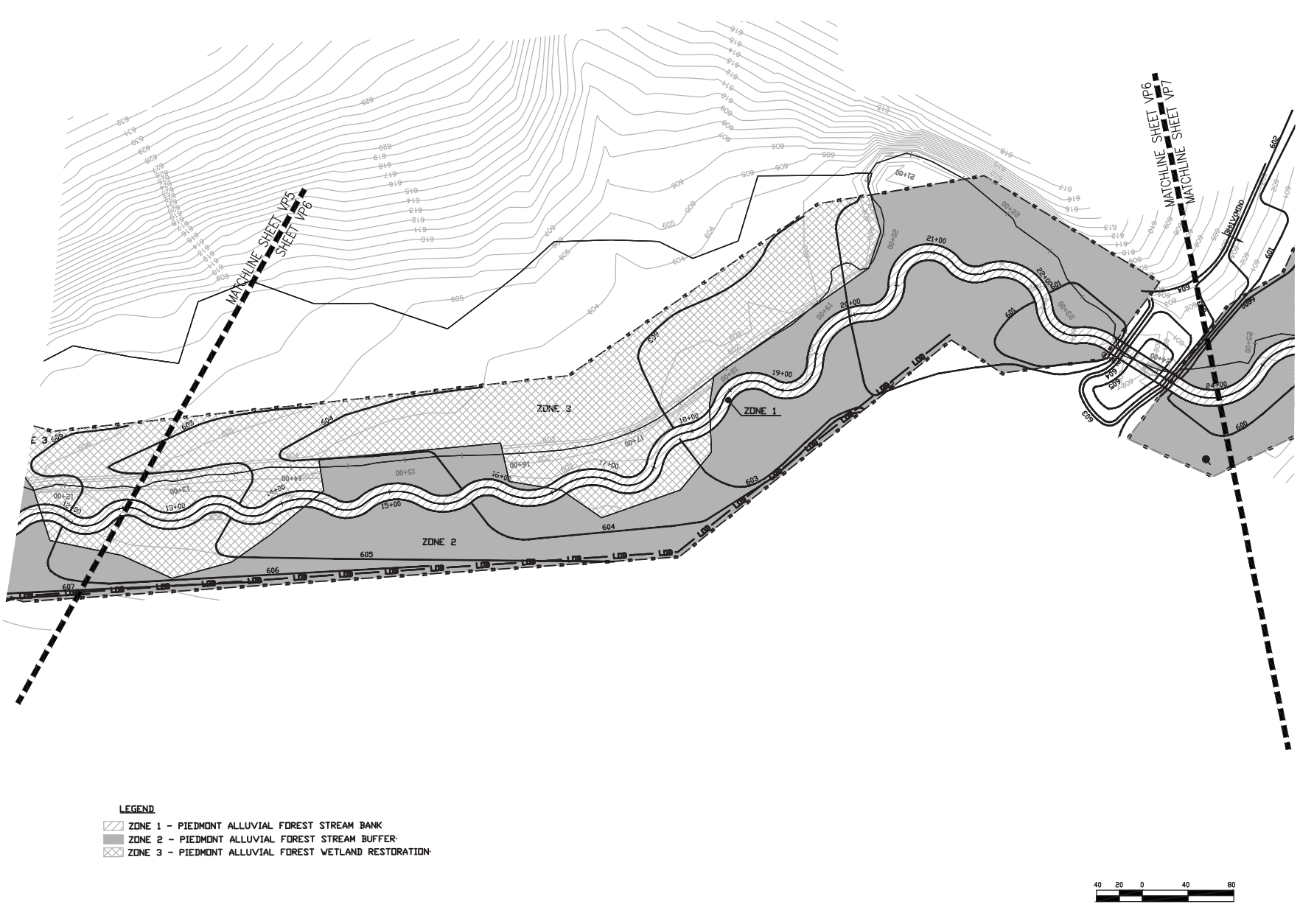
NEWTOWN PLANTING PLAN
STATION 0+00 TO 12+00
UT TO UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:

PROJECT NAME: New Town Creek
DWG NAME: Planting Plan
SCALE: 1"=40'

RECORD DRAWINGS

SHEET NO.
VP5



LEGEND

ZONE 1 - PIEDMONT ALLUVIAL FOREST STREAM BANK
ZONE 2 - PIEDMONT ALLUVIAL FOREST STREAM BUFFER
ZONE 3 - PIEDMONT ALLUVIAL FOREST WETLAND RESTORATION

40 20 0 40 80

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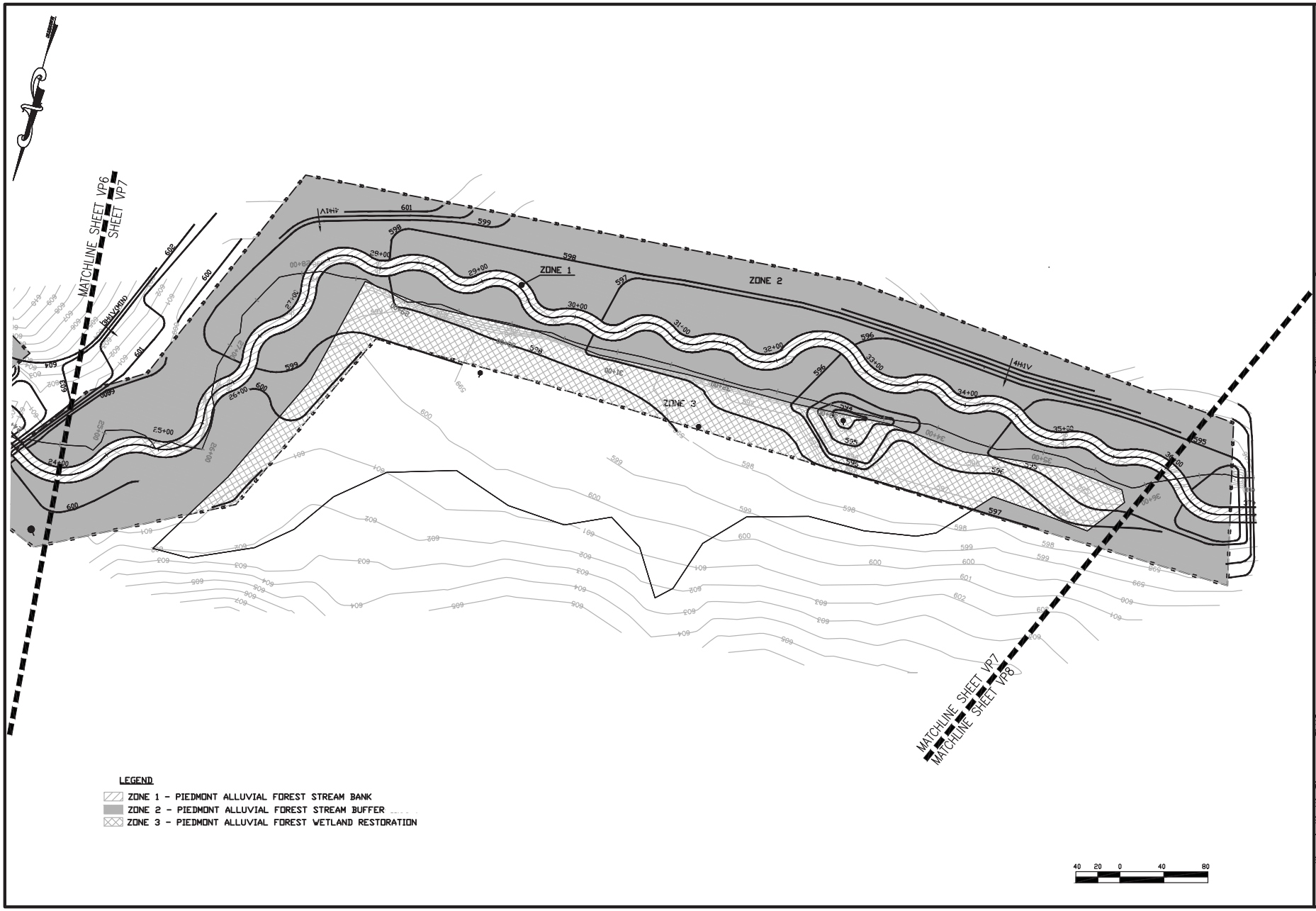
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 13344 BECKY L. LYNNE WARD

NEWTOWN PLANTING PLAN
STATION 12+00 TO 24+00
UT TO UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:
PROJECT NAME: Newtown Creek
DWG NAME: Planting Plan
SCALE: 1"=40'
RECORD DRAWINGS
SHEET NO.
VP6



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Fax: (919) 229-9913

SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 13441 BECKY LYNNE WARD

NEWTOWN PLANTING PLAN
STATION 24+00 TO 36+00
UT TO UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:

PROJECT NAME: Newtown Creek
DWG NAME: Planting Plan
SCALE: 1"=40'

RECORD DRAWINGS

SHEET NO.
VP7

NEWTOWN PLANTING PLAN
STATION 36+00 TO 43+06
UT TO UNDERWOOD CREEK
UNION COUNTY, NORTH CAROLINA

DATE: 5-27-2011
REVISIONS:

PROJECT NAME: Newtown Creek
DWG NAME: Planting Plan
SCALE: 1"=40'

RECORD DRAWINGS
SHEET NO. VP8

SEAL
NORTH CAROLINA
PROFESSIONAL
SEAL
13344
ENGINEER
BRUCE LYNNE WARD

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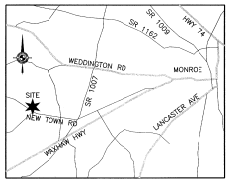

VICINITY MAP
NOT TO SCALE

MAP REFERENCE
NC GRID NAD 83

GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)
1 inch = 50 ft.

FRANKLIN W. HOWEY, JR.
D.B. 5201, PG. 692
PIN: 09-408-004

FRANKLIN W. HOWEY JR
D.B. 618, PG. 161
PIN: 09-408-005

FRANK HOWEY JR
D.B. 618, PG. 161
PIN: 09408005

WEDDINGTON RIDGE
PLAT C, PG. 418

UNDERWOOD CREEK

NEW TOWN ROAD

CONTROL POINT
N:448,901.96
E:1,507,252.60
ELEV: 598.63

CONTROL POINT
N:448,406.73
E:1,507,152.45
ELEV: 602.96

NGS MONT. "UNION HM48"
NC GRID NAD 83
N:447,608.74
E:1,502,818.16
ELEV: 595.70

CROSS SECTION 12928
CROSS SECTION 12967 (POST PROJECT)
CROSS SECTION 12584
CROSS SECTION 12465
CROSS SECTION 12406
CROSS SECTION 12253
CROSS SECTION 12022
CROSS SECTION 11813
CROSS SECTION 11606

FLOOD ZONE 'X'
FLOOD ZONE 'AE'
APPROXIMATE FLOODLINE PRIOR TO RESTORATION
CONSERVATION EASEMENT LINE
OLD CENTERLINE OF CREEK EXISTING PROPERTY LINE
TRIBUTARY TO UNDERWOOD CREEK
WOODLINE
POND
GRAVEL
ASPHALT
CONCRETE

LINE LEGEND:
EASEMENT
FENCE
GUARD RAIL
PROPERTY LINE
PROPERTY LINE (NOT SURVEYED)
RIGHT-OF-WAY
RIGHT-OF-WAY (NOT SURVEYED)
SETBACK
CABLE TV LINE
FIBER OPTIC LINE
GAS LINE
POWER LINE
POWER LINE (UNDERGROUND)
SANITARY SEWER PIPE
STORM DRAIN PIPE
TELEPHONE LINE
TELEPHONE LINE (UNDERGROUND)
WATER LINE
WOOD FENCE

LEGEND:
CP - CALCULATED POINT
D.B. - DEED BOOK
ECM - EXISTING CONCRETE MONUMENT
EIR - EXISTING IRON ROD
EMM - EXISTING METAL MONUMENT
EN - EXISTING NAIL
MBS - MAILBOX
M.B. - MAP BOOK
N.G.S. - NATIONAL GEODETIC SURVEY
NIR - NEW IRON ROD
NN - NEW NAIL
PIN - PARCEL IDENTIFICATION NUMBER
PG. - PAGE
ROW- RIGHT-OF-WAY
RCP - REINFORCED CONCRETE PIPE

NOTES:

1. THIS PLAT IS NOT FOR RECORDATION AS PER G.S. 47-30 AS AMENDED.
2. ALL CORNERS MONUMENTED AS SHOWN.
3. NO RECOVERABLE NGS MONUMENT LOCATED WITHIN 2,000 FEET OF SUBJECT PROPERTY.
4. THE LOCATION OF UNDERGROUND UTILITIES SHOWN ON THIS MAP IS APPROXIMATE, BASED ON INFORMACION PROVIDED BY OTHERS OR BY FIELD LOCATION. UTILITY LOCATIONS AS SHOWN HEREON ARE INTENDED FOR PLANNING ONLY. ACTUAL LOCATION, SIZE, OR DEPTH OF LINE SHOULD BE VERIFIED WITH THE INDIVIDUAL UTILITY COMPANY BEFORE CONSTRUCTION.
5. THIS SURVEY WAS PERFORMED WITHOUT BENEFIT OF A TITLE COMMITMENT REPORT. R.B. PHARR & ASSOCIATES, P.A. DOES NOT CLAIM THAT ALL MATTERS OF RECORD WHICH MAY OR MAY NOT AFFECT THE SUBJECT PROPERTY ARE SHOWN HEREON.
6. ELEVATIONS BASED ON N.G.S. MONUMENT "UNION HM 48" ELEVATION = 595.70 FEET, NAVD 88.
7. BROKEN LINES INDICATE PROPERTY LINES NOT SURVEYED.
8. THE OFF-SITE RIGHT-OF-WAY SHOWN HEREON IS FOR ILLUSTRATIVE PURPOSES ONLY. THE UNDERSIGNED CERTIFIES ONLY TO THE RIGHT-OF-WAYS SURVEYED, AND DOES NOT CURTIFY TO THE RIGHT OF WAY WIDTH OF ANY ADJACENT PROPERTIES.
9. THE PURPOSE OF THIS MAP IS TO SHOW IMPROVEMENTS AND TOPOGRAPHICAL INFORMATION ALONG THE CREEK CORRIDOR AS SHOWN HEREON, WITHIN THIS STREAM AND WETLAND RESTORATION AREA. NO BOUNDARY SURVEY WAS PERFORMED AT TIME OF SURVEY. ALL PARCEL LINES ARE APPROXIMATE ONLY BASED ON UNION COUNTY GIS DATA.
10. REFERENCE DESIGN PLANS PREPARED BY WARD CONSULTING ENGINEERS, P.C.; PROJECT NAME: NEWTOWN CREEK, DATED JUNE 30, 2010.
11. SEE SHEETS 2-5 FOR ALL CROSS SECTION INFORMATION.

FLOOD CERTIFICATION

THIS IS TO CERTIFY THAT THE SUBJECT PROPERTY IS LOCATED IN A SPECIAL FLOOD HAZARD AREA AS SHOWN ON MAPS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, FEDERAL INSURANCE ADMINISTRATION, DATED OCTOBER 16, 2008
COMMUNITY PANEL NO: 3702345404J; ZONE 'X' & 'AE'

THIS IS TO CERTIFY THAT ON THE 28TH DAY OF APRIL, 20 11 THIS MAP WAS PREPARED UNDER MY SUPERVISION AND THAT NO BOUNDARY WAS PERFORMED IN ITS PREPARATION. THE PURPOSE OF THIS MAP IS TO SHOW TOPOGRAPHICAL AND PHYSICAL FEATURES ONLY, AND IT DOES NOT MEET THE MINIMUM STANDARDS OF PRACTICE FOR LAND SURVEYING IN NORTH CAROLINA, BOARD RULE .1600 (21 NCAC 56), AND IS NOT INTENDED TO BE USED FOR RECORDATION, CONVEYANCES, OR SALES; HOWEVER THE POSITIONAL AND VERTICAL ACCURACY OF THE PHYSICAL AND TOPOGRAPHICAL FEATURES SHOWN ARE RELIABLE AND MEET THE ACCURACY STANDARDS OF THE CURRENT STANDARDS OF PRACTICE.

SIGNED

NORTH CAROLINA PROFESSIONAL LAND SURVEYOR JUSTIN F. CLONINGER SEAL L-4430

SHEET 1 OF 5
NOT A COMPLETE SURVEY WITHOUT ALL 5 SHEETS.

REVISIONS	SURVEY PREPARED FOR:
	ENVIRONMENTAL BANC & EXCHANGE
	RE: UNDERWOOD CREEK ASBUILT
	NEWTOWN ROAD
	UNION COUNTY, NORTH CAROLINA
	DEED REFERENCE: 618-161 AND 5201-692
	TAX PARCEL #: 09408004 AND 09408005

R.B. PHARR & ASSOCIATES, P.A.
SURVEYING & MAPPING
LICENSURE NO C-1471
420 HAWTHORNE LANE, CHARLOTTE, N.C. 28204 TEL. (704) 376-2186

CREW:	DRAWN:	REVISED:	SCALE:	DATE:	FILE NO. W-3840B
TR	CW		1" = 50'	APRIL 28, 2011	JOB NO. 77111

PLOTTED 5/5/2011
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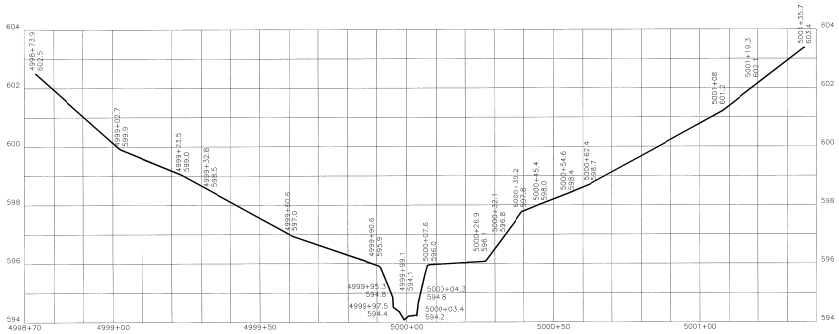
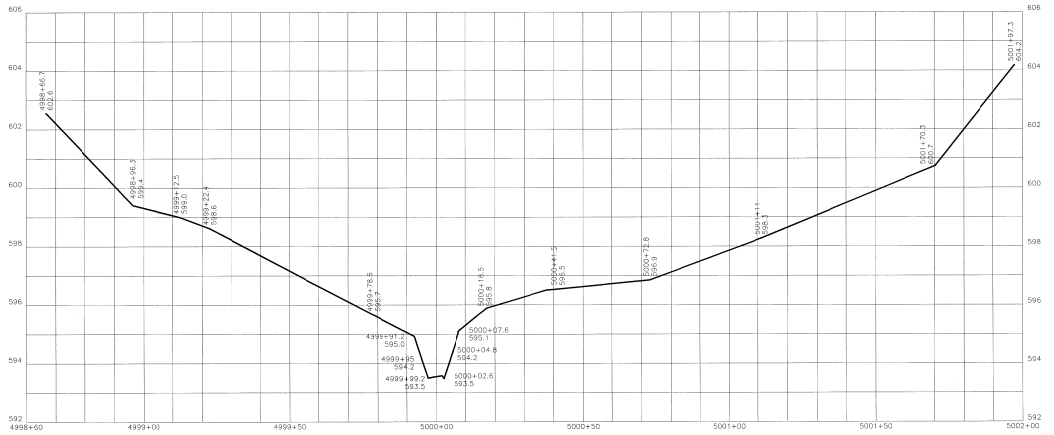
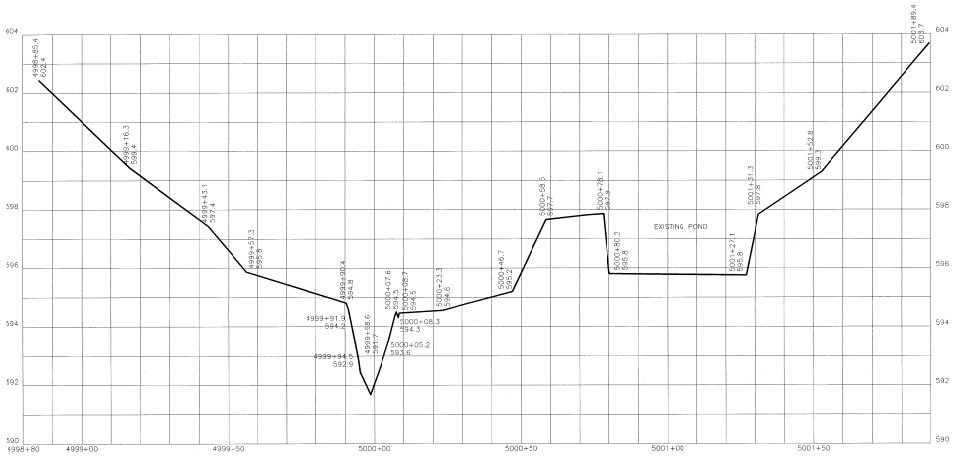
ABF1



CROSS SECTION 12828



CROSS SECTION
12695 (POST PROJECT)



CROSS SECTION 12584

SHEET 2 OF 5
NOT A COMPLETE SURVEY
WITHOUT ALL 5 SHEETS.

NOTES:
1. SEE SHEET 1 OF 5 FOR ALL NOTES AND PLAN VIEW OF UNDERWOODCR.EBX

REVISIONS			SURVEY PREPARED FOR:
			ENVIRONMENTAL BANC & EXCHANGE
			RE: UNDERWOOD CREEK ASBUILT
			NEWTOWN ROAD
			UNION COUNTY, NORTH CAROLINA
			DEED REFERENCE: 618-161 AND 5201-692
			TAX PARCEL #: 09408004 AND 09408005
			R.B. PHARR & ASSOCIATES, P.A.
			SURVEYING & MAPPING
			LICENSURE NO C-1471
			420 HAWTHORNE LANE CHARLOTTE, N.C. 28204 TEL. (704) 376-2186
CREW: TR	DRAWN: C#	REVISED:	SCALE: 1" = 20' | DATE: APRIL 28, 2011 | FILE NO. W-3840B | JOB NO. 77111

ABF2

PLOTTED: 5/5/2011
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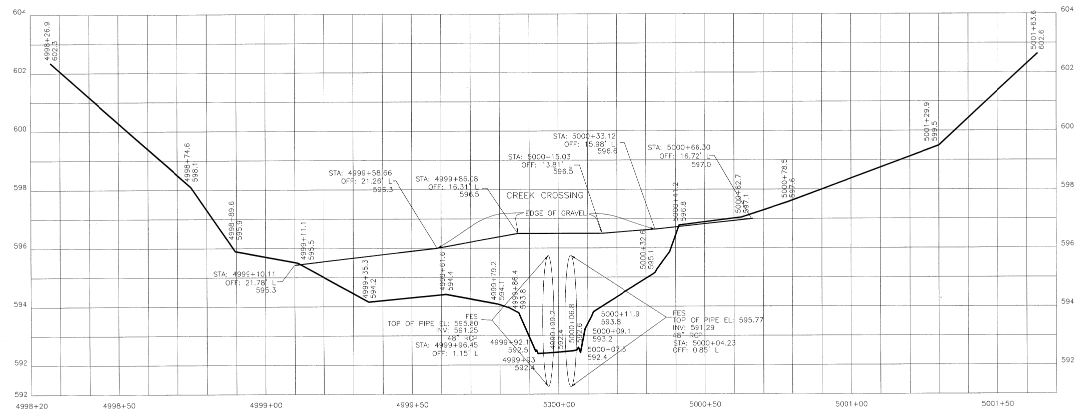

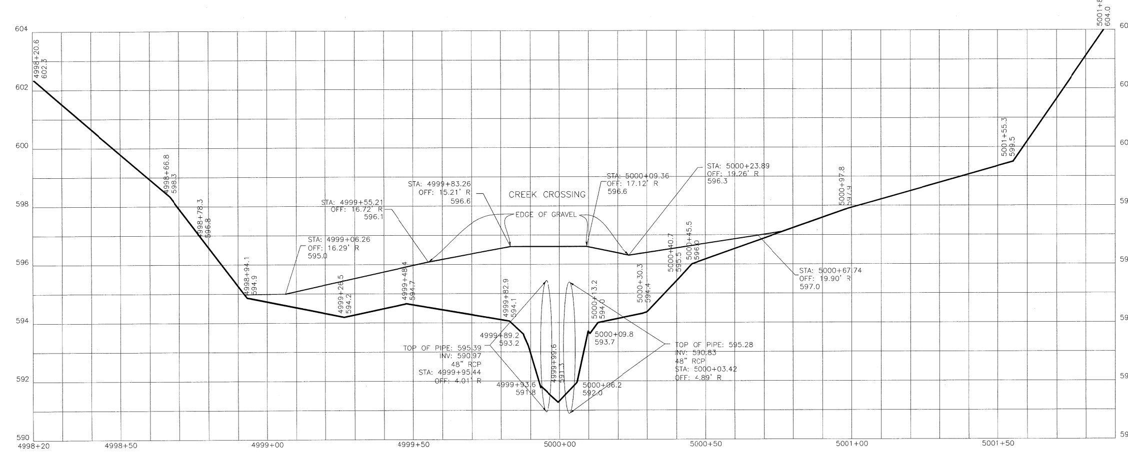

CROSS SECTION 12406

SHEET 3 OF 5
NOT A COMPLETE SURVEY
WITHOUT ALL 5 SHEETS.

NOTES:
1. SEE SHEET 1 OF 5 FOR ALL NOTES AND PLAN VIEW OF UNDERWOOD CREEK

REVISIONS

SURVEY PREPARED FOR:
ENVIRONMENTAL BANC & EXCHANGE
RE: UNDERWOOD CREEK ASBUILT
NEWTOWN ROAD
UNION COUNTY, NORTH CAROLINA
DEED REFERENCE: 618-161 AND 5201-692
TAX PARCEL #: 09408004 AND 09408005

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LICENSURE NO. C-1471
420 HAWTHORNE LANE CHARLOTTE, N.C. 28204 TEL. (704) 376-2186

CREW:	DRAWN:	REVISED:	SCALE:	DATE:	FILE NO. W-3840B
TR	CW		1" = 20'	APRIL 28, 2011	JOB NO. 77111

ABF3

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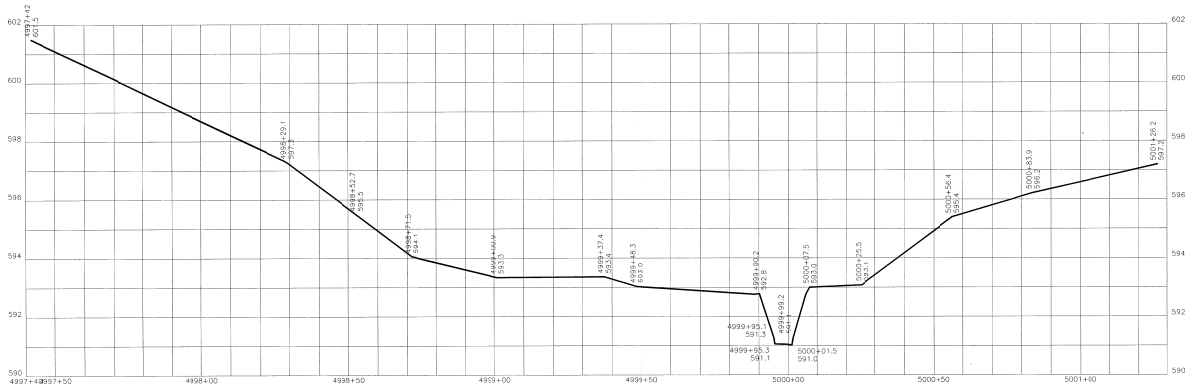
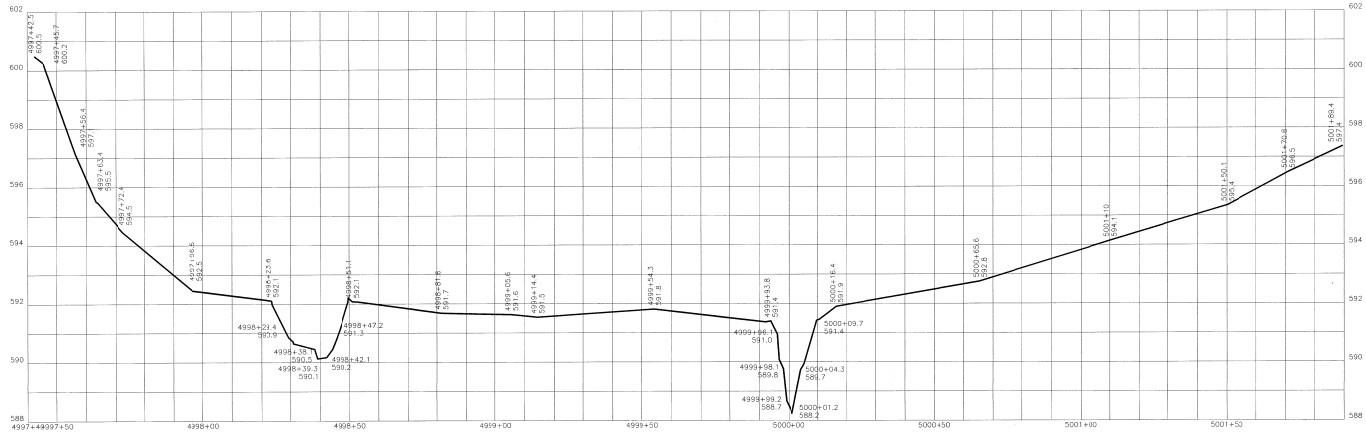


CROSS SECTION 12253



CROSS SECTION 12022

SHEET 4 OF 5
NOT A COMPLETE SURVEY
WITHOUT ALL 5 SHEETS.

NOTES:
1. SEE SHEET 1 OF 5 FOR ALL NOTES AND PLAN VIEW OF UNDERWOOD CREEK

REVISIONS	

SURVEY PREPARED FOR:

ENVIRONMENTAL BANC & EXCHANGE

RE: UNDERWOOD CREEK ASBUILT
NEWTOWN ROAD
UNION COUNTY, NORTH CAROLINA
DEED REFERENCE: 618-161 AND 5201-692
TAX PARCEL #: 09408004 AND 09408005

R.B. PHARR & ASSOCIATES, P.A.
SURVEYING & MAPPING
LICENSURE NO C-1471
425 HAWTHORNE LANE CHARLOTTE, N.C. 28204 TEL. (704) 376-2186

CREW:	DRAWN:	REVISED:	SCALE:	DATE:	FILE NO. W-3840B
TR	CW		1" = 20'	APRIL 28, 2011	JOB NO. 77111

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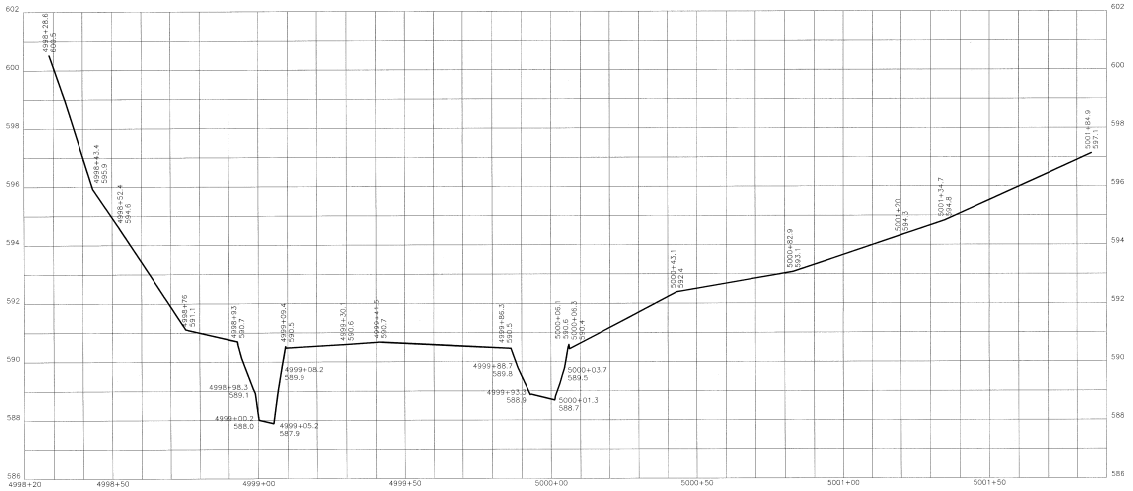
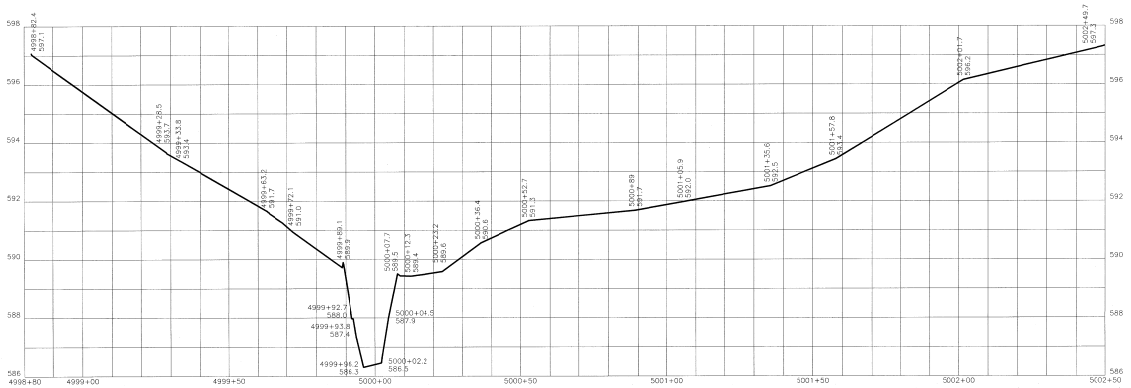


CROSS SECTION 11813



CROSS SECTION 11696

NOTES:

1. *SEE SHEET 1 OF 5 FOR ALL NOTES AND PLAN VIEW OF UNDERWOOD CR.EEK*

SHEET 5 OF 5
NOT A COMPLETE SURVEY
WITHOUT ALL 5 SHEETS.

NORTH CAROLINA PROFESSIONAL SEAL L-4457 SURVEYOR MARTIN F. CLONINGER
5/6/11

REVISIONS	SURVEY PREPARED FOR:
	ENVIRONMENTAL BANC & EXCHANGE
	RE: UNDERWOOD CREEK ASBUILT
	NEWTOWN ROAD
	UNION COUNTY, NORTH CAROLINA
	DEED REFERENCE: 618-161 AND 5201-692
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R.B. PHARR & ASSOCIATES, P.A.
SURVEYING & MAPPING
LICENSURE NO C-1471
428 HAWTHORNE LANE CHARLOTTE, N.C. 28204 TEL. (704) 376-2186

DREW:	DRAWN:	REVISED:	SCALE:	DATE:	FILE NO. W-3840E
TR	CW		1" = 20'	APRIL 28, 2011	JOB NO. 77111

PLOTTED: 5/7/2011
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