601 East Stream Restoration Site

(EEP Project #95756)
Union County, North Carolina

Baseline Monitoring Document and As-Built Baseline Report Final

Data Collected from December 2014 – February 2015

Submitted May 12, 2015

Ecosystem Enhancement PROGRAM

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Appendicies

1.0 Executive Summary

The 601 East Stream Restoration Site is located within the sub-basin 03-04-14 of the Yadkin River Basin in Union County, North Carolina and contains Tanyard Branch. The restoration of Tanyard Branch generated 3,713 stream mitigation credits. The project site is owned by one property owner Mr. Frank W. Howey, Jr. The project is located with the HUC 03040105081010 (Upper Lanes Creek). In 2009, nine (9) percent of the streams in the watershed were listed as impaired for Aquatic Life by the North Carolina Division of Water Quality (NCDWQ). The 601 East Stream Restoration Site was identified as a stream restoration opportunity to improve water quality and habitat within the Upper Lane's Creek Target Local Watershed (TLW). The 0.56 square mile watershed contributing drainage to the stream is primarily used for agricultural practices and angle family development. Vegetation typical of a Piedmont Alluvial Forest was planted throughout the conservation easement.

The project goals address the stressors identified in the TLW and include the following:

- Reduce water quality stressors originating in and around the project area affecting the project reaches and downstream watercourses, which included populations of the Savannah Lilliput (Toxolasma pullus) and the Carolina Creekshell (Vilosa vaughiana), both listed species of concern. Specifically, involving:
    - Reducing turbidity and sediment loading
    - Input reductions of nutrients and crop protection chemicals
    - Improving thermoregulation
- Improving aquatic habitat quality and diversity within the project reaches
- Improving recruitment of instream fine organic matter (FOM) in the near term and both FOM and large wood in the long term
- Improving terrestrial habitat diversity and quality in the vicinity of project reaches
- Establishing habitat continuity between the reach headwaters and Lanes Creek
- Improving flood flow attenuation and floodplain interaction

The project goals will be addressed through the project objectives:

- Restore or enhance reach pattern, dimension, and profile
- Stabilize eroding stream banks
- Install stream structures to maintain grade and improve bed form complexity
- Implement BMP detention devices on lateral agricultural drainages
- Install a diverse native riparian buffer
- Remove of invasive and/or exotic plant species
- Secure a protective conservation easement and establish fencing as needed

Construction was completed in December 2014. As-built surveys and plantings were completed in January 2015. In January 2015, ten (10) vegetation plots were established and baseline vegetation data was collected, excluding natural stems in accordance with the EEP/CVS protocol (Version 4.2). Data collected for these plots are included in Appendix C. The success criterion for planted woody species in the restoration areas is based on annual and cumulative survival and growth over seven (7) years. Survival on preferred species must be at a minimum of 320 stems/acre at the end of three years of monitoring and 260 stems/acre after five years. At year 7, density must be no less than 210 seven year-old planted stems/acre. Level II of the CVS protocol, which includes natural stems and planted stems, will be followed for monitoring year 2 and subsequent years until the project close out year.

2.0 Background

2.1 Location and Setting

The project area is located within the United States Geological Survey (USGS) Hydrologic Unit 03040105 (Rocky River Basin) of the greater Yadkin Pee-Dee River Basin. The project stream on the property is named Tanyard Branch which is a tributary to Lanes Creek. The Site is located on predominately agricultural land. The Site lies within the Carolina Slate Belt system of the Piedmont Geographical Province and is composed of gently sloping terrain with parent material consisting of a Metamudstone and Meta-Argillic metamorphic rock. The landowner to the northeast of the lower reach utilizes his land for livestock grazing. The livestock on this property is contained by fencing and does not have access to Tanyard Branch. The Vicinity Map can be found in Appendix A.

3.0 Project Structure, Restoration Type, and Approach

The historic land use at the Site has consisted primarily of agriculture use. Additional land use practices, including the maintenance and removal of riparian vegetation and the relocating and straightening of on-site streams have contributed to unstable channel characteristics and degraded water quality. Historic wetlands were likely drained in order to maximize agricultural production.

The streams were restored and enhanced using a combination of Rosgen priority 1 and 2 restoration techniques. The riparian buffer was planted with native vegetation. The mitigation work at the project site resulted in the restoration of 4023 linear feet of stream including 215 linear feet of ephemeral channel with buffer restoration and best management practices to filter sediment; 3,396 linear feet of Priority I restoration; and 412 linear feet of Stream Enhancement Level I. The project component breakdown and components can be found in Table 1.

4.0 Project History, Contacts, and Attribute Data

Stream construction began in November 2014 and concluded in December 2014. Live stakes and bare root planting of the site occurred in January 2015. Baseline stream data collection coincided with the as-built survey and was an ongoing process that took place throughout construction and concluded in January 2015. Vegetation monitoring baseline data was established and collected in January 2015. 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 of Tanyard Branch to the culvert at Landsford Road is 0.27 square miles and 0.56 square miles to the downstream end at Lanes Creek. Land use within the watershed consists of primarily agricultural use with some single family residential. Impervious area covers less than 2 percent of the total watershed. Land use changes are not anticipated n the watershed of this headwater stream in the near future as the watershed consists of primarily active agricultural crop production. Low density residential development is a possibility for the watershed due to the sites proximity to US 601.

5.0 Modifications to the Mitigation Plan and Construction Plan Summary

The following is a summary of changes implemented during construction that differ from the Construction Drawings.

Reach 1: Native rock was excavated on site and used for the constructed riffles. The farm crossing in this reach was installed to a length of 48 feet.

Reach 2: Native rock was excavated on site and used for the constructed riffles. No work was done in the conservation easement exclusion at the brick pump house. Brush toe was not installed on the right bank from station 22+70 to 23+10. The stone and log riffles were not installed due to the concerns with the wet soils in this area. The riffles were constructed only with stone.

Reach 3: The twin 42 inch pipe crossing was constructed to a length of 48 feet. Native rock was excavated on site and used for the constructed riffles. Native rock was added to dress the top of all of the riffles in this reach to stabilize the riffles that were not constructed as some erosion was observed.

Reach 4: Native rock was excavated on site and used for the constructed riffles. Stone was placed to dress the top of the riffle not constructed at station 53+70. The grade of the stream was changed from the end of the riffle at station 57+15 to the tie in at Lanes Creek at 58+50. The plans had called for a tie in location of 484.0 feet. To better tie into the existing elevation of Lanes Creek the elevation of the end of the riffle at station 58+50 was raised two feet to elevation 486 feet. The riffle elevations were changed accordingly:

HR Station 56+90 Elevation 487.4; no change
ER Station 57+15 Elevation 487.0; +0.25 feet
HR Station 57+50 Elevation 487.0; + 0.28 feet
ER Station 57+80 Elevation 486.5; +0.54 feet
HR Station 58+20 Elevation 486.5; +0.58 feet
ER Station 58+50 Elevation 486.0; +2.0 feet

6.0 Success Criteria

6.1 *Morphologic Parameters and Channel Stability*

6.1.1 *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).

6.1.2 *Pattern and Profile*

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.

6.1.3 *Substrate*

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

6.1.4 *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.

6.2 *Vegetation*

Vegetation success is based on the criteria established in the *Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation* dated November 7, 2011. Survival on preferred species must be at a minimum 320 stems/acre at the end of the three years of monitoring and 260 stems/acre after five years. At year 7, density must be no less than 210 seven year-old planted stems/acre. Level II of the CVS protocol, which includes natural stems and planted stems, will be followed for the monitoring year 2 and subsequent years until the project close out year. Invasive exotic

species were observed before construction. Additional treatments will be conducted where deemed necessary if regeneration of these invasive exotic species is observed.

6.2.1 *Streams*

Two bankfull storm events must be recorded during the standard 7-year monitoring period. For the monitoring to be completed, these events must occur in separate monitoring years.

7.0 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 seven 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 and visual assessments of stream dimension, profile, pattern, bed materials, photo documentation, vegetation survivability sampling, and stream bankfull return interval.

7.1 Hydrology

7.1.1 *Stream*

Two crest gages have been installed one in the upper and one in the lower reach on the site to document bankfull events (See Figure 3 for locations). The gauges shall be checked, documented, and reset during each site visit by the monitoring performer.

7.2 Stream Channel Stability and Geomorphology

This project consisted of four restoration reaches on Tanyard Branch. Two reaches are located above Landsford Road and two below the road. Eighteen permanent cross sections on both riffles and pools were established on the site as detailed below:

Reach 1: Station 7+60 - 22+00

- Cross Section 1: Station 8+32 (Pool)
- Cross Section 2: Station 10+95 (Riffle)
- Cross Section 3: Station 12+20 (Pool)
- Cross Section 4: Station 14+68 (Riffle)
- Cross Section 5: Station 16+23 (Pool)
- Cross Section 6: Station 17+66 (Riffle)
- Cross Section 7: Station 19+30 (Pool)
- Cross Section 8: Station 20+59 (Riffle)

Reach 2: Station 22+00 - 24+02

- Cross Section 9: Station 24+25 (Riffle)
- Cross Section 10: Station 26+16 (Pool)
- Cross Section 11: Station 27+15 (Riffle)
- Cross Section 12: Station 29+67 (Pool)

Reach 3: Station 42+92 - 53+70

- Cross Section 13: Station 44+45 (Riffle)
- Cross Section 14: Station 48+78 (Pool)
- Cross Section 15: Station 50+93 (Pool)
- Cross Section 16: Station 52+29 (Riffle)

Reach 4: Station 53+70 - 58+65

- Cross Section 17: Station 56+15 (Pool)
- Cross Section 18: Station 56+42 (Riffle)

7.2.1 *Dimension*

The permanent cross sections shall be monitored for seven years, with monitoring events occurring in years 1, 2, 3, 5, and 7 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 Tables 6a, 6b, 6c, and 6d.

7.2.2 *Profile and Pattern*

The entire project length of was surveyed for this baseline monitoring plan. The MY-00 pattern and profile data for each reach is summarized in Tables 5a, 5b, 5c and 5d. For subsequent monitoring years, profile data will be visually monitored. Pebble counts were collected on two constructed riffles on in the upper and one in the lower reach and are included in the digital support files in the stream subfolder.

7.2.3 *Visual Assessment*

An annual visual assessment shall be conducted twice each monitoring year per NCEEP morphometric monitoring guidelines. At least 5 months shall separate each visual monitoring event.

7.2.4 *Bank Stability Assessments*

Bank pins have been installed at all pool permanent monitoring sections and marked with pink flagging. The length of exposed pin shall be measured and reported during each cross-section monitoring event. Once the exposure has been measured, the pin should be hammered flush with the face of the bank. Three rebar bank pins were installed in an array approximately 6 inches above the normal water surface in three locations and installed flush with the to the face of the stream bank as detailed below:

Reach 1: Station 7+60 – 22+00

Pool Cross Section	River Station of Pin		
	Upstream Cross Section	At Cross Section	Downstream Cross Section
Cross Section 1	8+24.5	8+32	8+37.5
Cross Section 3	12+16	12+20	12+23.5
Cross Section 5	16+18.5	16+23	16+28
Cross Section 7	19+26	19+30	19+35

Reach 2: Station 22+00 – 24+02

Pool Cross Section	River Station of Pin		
	Upstream Cross Section	At Cross Section	Downstream Cross Section
Cross Section 10	26+08	26+16	26+24.5
Cross Section 12	29+61	29+67	29+73.5

Reach 3: Station 42+92 – 53+70

Pool Cross Section	River Station of Pin		
	Upstream Cross Section	At Cross Section	Downstream Cross Section
Cross Section 14	48+70.5	48+78	48+85
Cross Section 15	50+87.5	50+93	50+99

Reach 4: Station 53+70 – 58+65

Pool Cross Section	River Station of Pin		
	Upstream Cross Section	At Cross Section	Downstream Cross Section
Cross Section 17	56+07.5	56+15	56+22.5

7.2.5 *Vegetation*

Ten (10) vegetation plots were installed along Tanyard Branch. 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-01 data 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 2012).

7.2.6 *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.

7.3 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.

8.0 Documenting the As-Built Conditions (Baseline)

8.1 As-Built/Record Drawings

The project as-built survey was conducted in December of 2014 on reaches 3 & 4 and January 2015 on reaches 1 & 2 upon completion of construction. The entire project length of Tanyard Branch as-built data was collected by the staff of the Designer/Monitoring Performer. The Record Drawings (including red-line markups) were completed on February 19, 2015. Baseline vegetative data was collected January 26, 2015.

8.2 Installation and Marking of Monitoring Features

Monitoring features installation and the baseline monitoring data collection occurred in January 2015. Cross Section pins were set at each end of the cross section left and right and are 1/2" rebar marked with wooden stakes with pink flagging. Stream crest gauges located in both the upper and lower reaches are black plastic tubes set with 48" green T posts. Vegetation monitoring plots were established as 10mX10m

squares with each corner marked with 2' long ½"in diameter PVC pipes with pink flagging marking the plot origin. Plants within the plot were marked with pink flagging.

9.0 Report and Data Submission Format

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

10.0 References

USACOE (2003) *Stream Mitigation Guidelines*. USACOE, NCDENR-DWQ, USEPA, NCWRC,

USACOE (1987) *Corps of Engineering Wetlands Delineation Manual.* Tech report Y-87-1. AD/A176

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

Weakley, Alan (2012). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. http://www.herbarium.unc.edu/flora.htm.

Appendix A – General Tables and Figures

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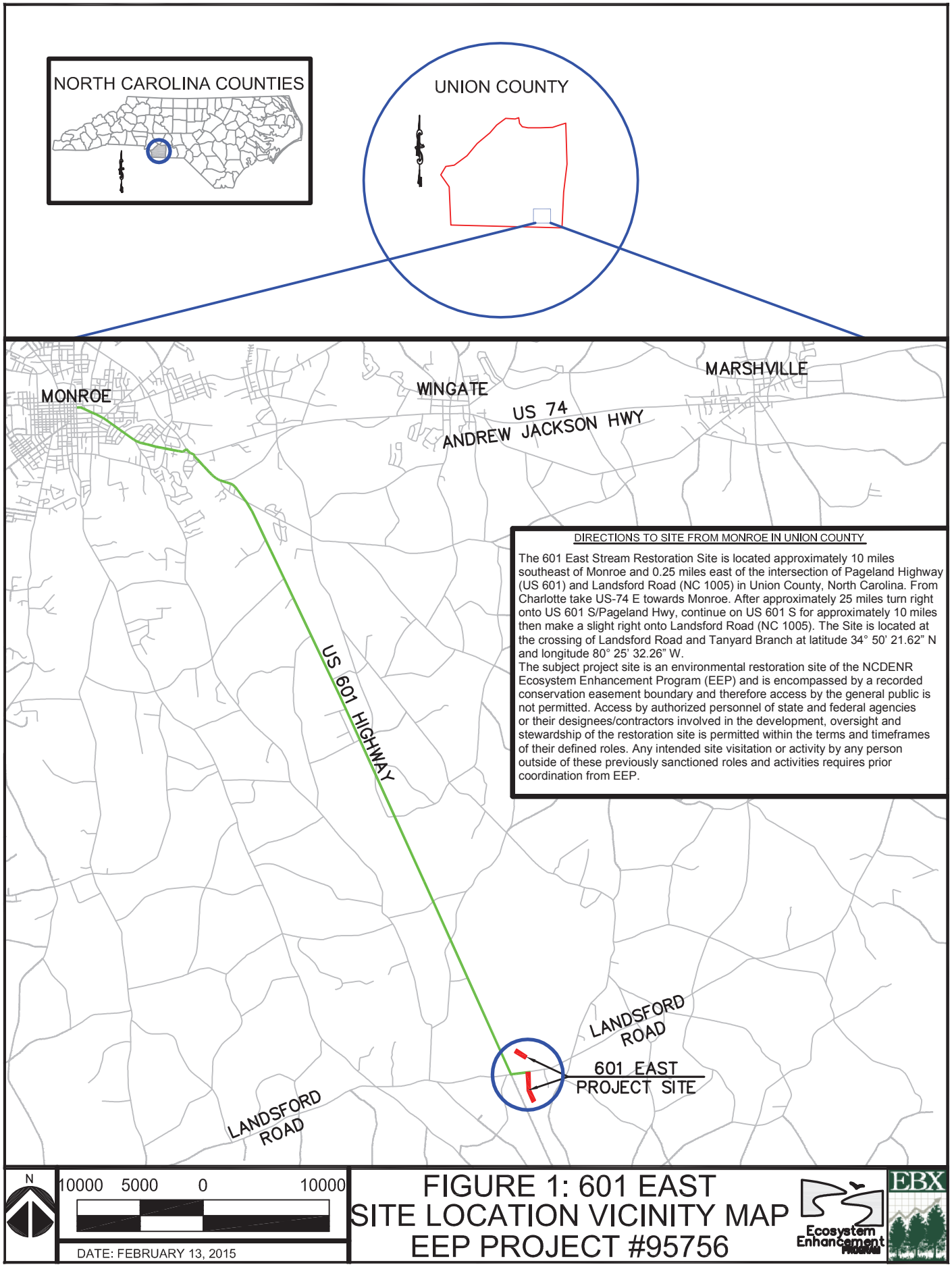
NORTH CAROLINA COUNTIES
UNION COUNTY
MONROE
WINGATE
MARSHVILLE
US 74
ANDREW JACKSON HWY
US 601 HIGHWAY
LANDSFORD ROAD
601 EAST
PROJECT SITE
LANDSFORD ROAD
DIRECTIONS TO SITE FROM MONROE IN UNION COUNTY
The 601 East Stream Restoration Site is located approximately 10 miles southeast of Monroe and 0.25 miles east of the intersection of Pageland Highway (US 601) and Landsford Road (NC 1005) in Union County, North Carolina. From Charlotte take US-74 E towards Monroe. After approximately 25 miles turn right onto US 601 S/Pageland Hwy, continue on US 601 S for approximately 10 miles then make a slight right onto Landsford Road (NC 1005). The Site is located at the crossing of Landsford Road and Tanyard Branch at latitude 34° 50' 21.62" N and longitude 80° 25' 32.26" W.
The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation 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 from EEP.
N
10000 5000 0 10000
DATE: FEBRUARY 13, 2015
FIGURE 1: 601 EAST
SITE LOCATION VICINITY MAP
EEP PROJECT #95756
Ecosystem Enhancement
EBX

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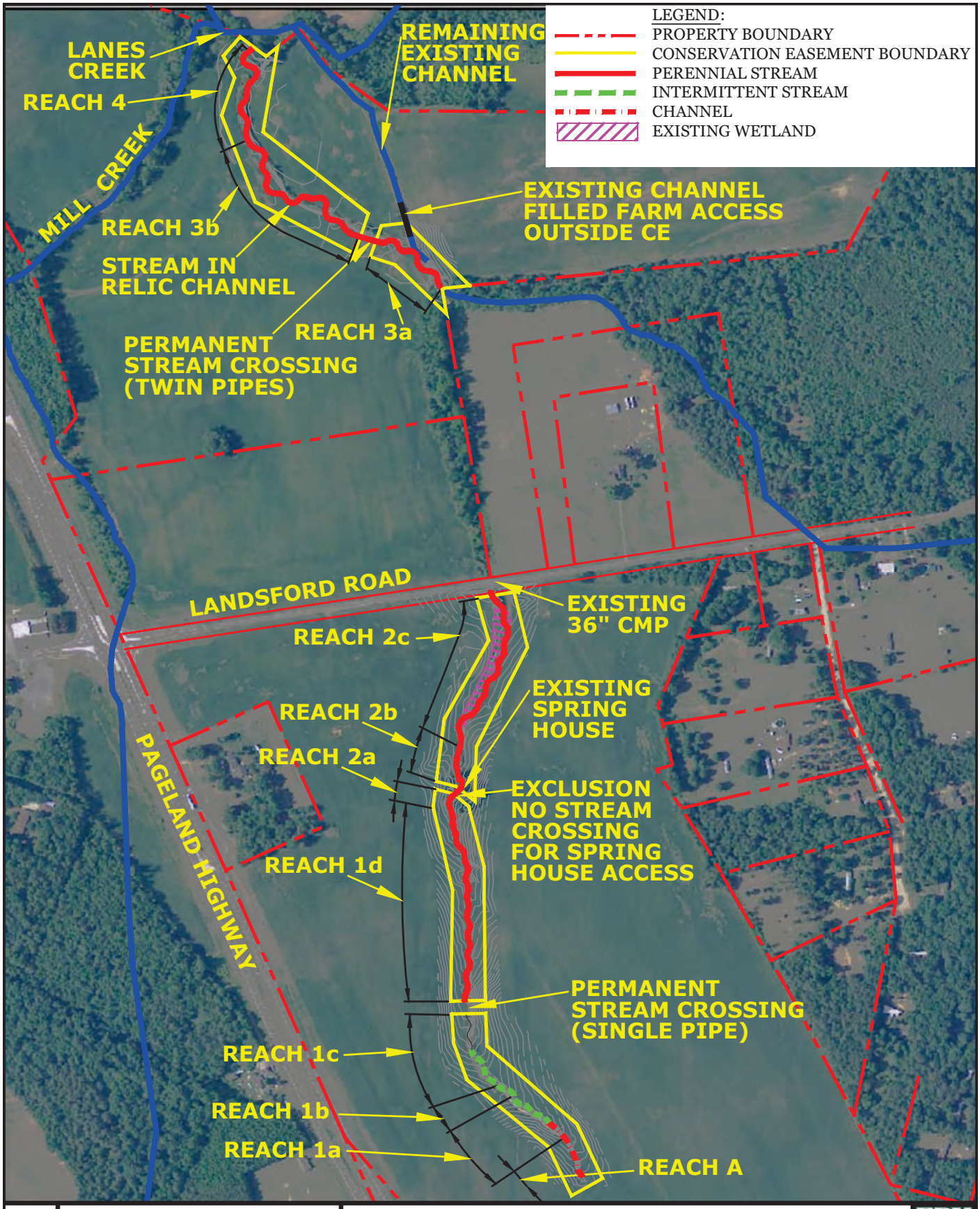

FIGURE 2 HYDROLOGIC FEATURES

601 EAST STREAM RESTORATION SITE
UNION COUNTY, NC

EEP PROJECT #95756

2011 Aerial from NCOneMap.org

WARD CONSULTING ENGINEERS, PC

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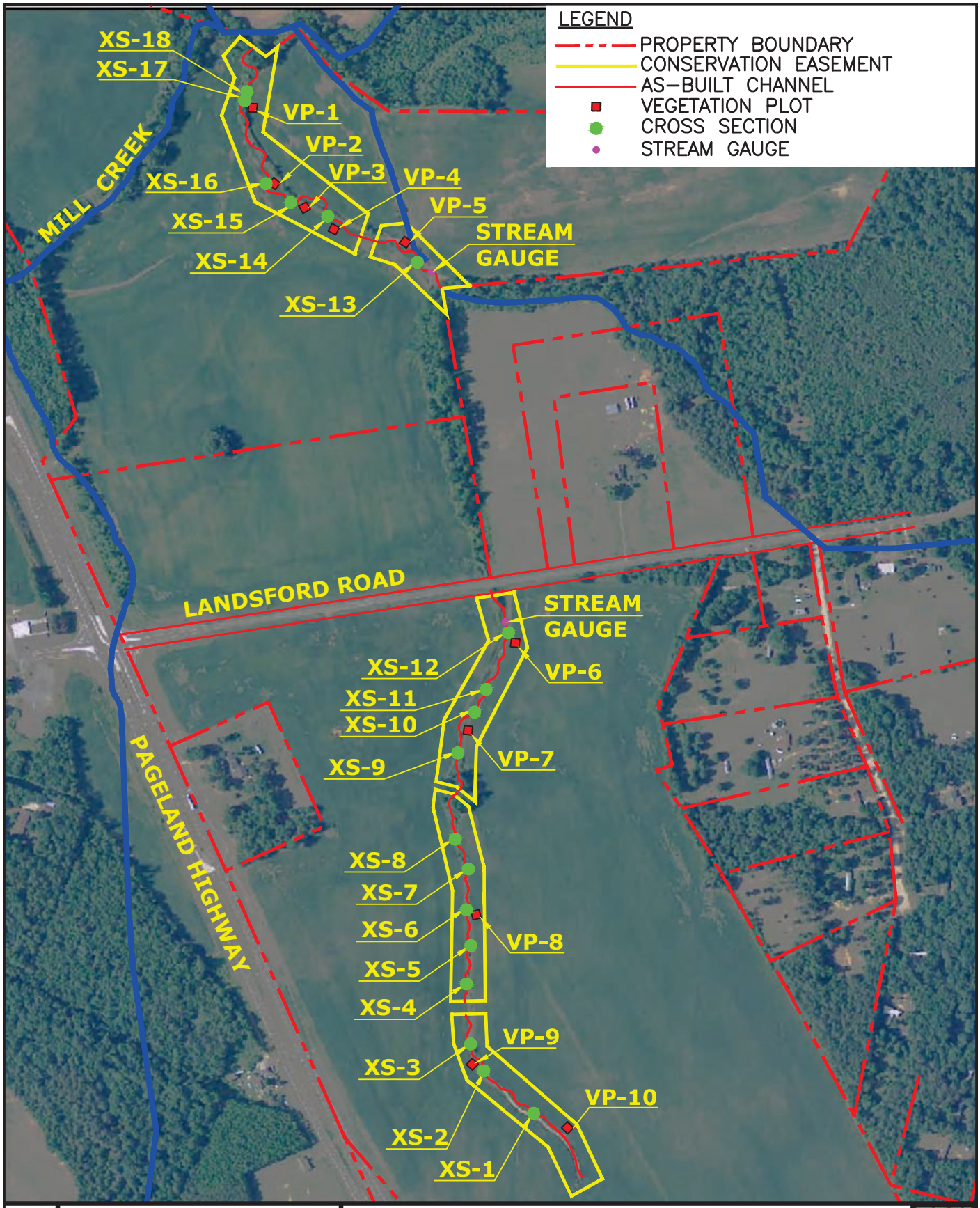

N

500 250 0 500

DATE: FEBRUARY 19, 2015

FIGURE 3 MONITORING FEATURES

601 EAST STREAM RESTORATION SITE
UNION COUNTY, NC

EEP PROJECT #95756

Ecosystem Enhancement Program

EBX

2011 Aerial from NCOneMap.org

WARD CONSULTING ENGINEERS, PC

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Table 1: 601 East Stream Restoration, Union County
EEP Project Number 95756

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	3671	43							

Project Components

Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation	
						Ratio	Credits
Reach A Ephemeral	5+45 – 7+60	215		Buffer establishment and BMP sediment import reduction	215	1:5	43
Reach 1a Intermittent	7+60 – 11+10	336	P1	R	350	1:1	350
Reach 1b Intermittent	11+10 – 11+95	85	Enhancement	E1	85	1:1.5	57
Reach 1c Perennial	11+95 – 13+47	136	Enhancement	E1	155	1:1.5	103
Reach 1d Perennial	13+97 – 22+00	790	P1	R	803	1:1	803
Reach 2a Perennial	22+00 – 22+45	40	Enhancement	E1	45	1:1.5	30
Reach 2b Perennial	22+75 – 24+02	125	Enhancement	E1	127	1:1.5	85
Reach 2c Perennial	24+02 – 31+32	669	P1	R	730	1:1	730
Reach 3a Perennial	42+92 – 46+61	80’ active channel 112’ relic channel	P1	R	369	1:1	369
Reach 3b Perennial	47+21 – 53+70	502’ relic channel	P1	R	649	1:1	649
Reach 4 Perennial	53+70 – 58+65	470’ relic channel	P3	R	495	1:1	495

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)	Mitigation Credits
		Riverine	Non-Riverine				
Restoration	3396						3396
Enhancement							
Enhancement I	412						275
Enhancement II							
Creation							
Preservation/Other	215						43
HQ Preservation							

BMP Elements

Element	Location	Purpose/Function	Notes
FB, LS, S, FS	Ephemeral Channel 5+45 – 7+60	Slowing the water down for settling and filtering excess sediment	Sediment expected from future degradation upstream

BMP Elements

BR = Bioretention cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spread; NI = Natural Infiltration Area; FB = Forested Buffer

Table 2. Project Activity and Reporting History 601 East Stream Restoration- EEP #95756		
Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	May 2013	Jan 2014
Final Design – Construction Plans	Sept 2013	Jan 2014
Construction	-	Dec 2014
Containerized, bare root and B&B plantings	-	Jan 2015
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Feb 2015	Feb 2015
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.
The above are obviously not the extent of potential relevant project activities, but are just provided as example as part of this exhibit.
If planting and morphology are on split monitoring schedules that should be made clear in the table

Table 3. Project Contact Table 601 East Stream Restoration- EEP #95756	
Designer Primary project design POC	Ward Consulting Engineers, P.C. (WCE) 4805 Green Road, Suite 100, Raleigh, NC 27616 Becky Ward (919) 870-0526
Construction Contractor Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Joseph Wright (919) 663-0810
Planting Contractor Planting contractor POC	H & J Forest Services 1416 Ocean Boulevard, Holly Ridge, NC 28445 (910) 512-6754
Construction Survey Contractor Survey contractor POC	Turner Land Survey, PLLC 3719 Benson Drive, Raleigh, NC 27629 Elizabeth Turner (919) 827-0745
Seeding Contractor Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Andrew Dimmette (919) 663-0810
Seed Mix Sources	Green Resource - Raleigh, NC As Purchased by EBX (919) 829-9909 x 213
Nursery Stock Suppliers	Arbor Gen - Blenheim, SC (800) 222-1290
	NC Forest Service Nursery - Goldsboro, NC (888) 628-7337
[Baseline] Monitoring Performers	Ward Consulting Engineers, P.C. 4805 Green Road, Suite 100, Raleigh, NC 27616
Stream Monitoring POC	Rachael Zigler - WCE - (919) 870-0526
Vegetation Monitoring POC	Chris Sheats - The Cantena Group - (919) 732-1300

Table 4. Project Baseline Information and Attributes

Project Information			
Project Name	601 East Stream Restoration Site		
County	Union County		
Project Area (acres)	12.78		
Project Coordinates (latitude and longitude)	34° 50’ 21.62” N, 80° 25’ 32.26”N		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Yadkin River Basin		
USGS Hydrologic Unit 8-Digit		USGS Hydrologic Unit 14-digit	03040105081010
DWQ Sub-basin	03-04-14		
Project Drainage Area (acres)	361.33		
Project drainage Area Percentage of Impervious Area	2%		
CGIA Land Use Classification	2.01.01.07 Annual Row Crop Rotation		

Reach Summary Information				
Parameters	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**
Length of reach (LF)	1418, 1393 LF Restored	906, 902 LF Restored	1080, 1018 LF Restored	Relic Channel, 495 LF Restored
Valley Classification	II	II	VIII	VIII
Drainage area (acres)	109	135	333	359
NCDWQ stream identification score	Intermittent: 19.5 Perennial: 33.5	33.5	33.5	33.5
NCDWQ Water Quality Classification	13-17-40-(1)	13-17-40-(1)	13-17-40-(1)	13-17-40-(1)
Morphological Description (stream type)	G4/B4/C4b	C4/E4/DA	C4/G4	G4
Evolutionary trend (reference channel evolution model used)	G	C/DA	G	G
Underlying mapped soils	Intermittent: Tatum gravelly silty clay loam Perrenial: Cid channery silt loam	Cid channery silt loam, Tatum gravelly silt loam	Chewacla silt loam	Chewacla silt loam
Drainage class	Well Drained	Moderately Well Drained	Somewhat Poorly Drained	Somewhat Poorly Drained
Soil Hydric status	Non Hydric	Non Hydric	Non Hydric	Non Hydric
Slope	2%	0.84%	0.67%	1.25%
FEMA classification	N/A	N/A	N/A	N/A
Native vegetation community	Agriculture along upstream portion of Intermittent channel. The remaining stream buffer within this reach is composed of Willow Oak, Red Maple, River Birch, Black Willow, Elderberry, and Blackberry.	Canopy species include Willow Oak, Black Willow, Red Maple, Sweetgum, Eastern Red Cedar, Tag Alder, and Silky Dogwood. Wetland A is composed of Cattails, spike rush arrow-arum, and duckweed.	Canopy species include Red Maple, Hackberry, Willow Oak, and Sweetgum. The presence of Chinese privet outcompete any shrub and herb layer.	Canopy species include Red Maple, Hackberry, Willow oak, and Sweetgum. The presence of Chinese privet outcompete any shrub and herb layer.
Percent composition of exotic invasive vegetation	0%	50% of Parrot feather	5% of Japanese stilt grass, 80% Chinese privet, and kudzu	80% Chinese privet

Table 4. Project Baseline Information and Attributes

Wetland Summary Information			
Parameters	**Wetland 1**		
Size of Wetland (acres)	0.43 ac		
Wetland Type (non-riparian, riparian riverine, or riparian non-riverine)	Non-Tidal Freshwater Marsh		
Mapped Soil Series	Cid channery Silt Loam		
Drainage class	Moderately Well Drained to Somewhat Poorly Drained		
Soil Hydric Status	Non-Hydric		
Source of Hydrology	Tanyard Branch headwaters, groundwater, and adjacent runoff		
Hydrologic Impairment	Wetland A formed from accumulating sediments filling the channel resulting in a braided channel system through the wetland.		
Native vegetation community	**Herbaceous-**Vegetation is domninated by herbaceous vegetation such as Cattail (*Typha latifolia*), Bulrush (*Scirpus cyperinus*), Common Rush (*Juncus effuses*). Some tree species such as Black Willow (*Salix nigra*), and Red Maple (*Acer rubrum*) are present in the wetland margins.		
Percent composition of exotic invasive vegetation	**95%**-The invasive Parrot Feather (*Miriophyllum aquaticum*) is dominant throughout the wetland where there is standing water.		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 404	Yes	SAW 2013-00265; EEP IMS #95756	
Waters of the United States – Section 401	Yes	DWR# 14-0547	
Endangered Species Act	No	Yes	ERTR
Historic Preservation Act	No	Yes	ERTR
Coastal Zone Management Act (CZMA)/Costal Area Management Act (CAMA)	No	N/A	
FEMA Floodplain Compliance	No	N/A	
Essential Fisheries Habitat	No	N/A	

Appendix B – Morphological Summary Data and Plots

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Table 5a. Baseline Stream Data Summary
601 East Stream Restoration, EEP Project Number 95756 - Reach 1 (1393 feet)

Parameter	Gauge[3]	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					7	21		60			7.42	9.88		11.61				10		8.82	11.45	10.77	15.13	2.23	8
Floodprone Width (ft)					8	60		101			18.51	26.43		33.59			22	28	35	40.00	74.38	69.00	154.00	35.32	8
Bankfull Mean Depth (ft)					0.2	0.5		0.9			0.68	0.79		0.97				0.72		0.50	0.81	0.77	1.20	0.26	8
[1]Bankfull Max Depth (ft)					0.7	1		1.4			1.28	1.78		2.16				1.2		0.87	1.53	1.54	2.07	0.49	8
Bankfull Cross Sectional Area (ft^2)					8	1		1.4			0.97	1.39		1.82				7.2		4.45	9.27	8.85	14.07	3.48	8
Width/Depth Ratio					1.1	27		47			8.14	12.95		16.82				13.9		8.56	15.45	14.89	25.33	5.40	8
Entrenchment Ratio					0.4	2.4		9.5			2.02	2.4		3.24			2.2	2.8	3.5	3.30	6.90	5.62	16.40	4.19	8
[1]Bank Height Ratio						0.34		2			0.97	1.39		1.82				1		0.93	0.98	1.00	1.00	0.03	8
d50 (mm)																									
Profile																									
Riffle Length (ft)					2.7	24.9		107.3			5.97	11.26		26.78			14	23	90	10.04	22.09	18.54	95.26	14.52	32
Riffle Slope (ft/ft)					0.0007	1.7		40			0.015	0.031		0.05			0.021	0.036	0.046	0.015	0.034	0.032	0.064	0.012	32
Pool Length (ft)					9.03	16.89		56.86			13.6	20.13		31.74			14	22	29	13.38	24.28	21.23	65.67	11.47	33
Pool Max depth (ft)					1	2.4		3.9			1.4	1.83		2.2				2.2		1.16	2.19	2.17	3.15	0.38	33
Pool Spacing (ft)					15.5	50		128			23.5	36.2		57.4			24	36.7	58	31.42	44.63	40.18	116.51	16.87	32
[3]Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					10	19.6		25			13	17.33		20			13	18	21	13		18	21		
Radius of Curvature (ft)					14.5	84		118			16	33		53			16	32.1	52	16		32.1	52		
Rc: Bankfull width (ft/ft)					1.7	4.6		11.5			4.35	6.04		8.9			4.3	6.1	8.9	4.3		6.1	8.9		
Meander Wavelength (ft)					36	96		240			43	59.67		88			43	61	89	43		61	89		
Meander Width Ratio					0.5	0.94		1.7			1.32	1.76		2.03			1.3	1.8	2.1	1.3		1.8	2.1		
Substrate, bed and transport parameters																									
[4]Ri%/Ru%/P%/G%/S%					45.5%		53.6%		0.0%		26.8%	17.2%	47.9%	8.1%	0.0%					44.3%		55.7%		0.0%	
[4]SC%/Sa%/G%/C%/B%/Be%					4.1%	27.3%	67.6%	1.0%	0.0%	0.0%															
[4]d16/d35/d50/d84/d95/di^p/di^{sp} (mm)					2.71	6.72	10.56	24.89	38.23																
Reach Shear Stress (competency) lb/ft^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)							0.166						0.144												
Impervious cover estimate (%)																									
Rosgen Classification							G4/B4/C4b						B4/C4					B4/C4b				B4/C4b			
Bankfull Velocity (fps)							3.2											3.2							
Bankfull Discharge (cfs)							24																		
Valley length (ft)							1425						378												
Channel Thalweg length (ft)							1479						440					1438				1438			
Sinuosity (ft)							1.04						1.16					1.17				1.17			
Water Surface Slope (Channel) (ft/ft)							0.0196											0.017				0.017			
BF slope (ft/ft)																		0.017				0.017			
[5]Bankfull Floodplain Area (acres)																									
[6]Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = Methodolgy should be described/cited. 3 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare). 4 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock, di^p=max pave, di^{sp}=max subpave Shaded cells indicate that these will typically not be filled in. 5. Utilizing survey data produce and estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace rise/slope. 6 = Proportion of reach determined to be over-wide based on the visual survey using the regional curve UL for width (see monitoring methodology document -pending); 7 = Entrechment Class (ER ranges (see monitoring methodolgy document -pending). 8 = Incision Class (BHR ranges - see monitoring methodology document -pending) Footnotes 6, 7, 8 involve planning pre-construction monitoring for future projects. If the referenced monitoring methodology document is not available at the time of contracting or RFP review, the provider is not expected to address these parameters.

Table 5b. Baseline Stream Data Summary
601 East Stream Restoration, EEP Project Number 95756 - Reach 2 (902 feet)

Parameter	Gauge[3]	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					7	21		19			10	12.2		14.3				12		15.50	19.73	19.63	24.18	3.56	4
Floodprone Width (ft)					40	60		214			42	77		11			48	91.5	135	62.00	108.75	102.50	168.00	50.05	4
Bankfull Mean Depth (ft)					0.5	0.5		1.33			0.92	1.12		1.34				0.9		0.61	0.93	0.90	1.31	0.32	4
[1]Bankfull Max Depth (ft)					0.7	1		1.9			1.2	1.6		2.2				1.5		1.49	2.01	2.02	2.53	0.58	4
Bankfull Cross Sectional Area (ft^2)					6	1		21			12.2	13		13.4				10.7		9.43	18.42	19.49	25.26	6.75	4
Width/Depth Ratio					6.1	27		38			7.7	11.3		15.6				13.3		14.64	23.00	22.13	33.10	8.07	4
Entrenchment Ratio					2.2	2.4		10			2.9	6.5		8.6			3.6	7.6	10	2.56	5.63	5.79	8.39	2.54	4
[1]Bank Height Ratio					0.9	0.34		1.7			1.1	1.5		1.7				1		0.90	0.96	0.96	1.00	0.05	4
d50 (mm)																									
Profile																									
Riffle Length (ft)					10.9	24.9		19.7			4.03	14.18		13.61			14	23	90	12.13	23.38	18.96	50.22	10.70	18
Riffle Slope (ft/ft)					0.00	1.7		0.04			0.006	0.02		0.05			0.021	0.036	0.046	0.004	0.02	0.02	0.04	0.01	17
Pool Length (ft)					11.1	16.89		525.4			18.51	32.11		58.03			14	22	29	15.06	32.87	29.14	74.26	14.68	17
Pool Max depth (ft)					1.9	2.4		4.2			1.7	2.47		3.1				2.5		1.91	2.87	2.67	4.03	0.59	17
Pool Spacing (ft)					20	50		512			29	48		84			38	57	85	32.94	55.57	47.60	110.28	20.48	17
[3]Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					12	32		42			25	40		65			25	40	65	25		40	65		
Radius of Curvature (ft)					68	75		77			20	31		65			38	47	58	38		47	58		
Rc: Bankfull width (ft/ft)					5.2	5.7		5.9			3.2	3.9		4.8			3.2	3.9	4.8	3.2		3.9	4.8		
Meander Wavelength (ft)					46	70		97			61	84		97			61	84	97	61		84	97		
Meander Width Ratio					0.9	2.4		3.2			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Substrate, bed and transport parameters																									
[4]Ri%/Ru%/P%/G%/S%					12.6%		87.4%		0.0%		27.2%	3.7%	61.5%	7.6%	0%					39.5%		60.5%		0.0%	
[4]SC%/Sa%/G%/C%/B%/Be%					0.0%	33.7%	66.3%	0.0%	0.0%	0.0%															
[4]d16/d35/d50/d84/d95/d^p/di^{sp} (mm)					0.90	4.57	8.92	24.42	47.93																
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)					0.212						0.5														
Impervious cover estimate (%)																									
Rosgen Classification					C4/E4/DA						C4						C4/E4			C4/E4					
Bankfull Velocity (fps)					2.1												2.6								
Bankfull Discharge (cfs)					27																				
Valley length (ft)					830						378														
Channel Thalweg length (ft)					1479						440						945			945					
Sinuosity (ft)					1.01						1.1						1.34			1.34					
Water Surface Slope (Channel) (ft/ft)																	0.0069			0.0069					
BF slope (ft/ft)																	0.0069			0.0069					
[5]Bankfull Floodplain Area (acres)																									
[6]Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = Methodolgy should be described/cited. 3 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare). 4 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock, di^p=max pave, di^{sp}=max subpave Shaded cells indicate that these will typically not be filled in. 5. Utilizing survey data produce and estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace rise/slope. 6 = Proportion of reach determined to be over-wide based on the visual survey using the regional curve UL for width (see monitoring methodology document -pending); 7 = Entrechment Class (ER ranges (see monitoring methodolgy document -pending). 8 = Incision Class (BHR ranges - see monitoring methodology document -pending)Footnotes 6, 7, 8 involve planning pre-construction monitoring for future projects. If the referenced monitoring methodology document is not available at the time of contracting or RFP review, the provider is not expected to address these parameters.

Table 5c. Baseline Stream Data Summary
601 East Stream Restoration, EEP Project Number 95756 - Reach 3 (1018 feet)

Parameter	Gauge[3]	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					65	15.7		29			10	12.2		14.3				17		15.86	17.69	17.66	19.58	1.52	4
Floodprone Width (ft)					150	200		2601.26			42	77		11			150	200	300	75.00	231.25	250.00	350.00	140.50	4
Bankfull Mean Depth (ft)					0.5	0.9		2.1			0.92	1.12		1.34				1.18		0.79	1.26	1.21	1.84	0.54	4
[1]Bankfull Max Depth (ft)					1.28	1.7		19.4			1.2	1.6		2.2				2		1.58	2.51	2.52	3.44	1.06	4
Bankfull Cross Sectional Area (ft^2)					10.5	14.5		31			12.2	13		13.4				21		12.85	22.79	21.12	36.08	11.26	4
Width/Depth Ratio					12.8	17.5		16.5			7.7	11.3		15.6				14.4		10.62	15.88	15.27	22.36	5.98	4
Entrenchment Ratio					9.6	12.7		4			2.9	6.5		8.6			8.8	11.8	17.6	4.73	12.74	13.17	19.90	7.31	4
[1]Bank Height Ratio					1.3	2.2		1.7			1.1	1.5		1.7				1		0.99	1.00	1.00	1.00	0.01	4
d50 (mm)																									
Profile																									
Riffle Length (ft)					0.97	10.58		23.77			4.03	14.18		13.61			15	25	103	10.12	24.10	16.77	110.25	22.07	19
Riffle Slope (ft/ft)					0	0.2		0.6			0.006	0.02		0.05			0.008	0.018	0.03	0.00	0.02	0.02	0.04	0.01	17
Pool Length (ft)					7.83	20.87		64.91			18.51	32.11		58.03			25	35	50	27.38	35.18	35.18	49.71	6.68	18
Pool Max depth (ft)					1.8	2.7		3.4			1.7	2.47		3.1				3.4		1.93	2.91	2.98	3.50	0.36	18
Pool Spacing (ft)					8	48		125			29	48		84			39	66	117	41.11	58.55	54.44	137.89	20.86	18
[3]Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					13	41		58			25	40		65			35	56	92	35		56	92		
Radius of Curvature (ft)					22.5	49.7		78			20	31		65			27	43	63	27		43	63		
Rc: Bankfull width (ft/ft)					1.4	3.2		4.9			3.2	3.9		4.8			1.6	2.5	3.7	1.6		2.5	3.7		
Meander Wavelength (ft)					32	57		89			61	84		97			87	119	134	87		119	134		
Meander Width Ratio					1.3	2.6		3.7			2.1	3.3		5.4			2.1	3.3	5.4	2.1		3.3	5.4		
Substrate, bed and transport parameters																									
[4]Ri%/Ru%/P%/G%/S%					38.0%		62.0%		0.0%		27.2%	3.7%	61.5%	7.6%	0.0%					43.0%		57.0%		0.0%	
[4]SC%/Sa%/G%/C%/B%/Be%					4.0%	51.9%	44.1%	0.0%	0.0%	0%															
[4]d16/d35/d50/d84/d95/d^p/di^{sp} (mm)					0.8	3.5	5.4	12.8	19.6																
Reach Shear Stress (competency) lb/ft^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)					0.52						0.5														
Impervious cover estimate (%)																									
Rosgen Classification					C4-G4						E4/C4						C4			C4					
Bankfull Velocity (fps)					3.2												3			3					
Bankfull Discharge (cfs)					55																				
Valley length (ft)																									
Channel Thalweg length (ft)																	1064			1064					
Sinuosity (ft)					1.05						1.2						1.2			1.2					
Water Surface Slope (Channel) (ft/ft)																	0.0056			0.0056					
BF slope (ft/ft)																	0.0056			0.0056					
[5]Bankfull Floodplain Area (acres)																									
[6]Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = Methodolgy should be described/cited. 3 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare). 4 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock, di^p=max pave, di^{sp}=max subpave Shaded cells indicate that these will typically not be filled in. 5. Utilizing survey data produce and estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace rise/slope. 6 = Proportion of reach determined to be over-wide based on the visual survey using the regional curve UL for width (see monitoring methodology document -pending); 7 = Entrechment Class (ER ranges (see monitoring methodolgy document -pending). 8 = Incision Class (BHR ranges - see monitoring methodology document -pending)Footnotes 6, 7, 8 involve planning pre-construction monitoring for future projects. If the referenced monitoring methodology document is not available at the time of contracting or RFP review, the provider is not expected to address these parameters.

Table 5d. Baseline Stream Data Summary
601 East Stream Restoration, EEP Project Number 95756 - Reach 4 (495 feet)

Parameter	Gauge[3]	Regional Curve			Pre- Existing Conditions						Reference Reach(es) Data						Design			As-built / Baseline					
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)					5.2	11.6		20			7.42	9.88		11.61				16		14.93	15.92	15.92	16.91	1.40	2
Floodprone Width (ft)					16	20		25			18.51	26.43		33.59			30	35	40	30.39	36.19	36.19	42.00	8.21	2
Bankfull Mean Depth (ft)					0.76	0.9		1.1			0.68	0.79		0.97				0.98		0.98	1.37	1.37	1.76	0.55	2
[1]Bankfull Max Depth (ft)					.	1.2		1.33			1.28	1.78		2.16				1.8		1.49	2.11	2.11	2.72	0.87	2
Bankfull Cross Sectional Area (ft^2)					12.3	15		16			0.97	1.39		1.82				15.7		14.70	22.25	22.25	29.81	10.68	2
Width/Depth Ratio					7	12.9		18			8.14	12.95		16.82				16.3		9.60	12.38	12.38	15.16	3.93	2
Entrenchment Ratio					1.4	1.7		2.2			2.02	2.4		3.24			1.9	2.2	2.5	2.04	2.26	2.26	2.48	0.32	2
[1]Bank Height Ratio					3.3	3.5		4.2			0.97	1.39		1.82				1		1.00	1.10	1.10	1.20	0.14	2
d50 (mm)																									
Profile																									
Riffle Length (ft)					0.79	10.58		23.7			5.97	11.26		26.78			15	23	103	15.84	20.829	18.18	28.96	4.7764	9
Riffle Slope (ft/ft)					0	0.02		0.06			0.015	0.031		0.05			0.021	0.036	0.03	0.018	0.0274	0.0298	0.0382	0.0068	9
Pool Length (ft)					7.83	20.7		64.91			13.6	20.13		31.74			14	22	42	30.82	35.01	35.78	38.85	3.1243	9
Pool Max depth (ft)					2	2.5		3.2			1.4	1.83		2.2				2.2		1.997	2.8154	2.753	3.392	0.3909	9
Pool Spacing (ft)					12	29		55			23.5	36.2		57.4			38	59	93	49.77	56.111	54.805	69.26	6.2441	8
[3]Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)					12	32		82			13	17.33		20			21	28	32	21		28	32		
Radius of Curvature (ft)					18	34.9		61			16	33		53			26	52	84	26		52	84		
Rc: Bankfull width (ft/ft)					1.6	3		5.3			4.35	6.04		8.9			162	3.25	5.25	162		3.25	5.25		
Meander Wavelength (ft)					30	56		113			43	59.67		88			69	97	142	69		97	142		
Meander Width Ratio					1.1	2.8		7.2			1.32	1.76		2.03			1.32	1.76	2.03	1.32		1.76	2.03		
Substrate, bed and transport parameters																									
[4]Ri%/Ru%/P%/G%/S%					19.9%		80.1%		0.0%		26.8%	17.2%	47.9%	8.1%	0.0%					39.1%		65.6%		0.0%	
[4]SC%/Sa%/G%/C%/B%/Be%																									
[4]d16/d35/d50/d84/d95/di^P/di^{SP} (mm)																									
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) Mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)							0.56						0.144												
Impervious cover estimate (%)																									
Rosgen Classification							G4						B4/C4					B4				B4			
Bankfull Velocity (fps)							4											3.27				3.27			
Bankfull Discharge (cfs)							55																		
Valley length (ft)													378												
Channel Thalweg length (ft)													440					465				465			
Sinuosity (ft)							1.04						1.16					1.13				1.13			
Water Surface Slope (Channel) (ft/ft)																		0.0114				0.0114			
BF slope (ft/ft)																		0.0114				0.0114			
[5]Bankfull Floodplain Area (acres)																									
[6]Proportion over wide (%)																									
Entenchment Class (ER Range)																									
Incision Class (BHR Range)																									
BEHI VL%/L%/M%/H%/VH%/E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = Methodolgy should be described/cited. 3 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare). 4 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock, di^P=max pave, di^{SP}=max subpave Shaded cells indicate that these will typically not be filled in. 5. Utilizing survey data produce and estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace rise/slope. 6 = Proportion of reach determined to be over-wide based on the visual survey using the regional curve UL for width (see monitoring methodology document -pending); 7 = Entrechment Class (ER ranges (see monitoring methodolgy document -pending). 8 = Incision Class (BHR ranges - see monitoring methodology document -pending) Footnotes 6, 7, 8 involve planning pre-construction monitoring for future projects. If the referenced monitoring methodology document is not available at the time of contracting or RFP review, the provider is not expected to address these parameters.

Table 6a. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters-Cross Section)

601 East Stream Restoration, EEP Project Number 95756 - Reach 1 (1393 feet)

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							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+
Bankfull Width (ft)	13.64							15.13							9.39							8.82						
Floodprone Width (ft)	45							77							154							75						
Bankfull Mean Depth (ft)	1.03							0.60							0.92							0.50						
Bankfull Max Depth (ft)	2.07							1.20							1.76							0.87						
Bankfull Cross Sectional Area (ft^2)	14.07							9.04							8.67							4.45						
Bankfull Width/Depth Ratio	13.22							25.33							10.17							17.48						
Bankfull Entrenchment Ratio	10.26							9.25							14.91							15.87						
Bankfull Bank Height Ratio	1.00							1.00							1.00							0.93						
Based on current/developing bankfull feature[2]																												
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)	22.967525							14.25679							14.58241							8.58						
d50 (mm)																												
	Cross Section 5 (Pool)							**Cross Section 6 (Riffle)**							**Cross Section 7 (Pool)**							**Cross Section 8 (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+
Bankfull Width (ft)	12.92							11.29							10.25							10.13						
Floodprone Width (ft)	61							80							63							40						
Bankfull Mean Depth (ft)	0.99							0.59							1.20							0.61						
Bankfull Max Depth (ft)	2.02							1.31							1.98							1.01						
Bankfull Cross Sectional Area (ft^2)	12.84							6.62							12.27							6.20						
Bankfull Width/Depth Ratio	12.99							19.26							8.56							16.55						
Bankfull Entrenchment Ratio	17.42							9.74							10.73							10.86						
Bankfull Bank Height Ratio	0.94							1.00							1.00							1.00						
Based on current/developing bankfull feature[2]																												
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)	20.51714							16.673495							24.88571							11.37						
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

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

Table 6b. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters-Cross Section)

601 East Stream Restoration, EEP Project Number 95756 - Reach 2 (902 feet)

	Cross Section 9 (Riffle)							Cross Section 10 (Pool)							Cross Section 11 (Riffle)							Cross Section 12 (Pool)						
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+
Bankfull Width (ft)	24.18							19.23							15.50							20.02						
Floodprone Width (ft)	62							132							73							168						
Bankfull Mean Depth (ft)	0.73							1.31							0.61							1.06						
Bankfull Max Depth (ft)	1.54							2.53							1.49							2.50						
Bankfull Cross Sectional Area (ft^2)	17.66							25.26							9.43							21.33						
Bankfull Width/Depth Ratio	33.10							14.64							25.45							18.80						
Bankfull Entrenchment Ratio	5.79							11.70							7.10							6.99						
Bankfull Bank Height Ratio	1.00							1.00							0.90							0.93						
Based on current/developing bankfull feature[2]																												
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)	30.35249							44.920645							28.42963							37.27						
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

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 6c. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters-Cross Section)

601 East Stream Restoration, EEP Project Number 95756 - Reach 3 (1018 feet)

	Cross Section 13 (Riffle)							Cross Section 14 (Pool)							Cross Section 15 (Pool)							Cross Section 16 (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+
Bankfull Width (ft)	15.86							17.58							19.58							17.74						
Floodprone Width (ft)	75							350							350							150						
Bankfull Mean Depth (ft)	0.81							1.60							1.84							0.79						
Bankfull Max Depth (ft)	1.61							3.43							3.44							1.58						
Bankfull Cross Sectional Area (ft^2)	12.85							28.18							36.08							14.07						
Bankfull Width/Depth Ratio	19.57							10.97							10.62							22.36						
Bankfull Entrenchment Ratio	8.83							12.80							5.62							7.89						
Bankfull Bank Height Ratio	1.00							1.00							1.00							0.99						
Based on current/developing bankfull feature[2]																												
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)	21.49233							34.1507							39.69315							18.87						
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

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.

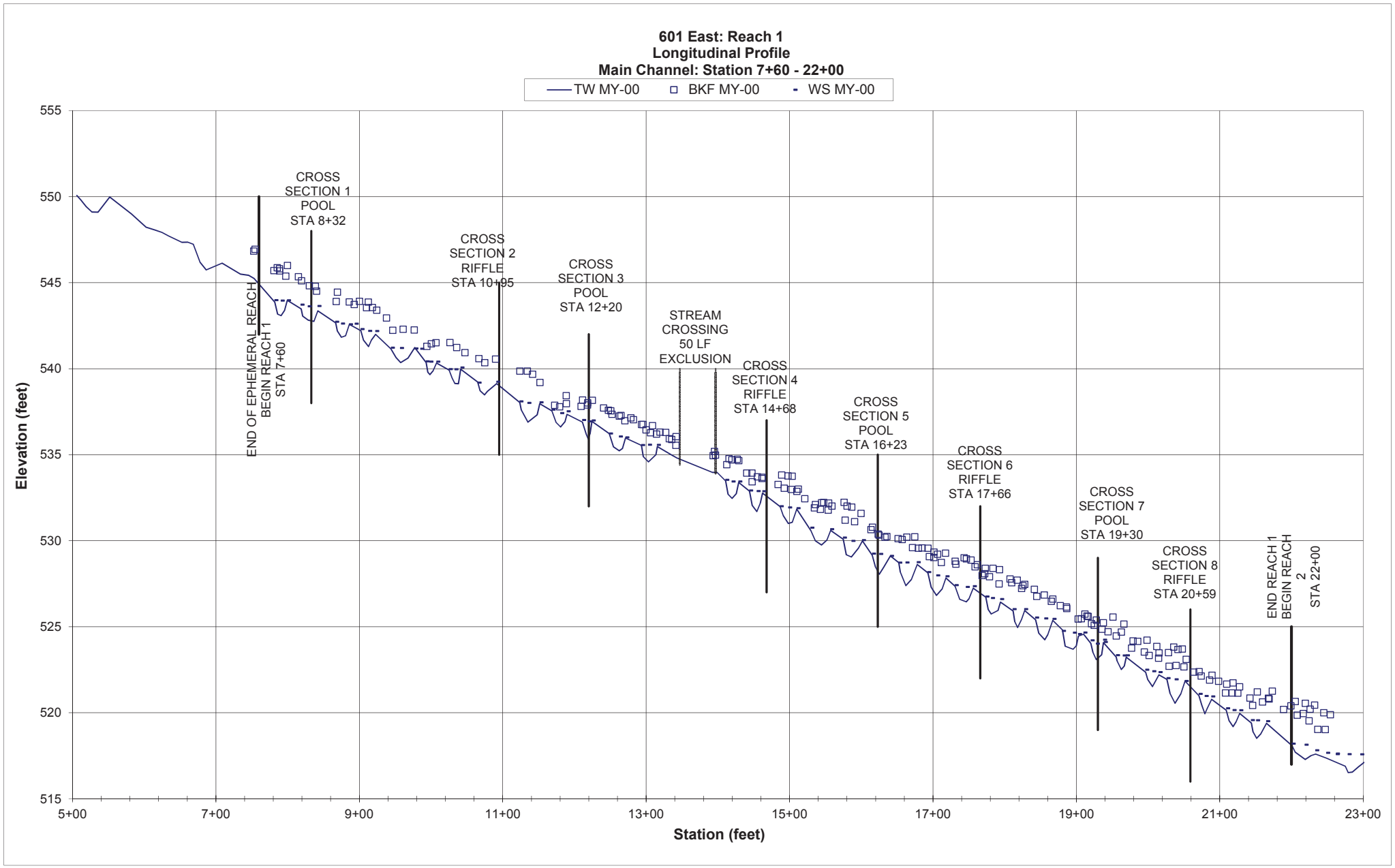
Table 6d. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters-Cross Section)

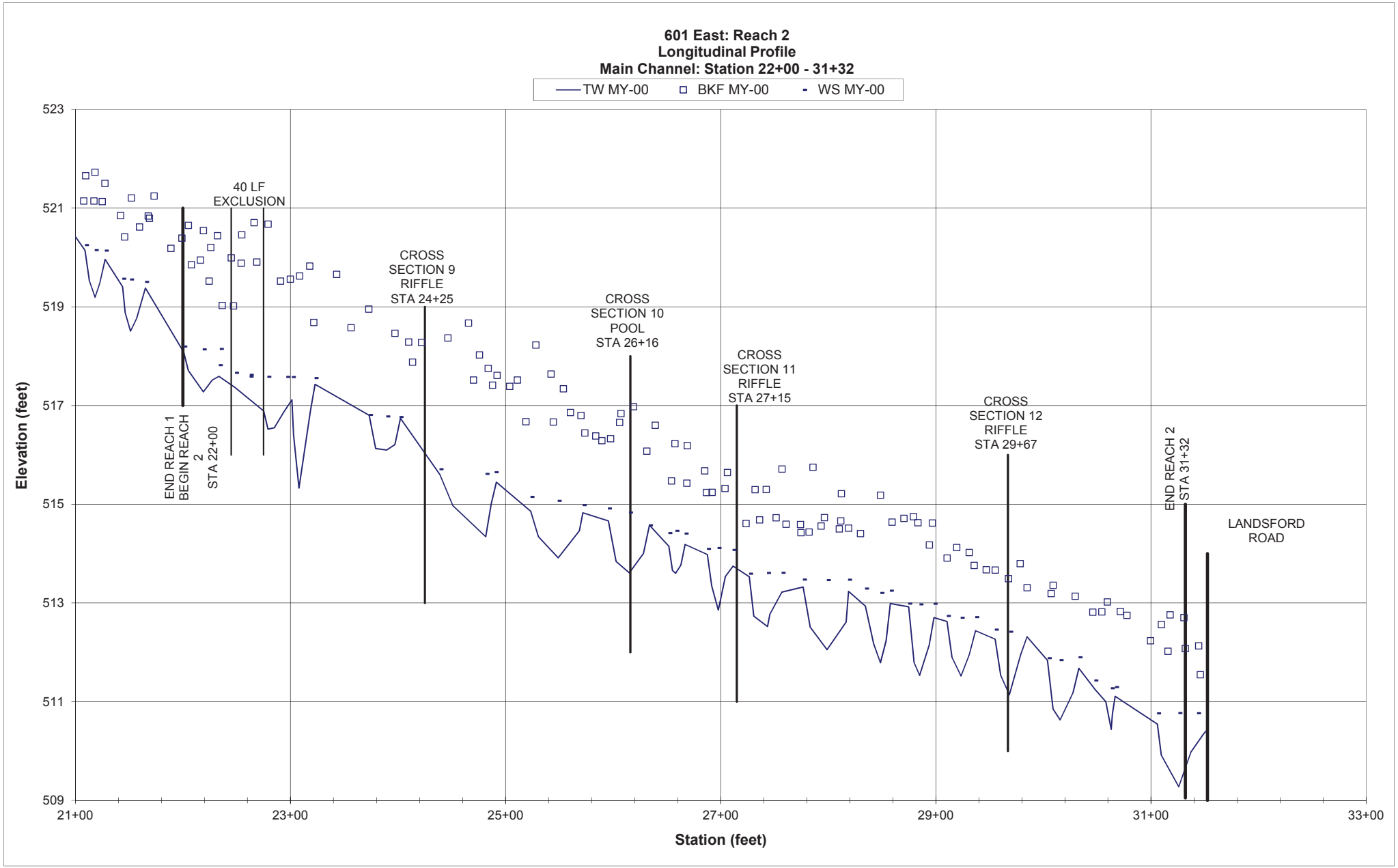
601 East Stream Restoration, EEP Project Number 95756 - Reach 4 (495 feet)

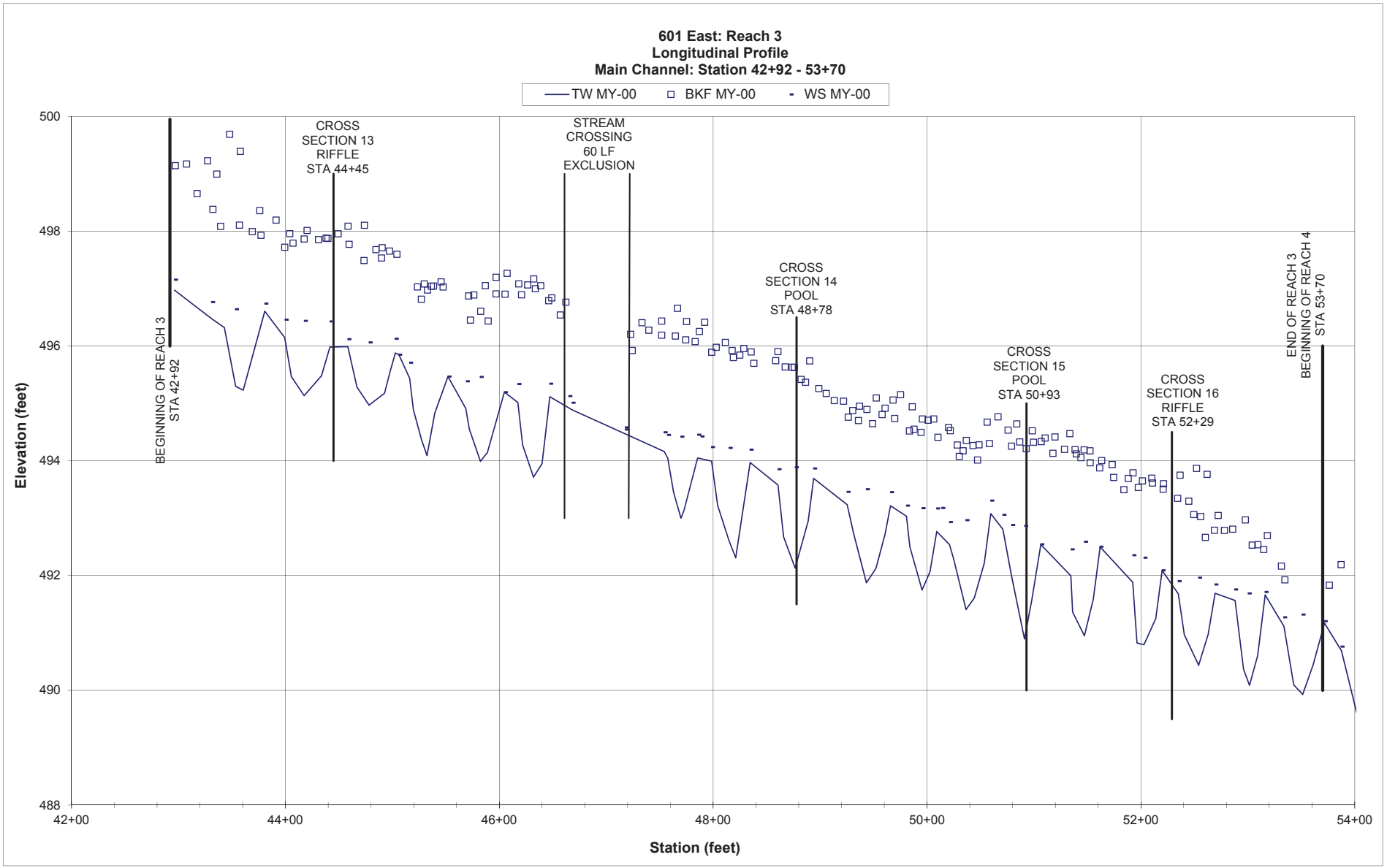
	Cross Section 17 (Pool)							Cross Section 18 (Riffle)							Cross Section 3 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	16.91							14.93													
Floodprone Width (ft)	42							30.3896229													
Bankfull Mean Depth (ft)	1.76							0.98													
Bankfull Max Depth (ft)	2.72							1.49													
Bankfull Cross Sectional Area (ft^2)	29.81							14.70													
Bankfull Width/Depth Ratio	9.60							15.16													
Bankfull Entrenchment Ratio	2.48							2.04													
Bankfull Bank Height Ratio	1.20							1.00													
Based on current/developing bankfull feature[2]																					
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)	99.86796							86.17401													
d50 (mm)																					

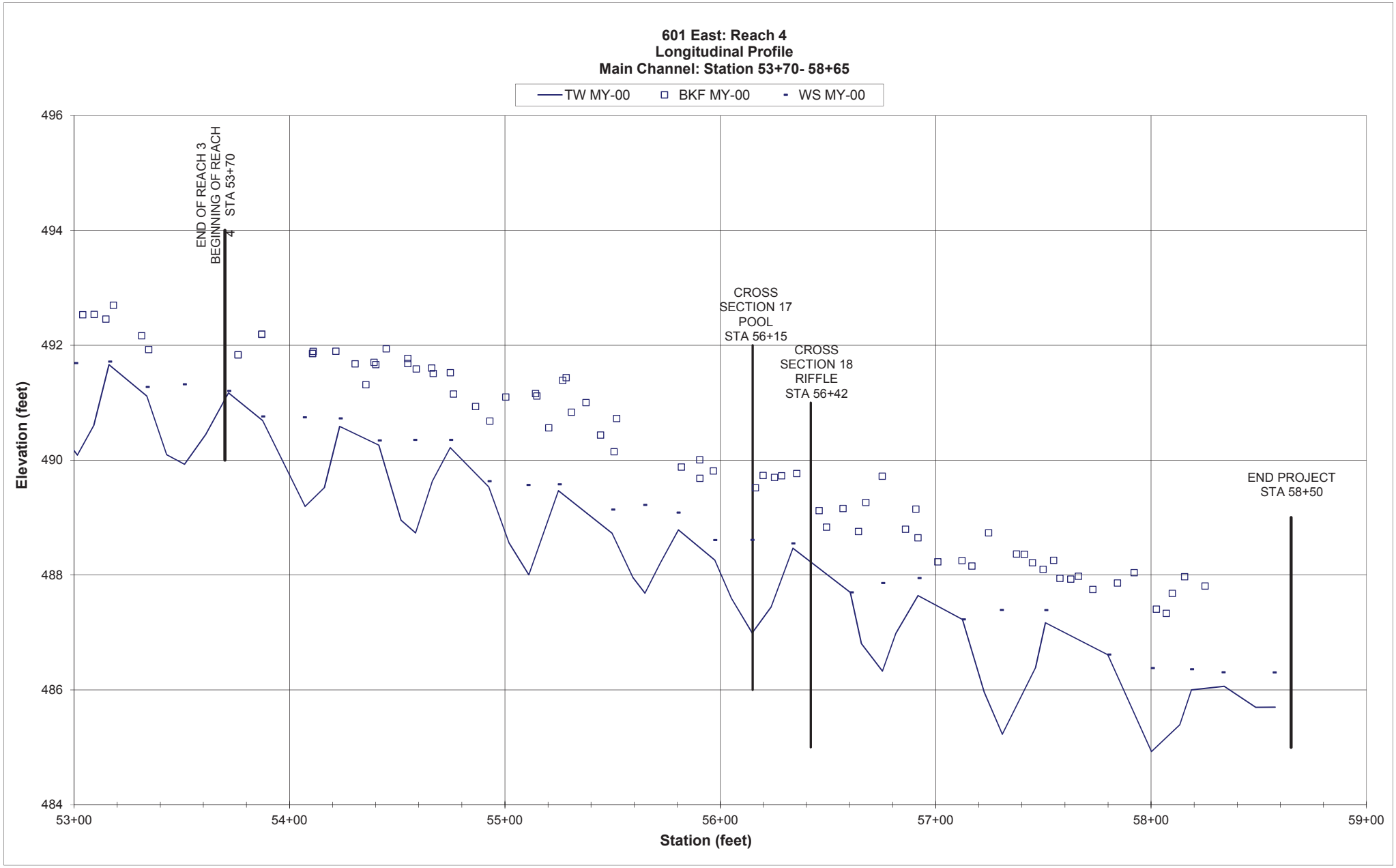
1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the

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.


601 East: Reach 1
Longitudinal Profile
Main Channel: Station 7+60 - 22+00
TW MY-00
BKF MY-00
WS MY-00
Elevation (feet)
Station (feet)
555
550
545
540
535
530
525
520
515
5+00
7+00
9+00
11+00
13+00
15+00
17+00
19+00
21+00
23+00
END OF EPHEMERAL REACH
BEGIN REACH 1
STA 7+60
CROSS SECTION 1 POOL STA 8+32
CROSS SECTION 2 RIFFLE STA 10+95
CROSS SECTION 3 POOL STA 12+20
STREAM CROSSING 50 LF EXCLUSION
CROSS SECTION 4 RIFFLE STA 14+68
CROSS SECTION 5 POOL STA 16+23
CROSS SECTION 6 RIFFLE STA 17+66
CROSS SECTION 7 POOL STA 19+30
CROSS SECTION 8 RIFFLE STA 20+59
END REACH 1
BEGIN REACH 2
STA 22+00


601 East: Reach 2
Longitudinal Profile
Main Channel: Station 22+00 - 31+32
TW MY-00
BKF MY-00
WS MY-00
Elevation (feet)
523
521
519
517
515
513
511
509
21+00
23+00
25+00
27+00
29+00
31+00
33+00
Station (feet)
40 LF EXCLUSION
END REACH 1
BEGIN REACH 2
STA 22+00
CROSS SECTION 9 RIFFLE STA 24+25
CROSS SECTION 10 POOL STA 26+16
CROSS SECTION 11 RIFFLE STA 27+15
CROSS SECTION 12 RIFFLE STA 29+67
END REACH 2
STA 31+32
LANDSFORD ROAD


601 East: Reach 3
Longitudinal Profile
Main Channel: Station 42+92 - 53+70
TW MY-00
BKF MY-00
WS MY-00
Elevation (feet)
Station (feet)
500
498
496
494
492
490
488
42+00
44+00
46+00
48+00
50+00
52+00
54+00
BEGINNING OF REACH 3
STA 42+92
CROSS
SECTION 13
RIFFLE
STA 44+45
STREAM
CROSSING
60 LF
EXCLUSION
CROSS
SECTION 14
POOL
STA 48+78
CROSS
SECTION 15
POOL
STA 50+93
CROSS
SECTION 16
RIFFLE
STA 52+29
END OF REACH 3
BEGINNING OF REACH 4
STA 53+70


601 East: Reach 4
Longitudinal Profile
Main Channel: Station 53+70- 58+65
TW MY-00
BKF MY-00
WS MY-00
Elevation (feet)
Station (feet)
496
494
492
490
488
486
484
53+00
54+00
55+00
56+00
57+00
58+00
59+00
END OF REACH 3
BEGINNING OF REACH 4
STA 53+70
CROSS SECTION 17
POOL
STA 56+15
CROSS SECTION 18
RIFFLE
STA 56+42
END PROJECT
STA 58+50

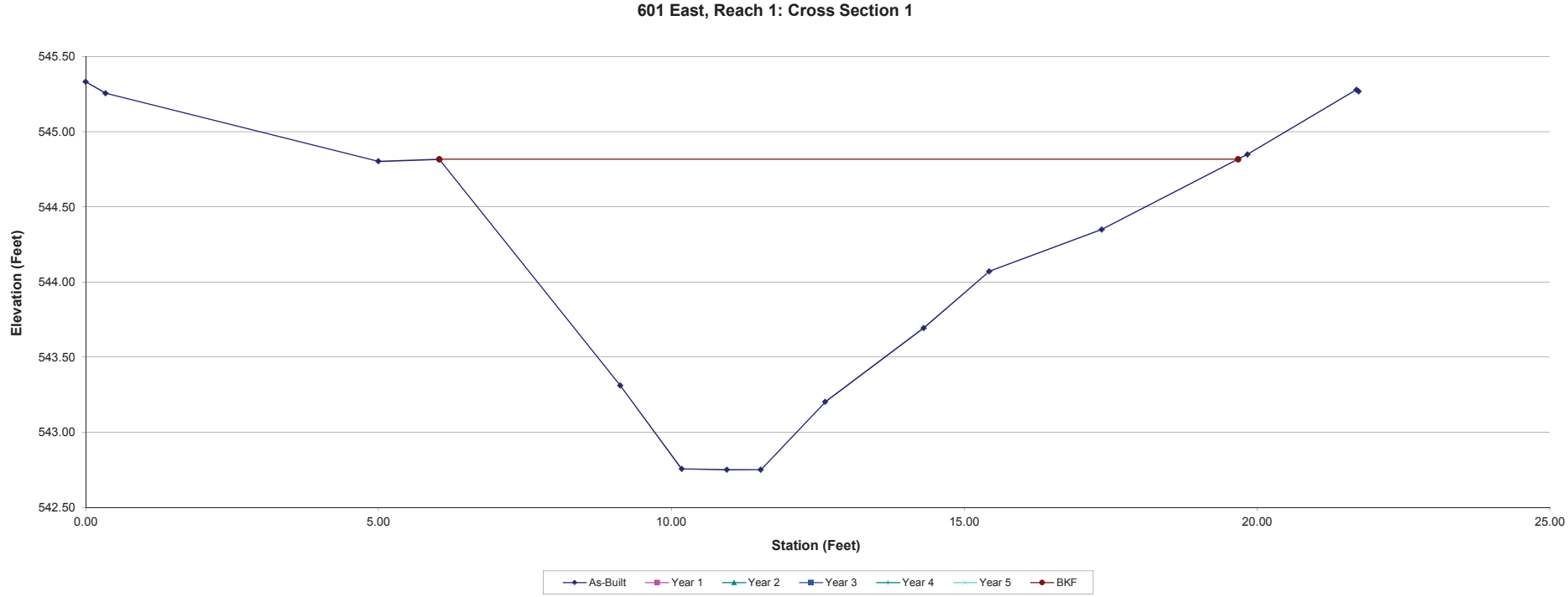
Project:	601 East
Cross Section:	Cross Section 1
Feature	Pool
Station:	8+32
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	14.1					
W (BKF)	13.6					
Max d	2.1					
Mean d	1.0					
W/D	13.2					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04-Ye	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevatio
	545.33	LPIN											
0.34	545.26												
5.00	544.80												
6.04	544.82	Bankfull left TOBL											
9.13	543.31												
10.18	542.76	TOE L											
10.95	542.75	TW											
11.53	542.75												
12.63	543.20	TOE R											
14.31	543.69												
15.43	544.07												
17.35	544.35												
19.84	544.85												
21.70	545.28	Bankfull right TOBR											
21.74	545.27	RPIN											

Photo of XS-1, looking in the downstream direction



Project:	601 East
Cross Section:	Cross Section 2
Feature	Riffle
Station:	10+95
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	9.0					
W (BKF)	15.1					
Max d	1.2					
Mean d	0.6					
W/D	25.3					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04-Ye	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevatio
	540.72	LPIN											
0.12	540.64												
0.75	540.40	TOBL Bankfull left											
1.44	540.14												
4.26	539.91												
7.46	539.82												
9.65	539.34												
10.27	539.21	TOE L											
10.48	539.20	TW											
11.25	539.30	TOE R											
11.58	539.29												
12.68	539.46												
12.81	539.77												
15.59	540.34												
16.47	540.52	TOBR Bankfull right											
18.33	540.48												
19.40	540.46												
19.40	540.66	Rpin											

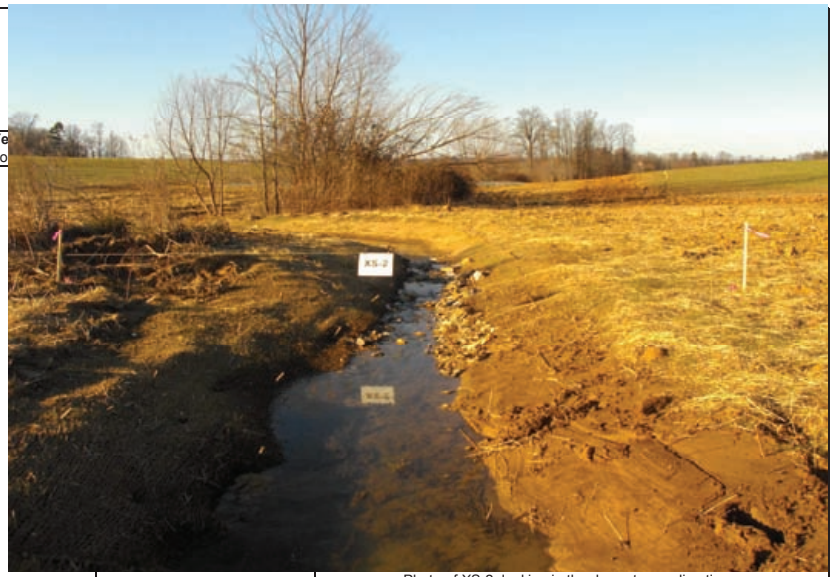


Photo of XS-2, looking in the downstream direction

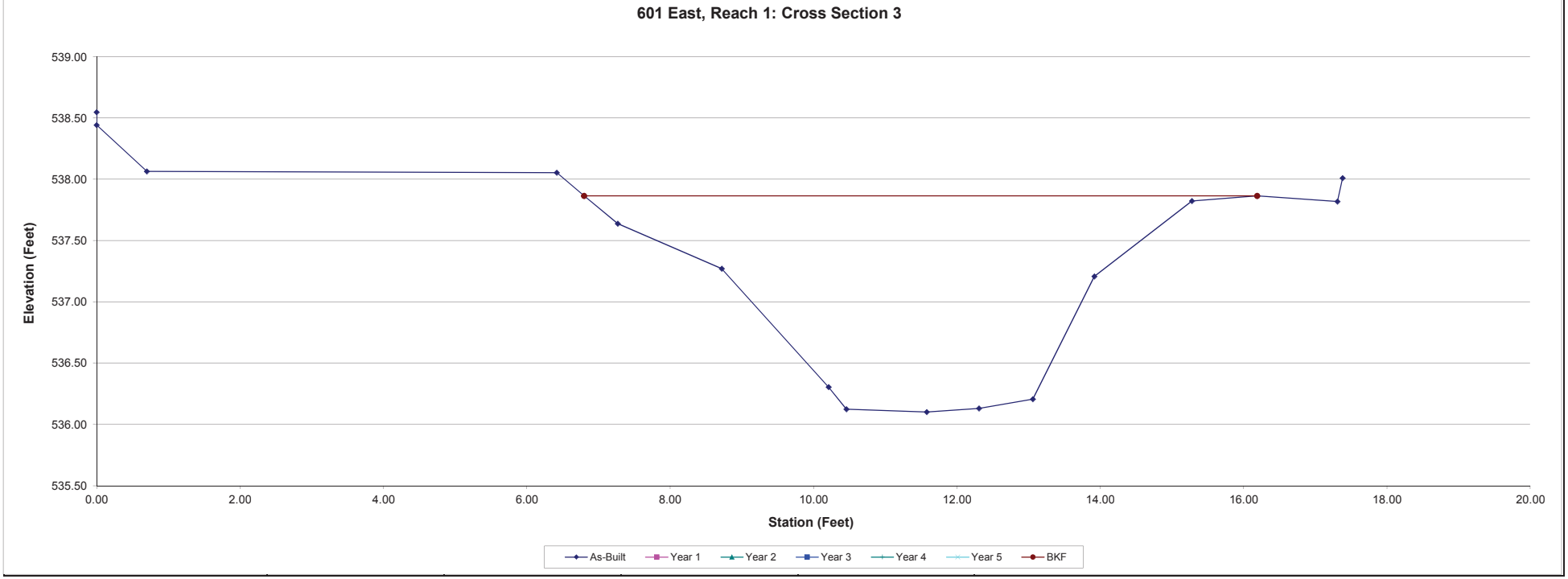
Project:	601 East
Cross Section:	Cross Section 3
Feature	Pool
Station:	12+20
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	8.7					
W (BKF)	9.4					
Max d	1.8					
Mean d	0.9					
W/D	10.2					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04-	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Eleva
	538.55	LPIN											
	538.44												
0.70	538.07												
6.42	538.06												
6.80	537.87	TOBL BANKFULL LEFT											
7.27	537.64												
8.72	537.27												
10.21	536.30	TOE L											
10.46	536.13												
11.58	536.10	TW											
12.31	536.13												
13.06	536.21	TOE R											
13.92	537.21												
15.28	537.82												
16.19	537.87	TOBR BANKFULL RIGHT											
17.31	537.82												
17.38	538.01	RPIN											

Photo of XS-3, looking in the downstream direction

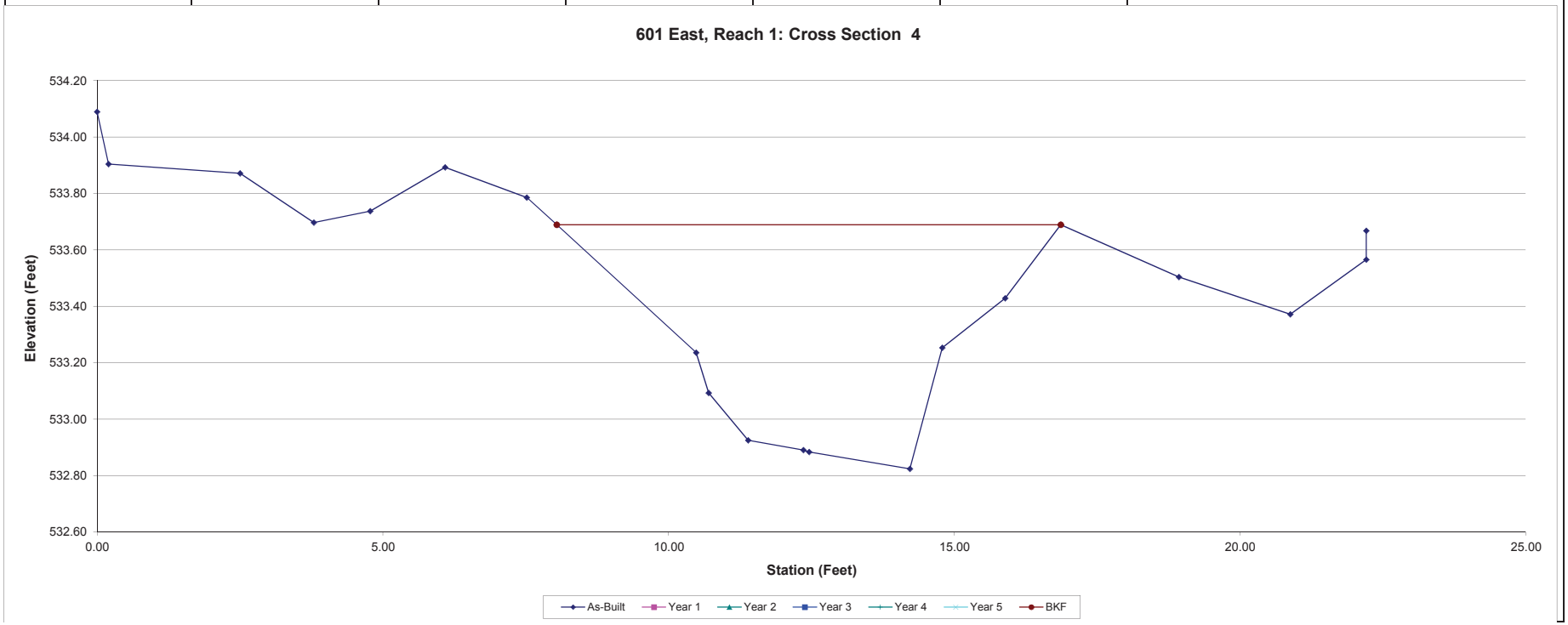


Project:	601 East
Cross Section:	Cross Section 4
Feature	Riffle
Station:	14+68
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)						
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	4.5					
W (BKF)	8.8					
Max d	0.9					
Mean d	0.5					
W/D	17.5					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elev
	534.09	LPIN											
0.20	533.90												
2.50	533.87												
3.79	533.70												
4.78	533.74												
6.09	533.89												
7.52	533.79												
8.04	533.69	BANKFULL LEFT											
10.48	533.24												
10.70	533.09												
11.39	532.93	TOE L											
12.36	532.89												
12.46	532.88	TW											
14.22	532.82	TOE R											
14.79	533.25												
15.89	533.43												
16.86	533.69	BANKFULL RIGHT											
18.93	533.50												
20.88	533.37												
22.21	533.57												
22.21	533.67	RPIN											

Photo of XS-4, looking in the downstream direction



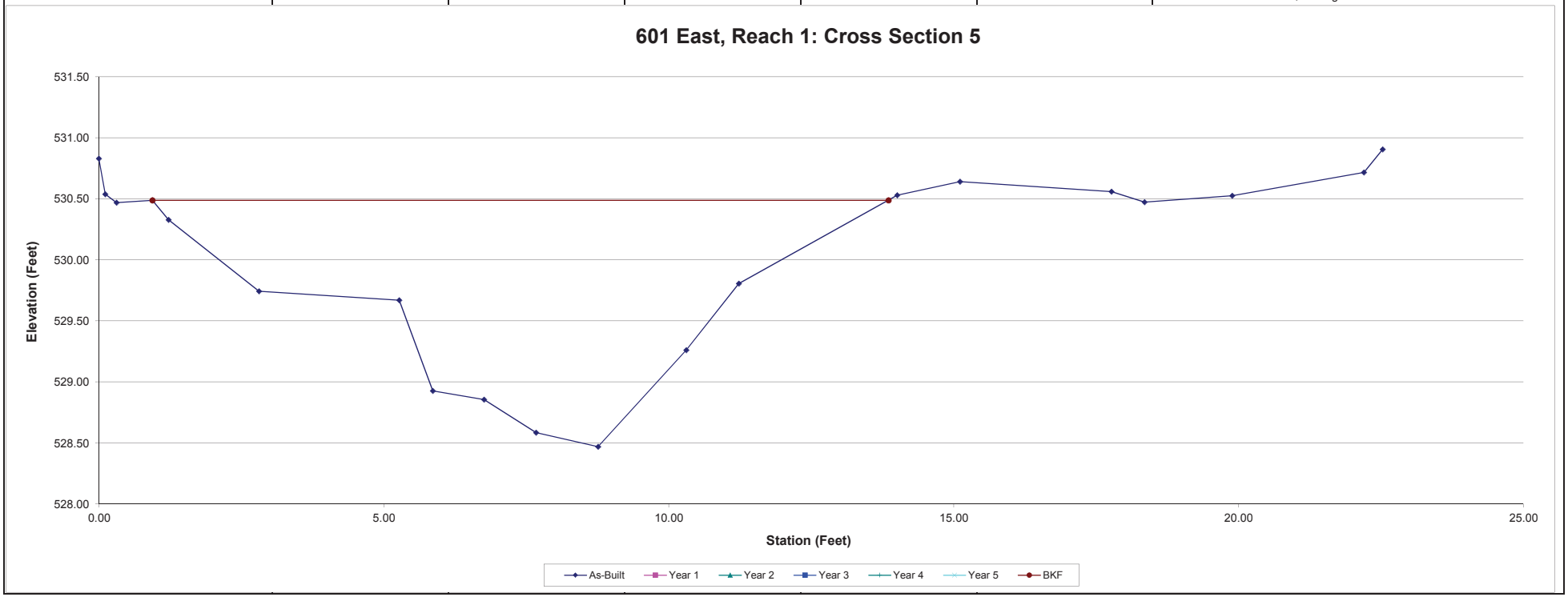
Project:	601 East
Cross Section:	Cross Section 5
Feature	Pool
Station:	16+23
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	12.8					
W (BKF)	12.9					
Max d	2.0					
Mean d	1.0					
W/D	13.0					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
	530.83	LPIN										
0.11	530.54											
0.31	530.47											
0.94	530.49	TOBL BANKFULL LEFT										
1.22	530.33											
2.81	529.74											
5.27	529.67											
5.86	528.93											
6.76	528.86	TOE L										
7.67	528.59	TW										
8.76	528.47	TOE R										
10.31	529.26											
11.23	529.81											
14.01	530.53											
15.11	530.64	TOBR BANKFULL RIGHT										
17.77	530.56											
18.35	530.47											
19.89	530.52											
22.20	530.72											
22.53	530.90	RPIN										

Photo of XS-5, looking in the downstream direction



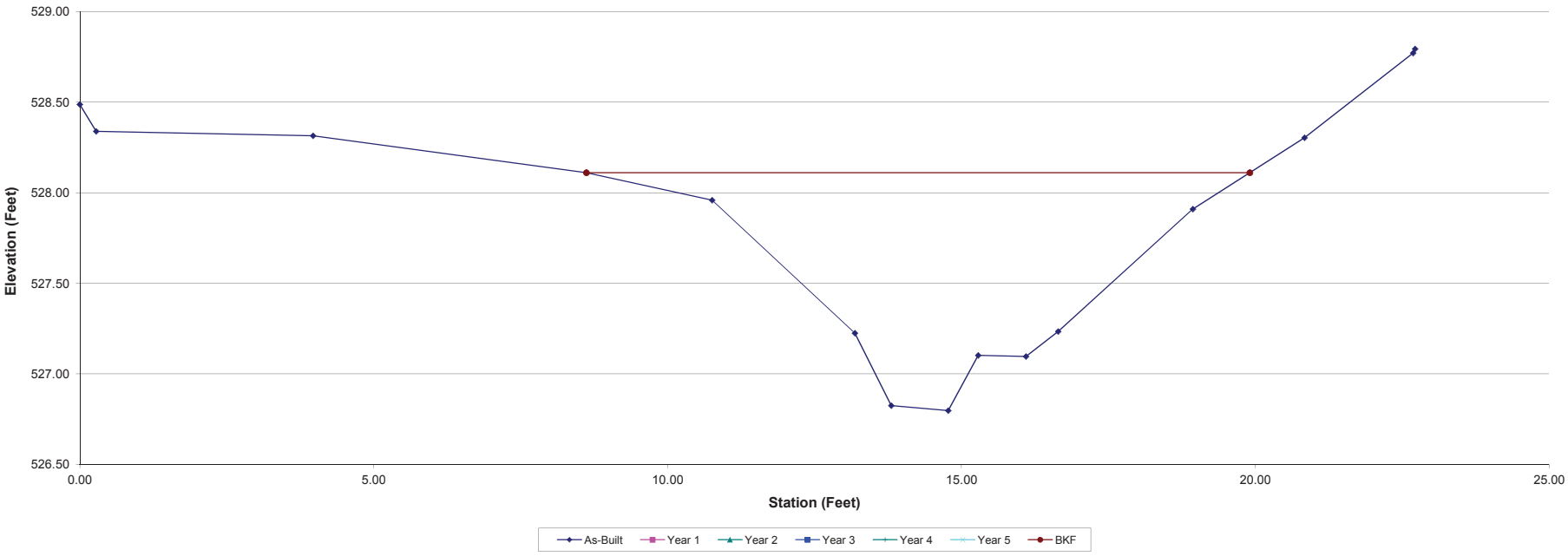
Project:	601 East
Cross Section:	Cross Section 6
Feature	Riffle
Station:	17+66
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	6.6					
W (BKF)	11.3					
Max d	1.3					
Mean d	0.6					
W/D	19.3					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
	528.49	LPIN										
0.28	528.34											
3.97	528.31											
8.62	528.11	BANKFULL LEFT										
10.76	527.96											
13.19	527.22											
13.81	526.82	TOE L										
14.78	526.80	TW										
15.29	527.10											
16.10	527.10	TOE R										
16.65	527.23											
18.94	527.91											
20.84	528.30											
22.69	528.77	BANKFULL RIGHT										
22.72	528.80	RPIN										

Photo of XS-6 looking in the downstream direction



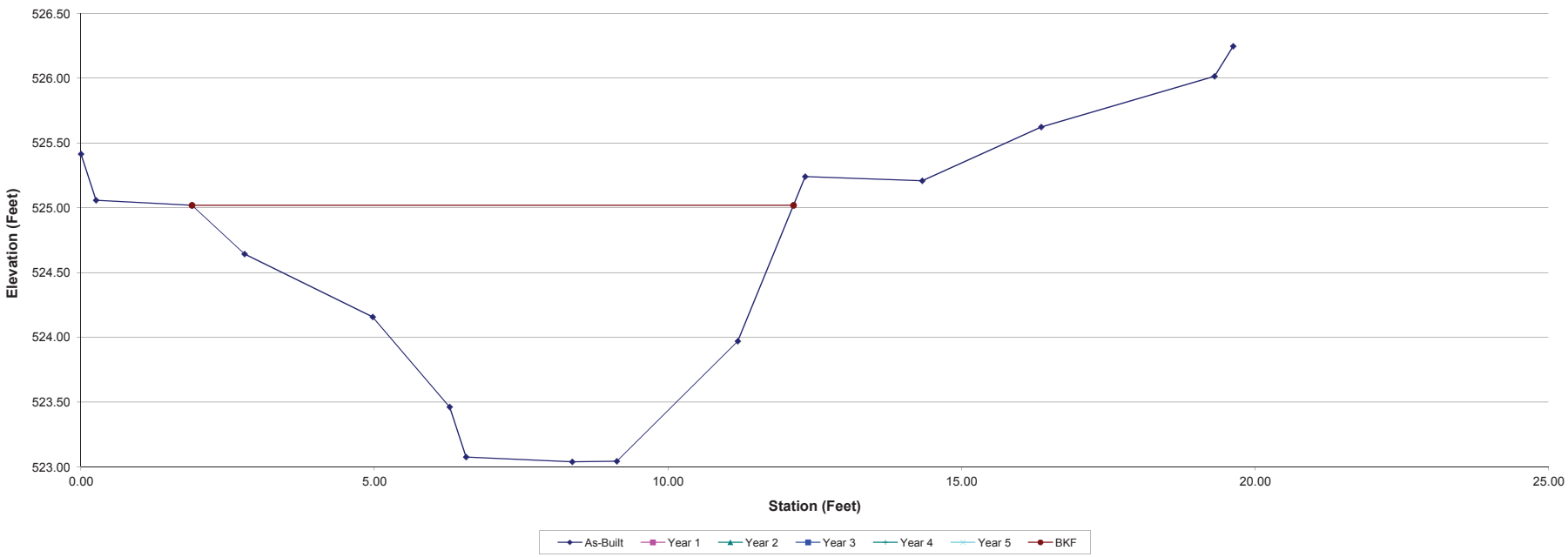
Project:	601 East
Cross Section:	Cross Section 7
Feature	Pool
Station:	19+30
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	12.3					
W (BKF)	10.3					
Max d	2.0					
Mean d	1.2					
W/D	8.6					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04-Year	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation
	525.41	LPIN											
0.26	525.06												
1.89	525.02	TOBL BANKFULL LEFT											
2.79	524.64												
4.97	524.16												
6.28	523.46	TOE L											
6.56	523.08												
8.37	523.04	TW											
9.13	523.04	TOE R											
11.19	523.97												
12.34	525.24												
14.33	525.21												
16.36	525.62	TOBR BANKFULL RIGHT											
19.31	526.02												
19.63	526.25	RPIN											

Photo of XS-7 looking in the downstream direction



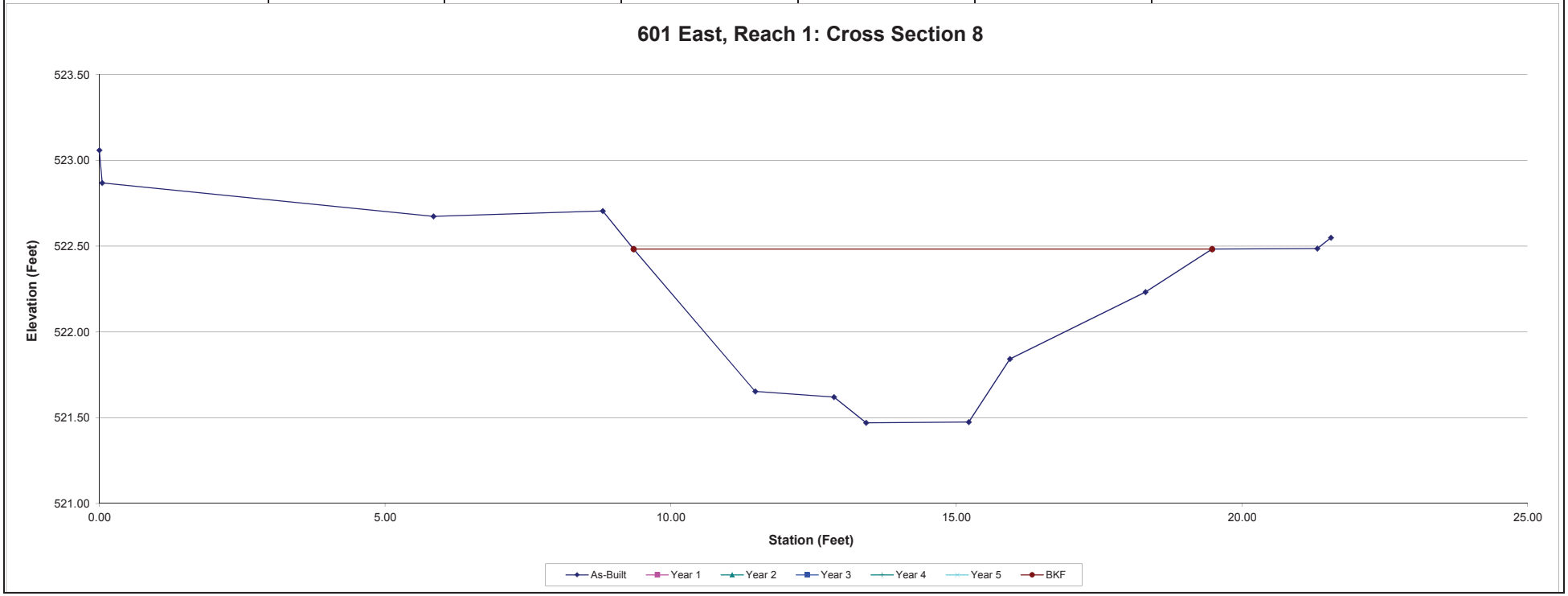
Project:	601 East
Cross Section:	Cross Section 8
Feature	Riffle
Station:	20+59
Date:	1/29/15
Crew:	SV, RZ

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	6.2					
W (BKF)	10.1					
Max d	1.0					
Mean d	0.6					
W/D	16.6					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
	523.06	LPIN									
0.05	522.87										
5.85	522.67										
8.81	522.71										
9.35	522.48	BANKFULL LEFT TOBL									
11.48	521.65	TOE L									
12.86	521.62										
13.42	521.47	TW									
15.22	521.48	TOE R									
15.94	521.84										
18.31	522.23										
19.48	522.48	TOBR BANKFULL RIGHT									
21.32	522.49										
21.56	522.55	RPIN									

Photo of XS-8 looking in the downstream direction



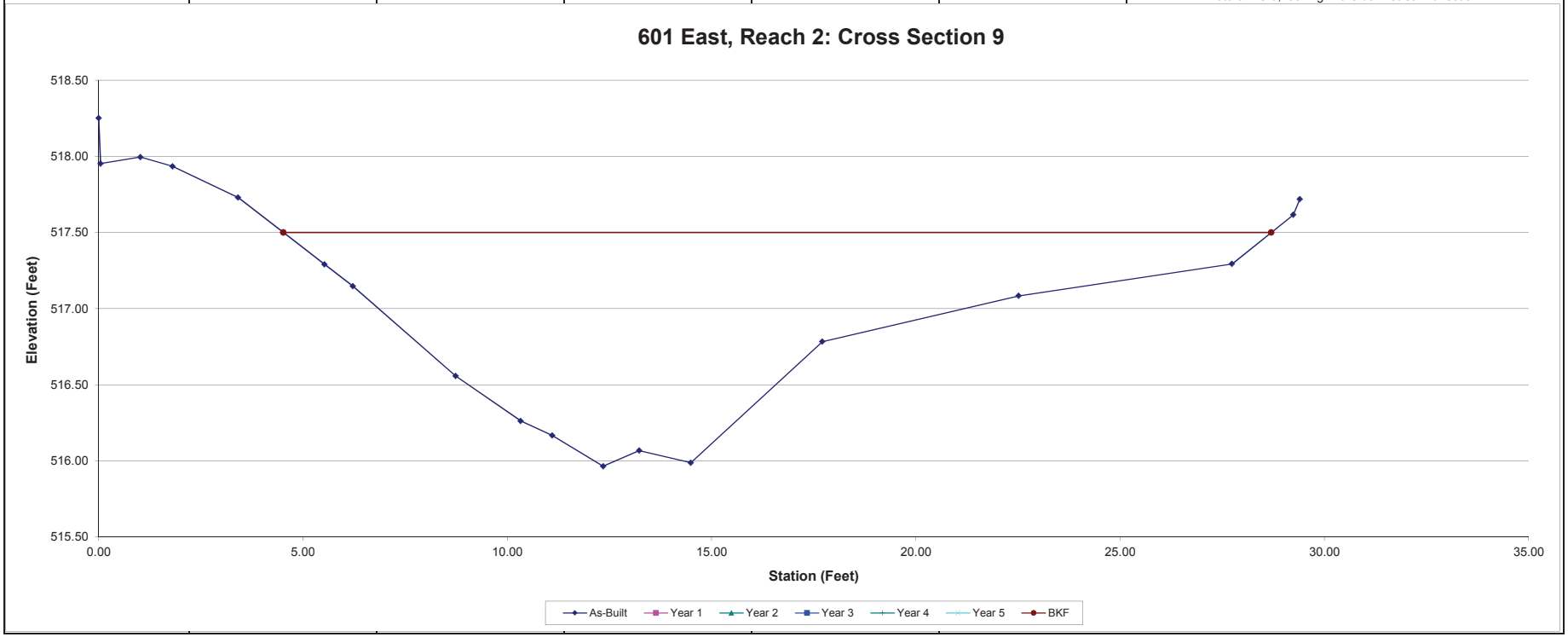
Project:	601 East
Cross Section:	Cross Section 9
Feature	Riffle
Station:	24+25
Date:	1/29/15
Crew:	RZ, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	17.7					
W (BKF)	24.2					
Max d	1.5					
Mean d	0.7					
W/D	33.1					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	E
	518.25	LPIN											
0.05	517.95												
1.02	517.99												
1.81	517.93												
3.41	517.73												
4.52	517.50	BANKFULL LEFT TOBL											
5.53	517.29												
6.22	517.15												
8.74	516.56												
10.33	516.26												
11.10	516.17	TOE L											
12.35	515.96	TW											
13.23	516.07												
14.49	515.99	TOE R											
17.71	516.78												
22.52	517.08												
27.74	517.29												
29.24	517.62	ULL RIGHT TOBR											
29.40	517.72	RPIN											

Photo of XS-9, looking in the downstream direction



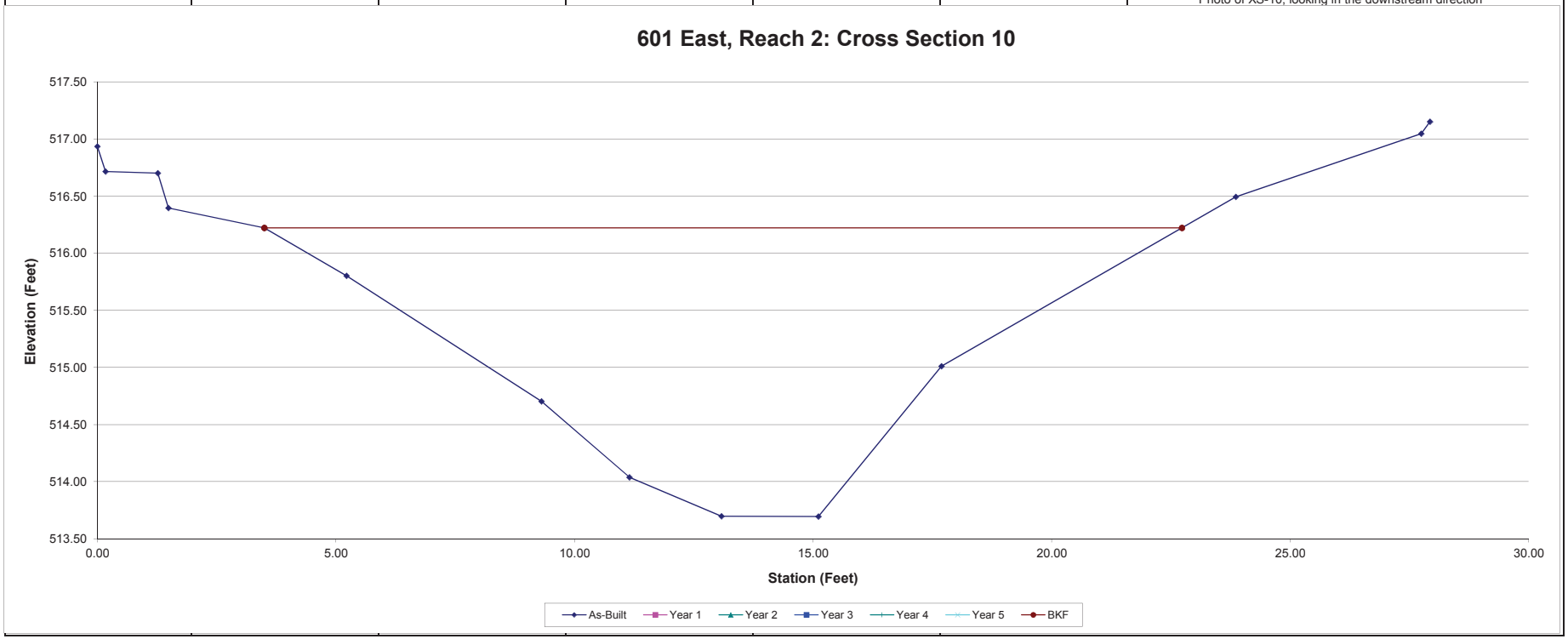
Project:	601 East
Cross Section:	Cross Section 10
Feature	Pool
Station:	26+16
Date:	1/29/15
Crew:	RZ, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	25.3					
W (BKF)	19.2					
Max d	2.5					
Mean d	1.3					
W/D	14.6					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
	516.93	LPIN										
0.17	516.72											
1.27	516.70											
1.49	516.40											
3.50	516.22	BANKFULL LEFT TOBL										
5.22	515.80											
9.31	514.70											
11.15	514.04	TOE L										
13.08	513.70	TW										
15.11	513.70	TOE R										
17.69	515.01											
23.86	516.49	BANKFULL RIGHT TOBR										
27.75	517.05											
27.93	517.15	RPIN										

Photo of XS-10, looking in the downstream direction



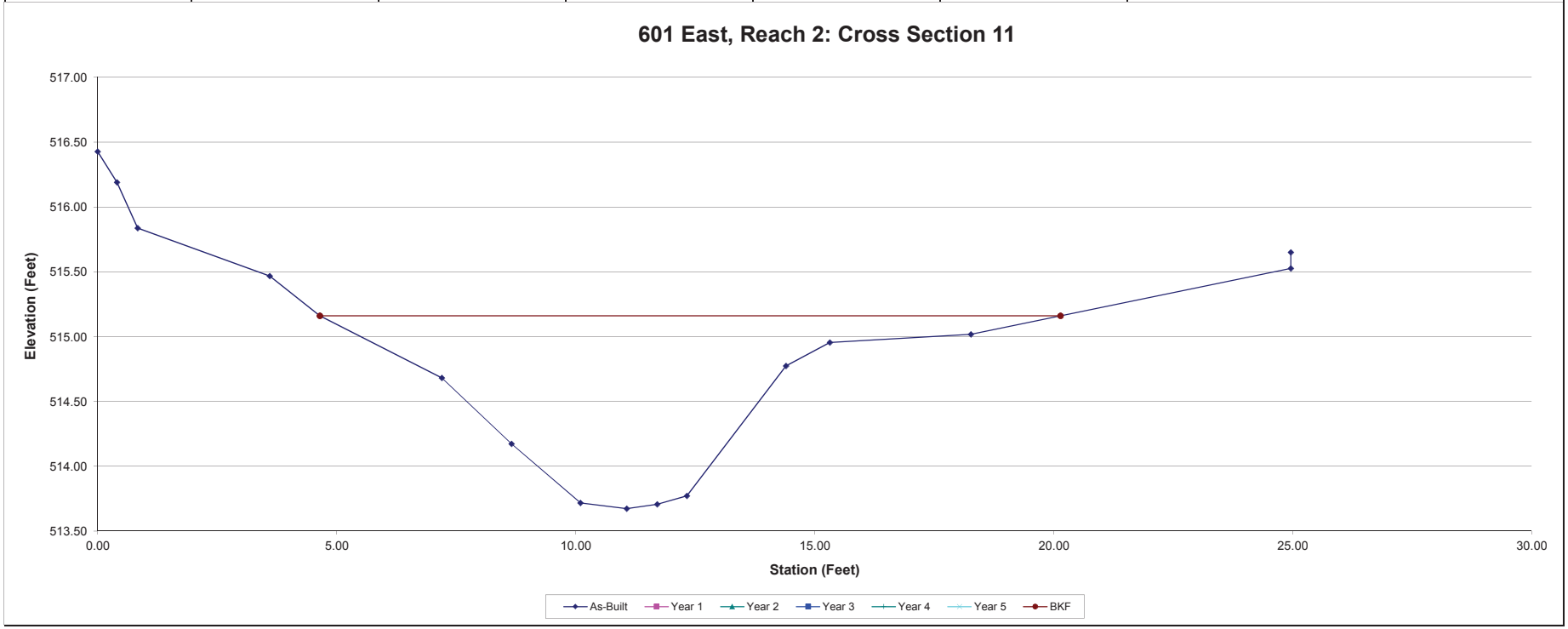
Project:	601 East
Cross Section:	Cross Section 11
Feature	Riffle
Station:	27+15
Date:	1/29/15
Crew:	RZ, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	9.4					
W (BKF)	15.5					
Max d	1.5					
Mean d	0.6					
W/D	25.5					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station
	516.43	LPIN										
0.41	516.19											
0.84	515.84											
3.60	515.47											
4.65	515.16	BANKFULL LEFT TOBL										
7.20	514.68											
8.66	514.17											
10.10	513.72	TOE L										
11.07	513.67	TW										
11.71	513.71	TOE R										
12.33	513.77											
14.40	514.78											
15.32	514.95											
18.27	515.02	BANKFULL RIGHT TOBR										
24.96	515.53											
24.96	515.65	RPIN										

Photo of XS-11 looking in the downstream direction



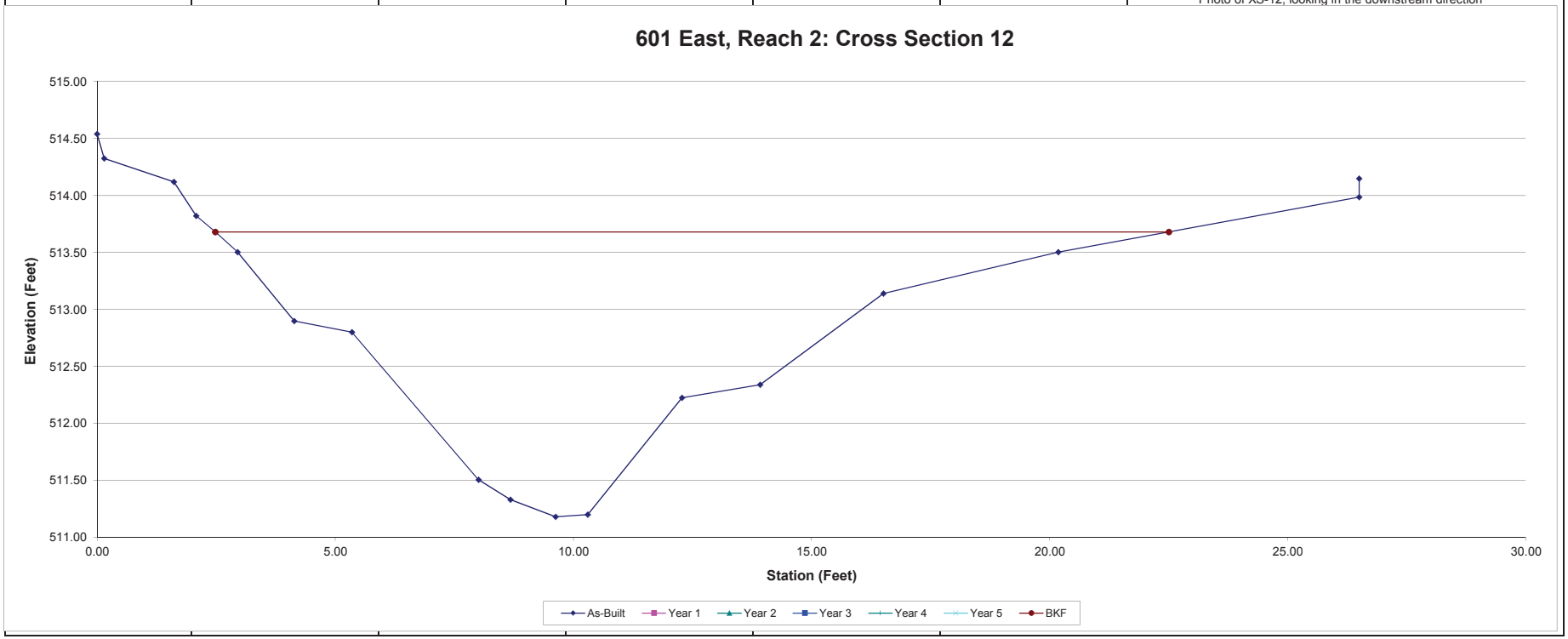
Project:	601 East
Cross Section:	Cross Section 12
Feature	Pool
Station:	29+67
Date:	1/29/15
Crew:	RZ, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	21.3					
W (BKF)	20.0					
Max d	2.5					
Mean d	1.1					
W/D	18.8					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	El
	514.54	LPIN											
0.15	514.33												
1.61	514.12												
2.08	513.82												
2.48	513.68	TOBL, BANKFULL LEFT											
2.95	513.50												
4.14	512.90												
5.35	512.80												
8.01	511.51												
8.68	511.33	TOE L											
9.63	511.18	TW											
10.30	511.20	TOE R											
12.28	512.22												
13.92	512.34												
16.51	513.14												
20.18	513.50	TOBR, BANKFULL RIGHT											
26.50	513.99												
26.50	514.15	RPIN											

Photo of XS-12, looking in the downstream direction

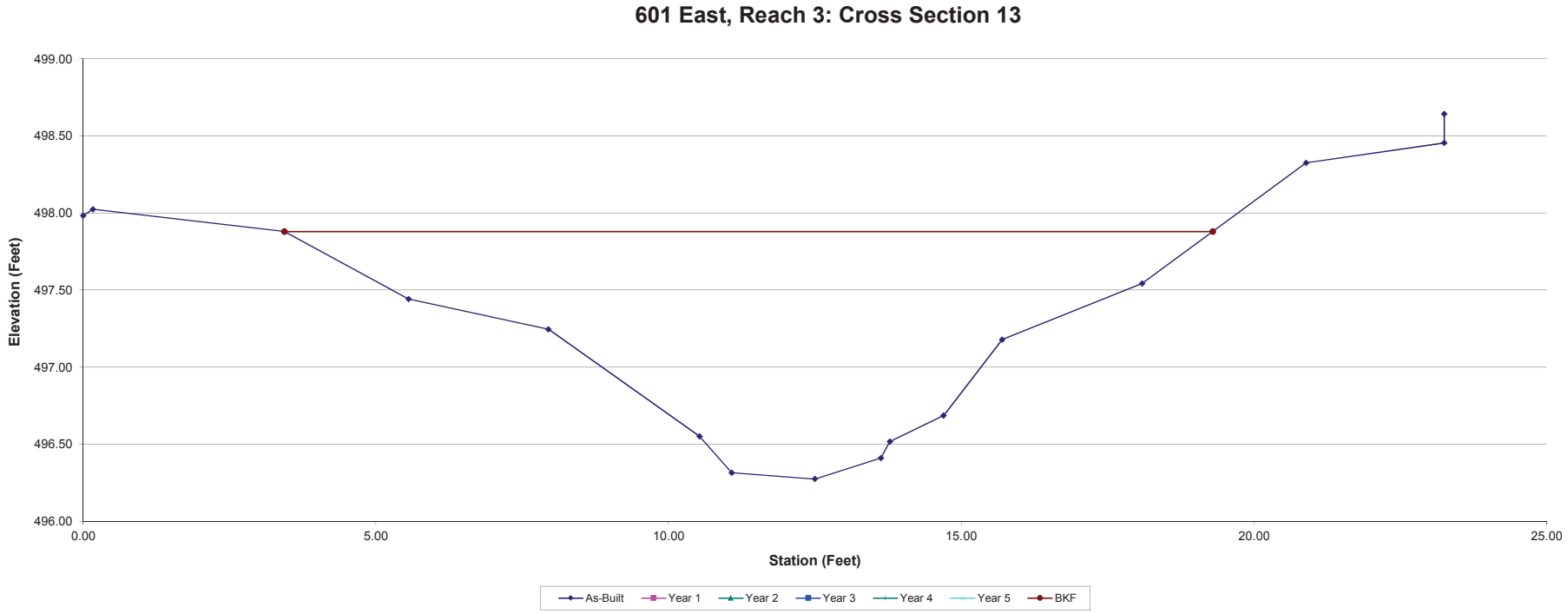


Project:	601 East
Cross Section:	Cross Section 13
Feature	Riffle
Station:	44+45
Date:	1/28/15
Crew:	RZ, SV

Summary (bankfull)						
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	12.8					
W (BKF)	15.9					
Max d	1.6					
Mean d	0.8					
W/D	19.6					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04-Yea	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation
	497.98	LPIN											
0.17	498.02												
3.44	497.88	TOBL, BANKFULL LEFT											
5.56	497.44												
7.95	497.24												
10.53	496.55												
11.08	496.31	TOE R											
12.50	496.27	TW											
13.63	496.41	TOE L											
13.78	496.52												
14.70	496.69												
15.70	497.18												
18.09	497.54												
20.89	498.33	TOBR, BANKFULL RIGHT											
23.25	498.45												
23.25	498.64	RPIN											

Photo of XS-13, looking in the downstream direction

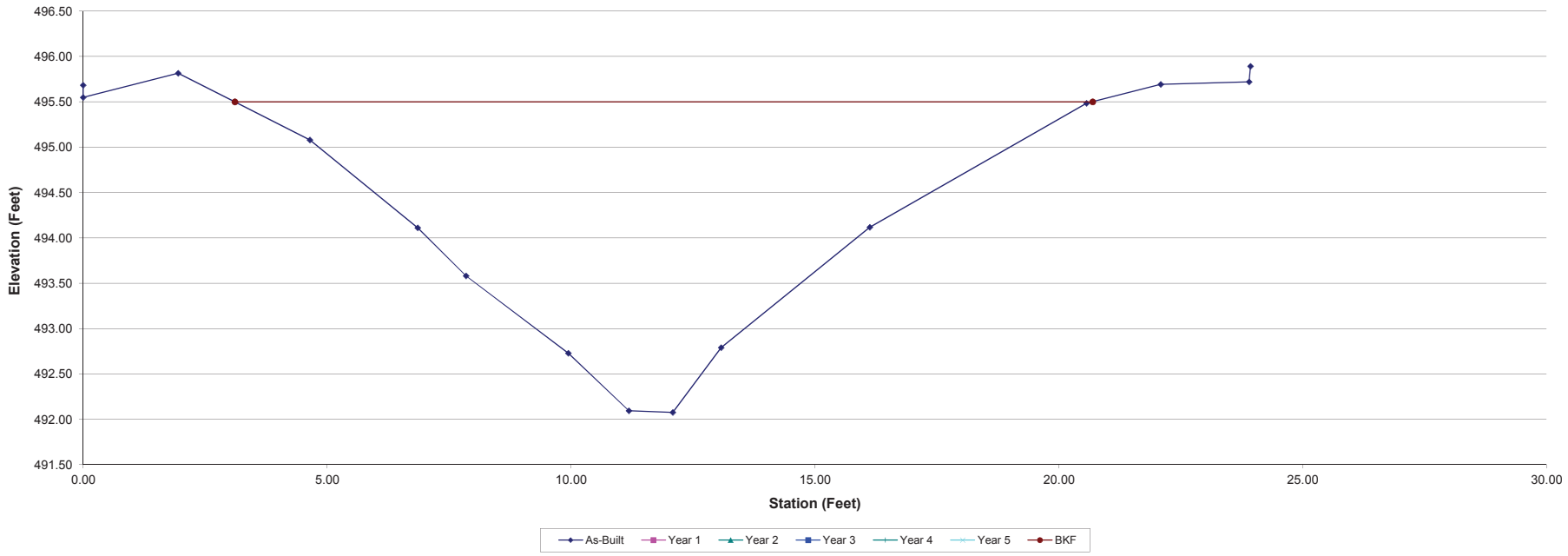


Project:	601 East
Cross Section:	Cross Section 14
Feature	Pool
Station:	48+78
Date:	1/28/15
Crew:	RZ, SV

Summary (bankfull)						
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	28.2					
W (BKF)	17.6					
Max d	3.4					
Mean d	1.6					
W/D	11.0					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elev.
	495.69	LPIN											
	495.55												
1.95	495.82												
3.11	495.50	BANKFULL LEFT											
4.65	495.08												
6.86	494.11												
7.85	493.58												
9.95	492.73	TOE L											
11.19	492.09												
12.09	492.08	TW											
13.08	492.79	TOE R											
16.13	494.12												
20.57	495.48												
22.09	495.69	BANKFULL RIGHT											
23.90	495.72												
23.93	495.89	RPIN											

Photo of XS-14, looking in the downstream direction

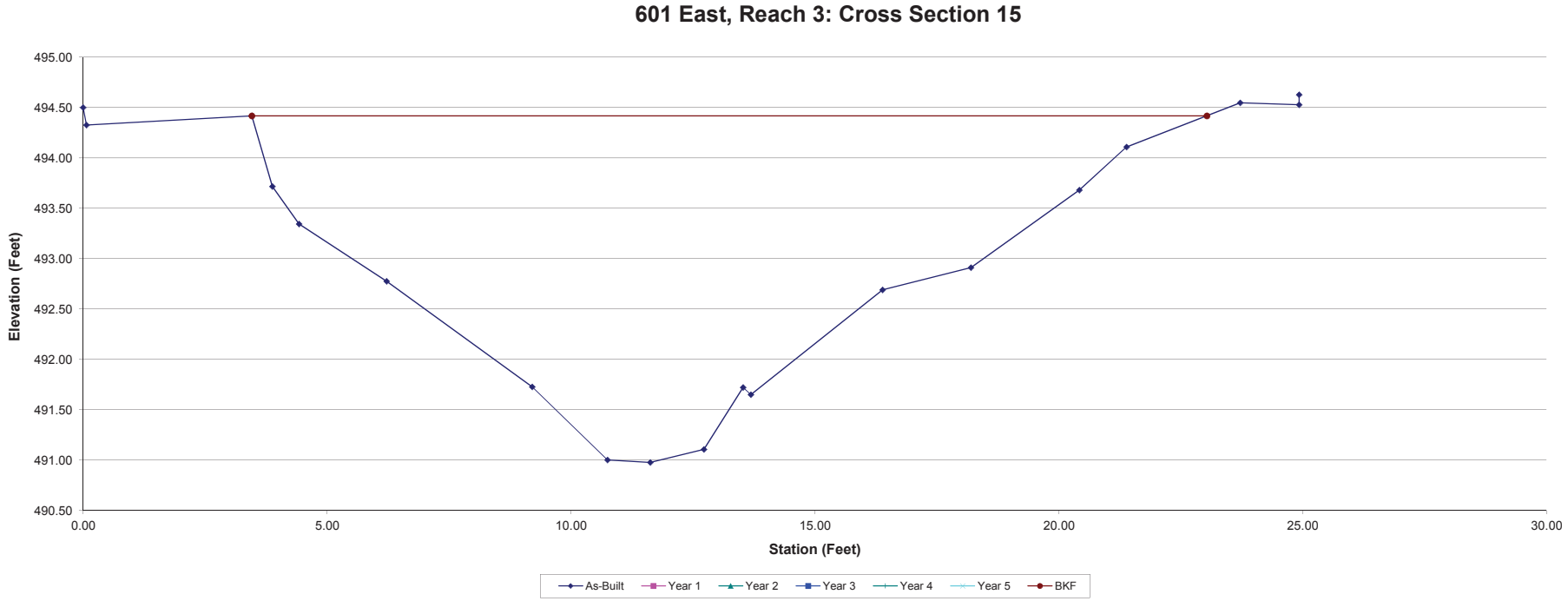


Project:	601 East
Cross Section:	Cross Section 15
Feature	Pool
Station:	50+93
Date:	1/28/15
Crew:	RZ, SV

Summary (bankfull)						
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	36.1					
W (BKF)	19.6					
Max d	3.4					
Mean d	1.8					
W/D	10.6					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elev
	494.50	LPIN											
0.07	494.33												
3.46	494.42	TOBL, BANKFULL LEFT											
3.88	493.72												
4.43	493.35												
6.22	492.78												
9.21	491.73	TOE L											
10.75	491.00												
11.63	490.98	TW											
12.73	491.11												
13.53	491.72												
13.69	491.65	TOE R											
16.39	492.69												
18.20	492.91												
20.42	493.68												
21.39	494.11												
23.72	494.55	TOBR, BANKFULL RIGHT											
24.93	494.53												
24.93	494.63	RPIN											

Photo of XS-15 looking in the downstream direction

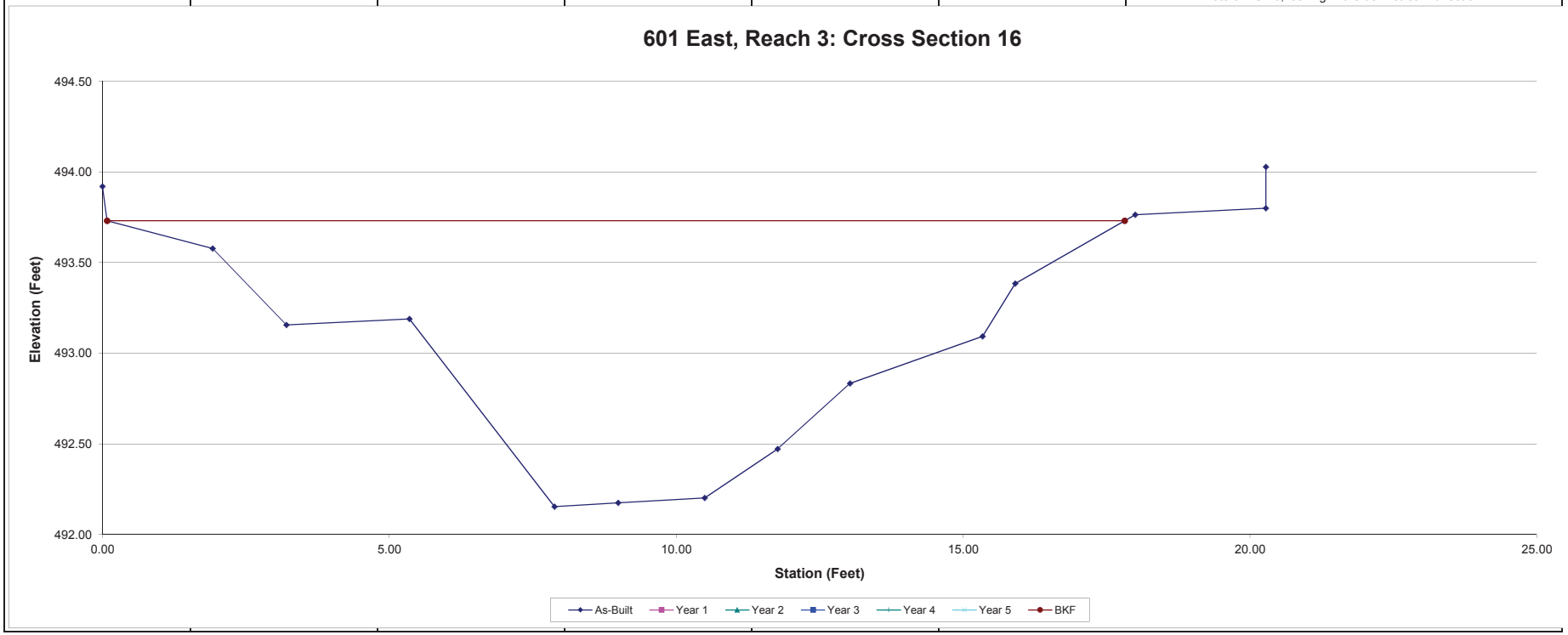


Project:	601 East
Cross Section:	Cross Section 16
Feature	Riffle
Station:	52+29
Date:	1/28/15
Crew:	RZ, SV

Summary (bankfull)						
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	14.1					
W (BKF)	17.7					
Max d	1.6					
Mean d	0.8					
W/D	22.4					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY04-Year	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation
	493.92	LPIN											
0.08	493.73	BANKFULL LEFT											
1.92	493.58												
3.21	493.16												
5.35	493.19												
7.88	492.15	TOE L											
8.99	492.18	TW											
10.50	492.20	TOE R											
11.77	492.47												
13.03	492.83												
15.34	493.09												
15.91	493.38												
18.00	493.76	BANKFULL RIGHT											
20.28	493.80												
20.28	494.03	RPIN											

Photo of XS-16, looking in the downstream direction



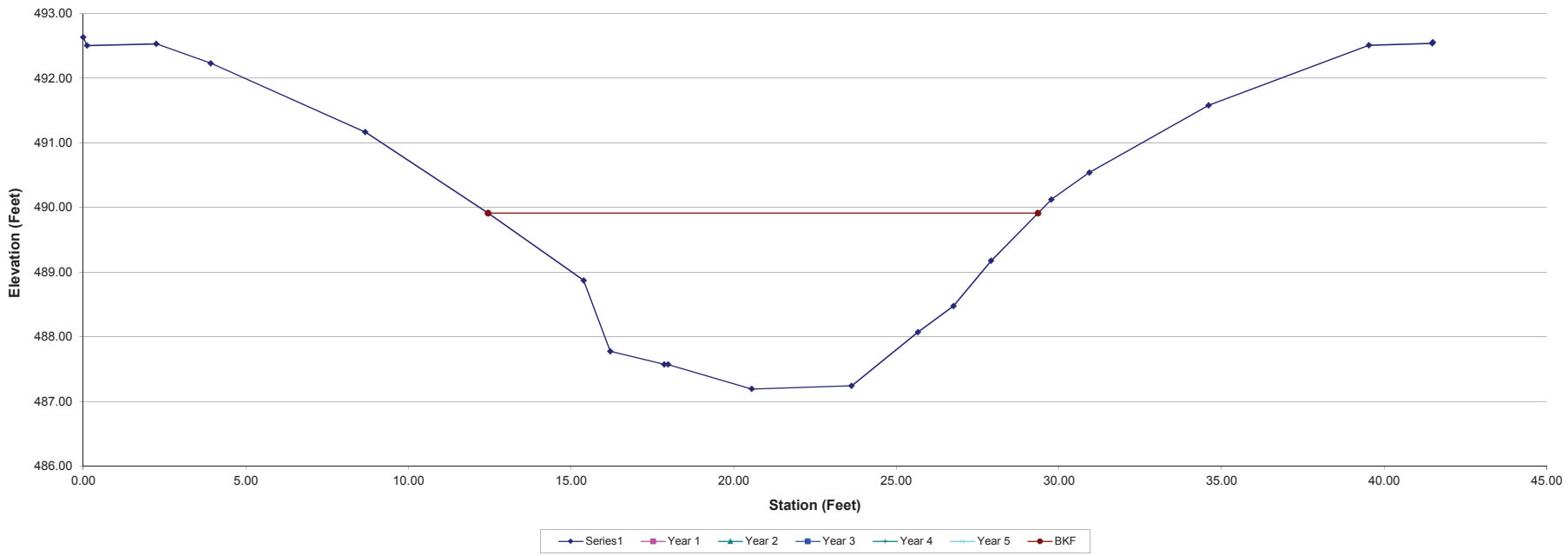
Project:	601 East
Cross Section:	Cross Section 17
Feature	Pool
Station:	56+51
Date:	1/28/15
Crew:	RZ, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	29.8					
W (BKF)	16.9					
Max d	2.7					
Mean d	1.8					
W/D	9.6					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY0	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Ele
	492.63	LPIN											
0.12	492.50												
2.25	492.53	TOBL											
3.93	492.23												
8.68	491.16												
12.45	489.91	BANKFULL LEFT											
15.39	488.87												
16.21	487.77	TOE L											
17.87	487.57												
17.99	487.57												
20.56	487.19	TW											
23.63	487.24												
25.67	488.07												
26.76	488.47	TOE R											
27.92	489.17												
29.77	490.12	BANKFULL RIGHT											
30.94	490.54												
34.61	491.58												
39.54	492.51	TOBR											
41.48	492.54												
41.50	492.55	RPIN											

Photo of XS-17, looking in the downstream direction



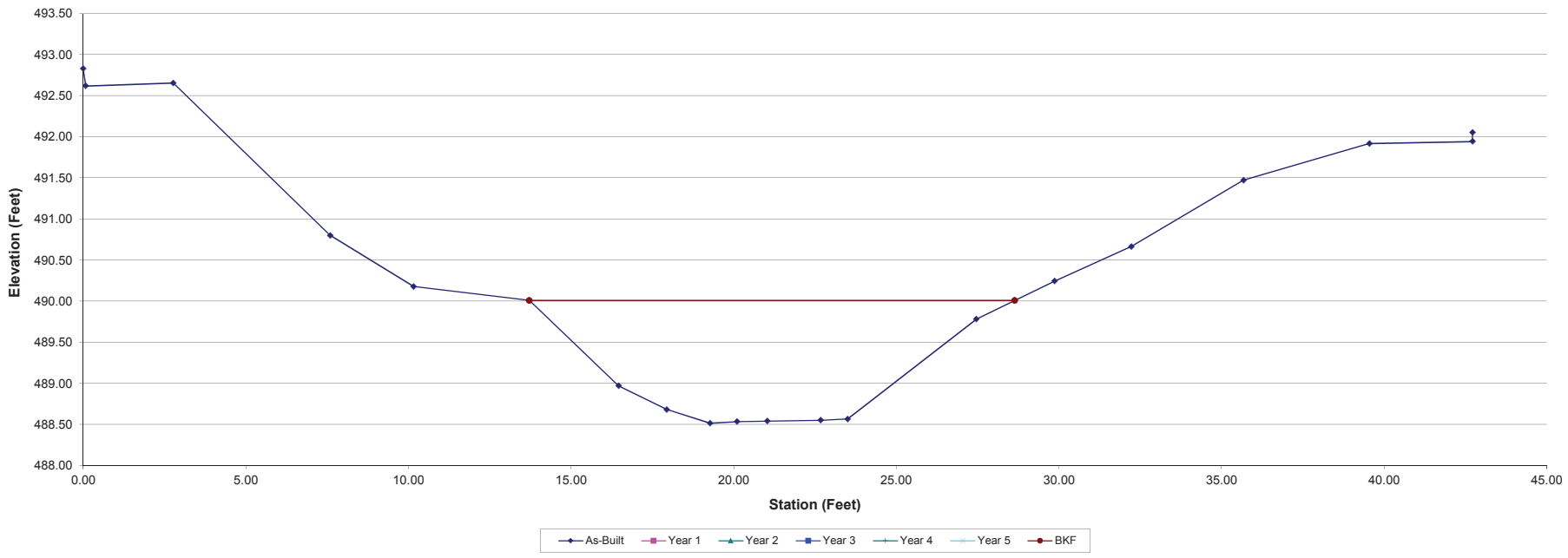
Project:	601 East
Cross Section:	Cross Section 18
Feature	Riffle
Station:	56+42
Date:	1/28/15
Crew:	RZ, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	14.7					
W (BKF)	14.9					
Max d	1.5					
Mean d	1.0					
W/D	15.2					

MY00-YEAR			MY01-Year			MY02-Year			MY03-Year			MY0	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Ele
	492.83	LPIN											
0.08	492.62												
2.77	492.65	TOBL											
7.60	490.80												
10.16	490.18												
13.72	490.01	BANKFULL LEFT											
16.47	488.97												
17.95	488.68	TOE L											
19.28	488.51												
20.11	488.53	TW											
21.04	488.54												
22.68	488.55												
23.51	488.57	TOE R											
27.46	489.78	BANKFULL RIGHT											
29.87	490.24												
32.23	490.66												
35.68	491.47												
39.55	491.92	TOBR											
42.72	491.94												
42.72	492.05	RPIN											

Photo of XS-18, looking in the downstream direction



Appendix C – Vegetation Data

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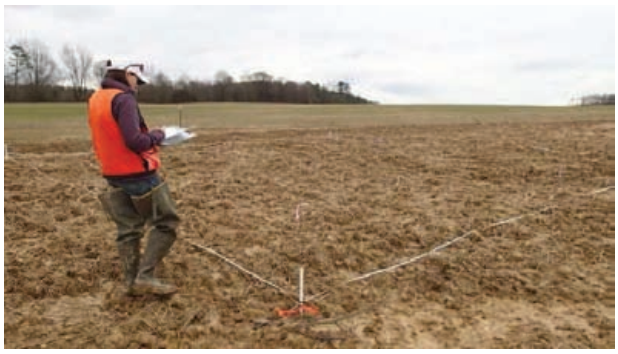
Vegetation Plot Photos

Veg Plot 1

Veg Plot 5

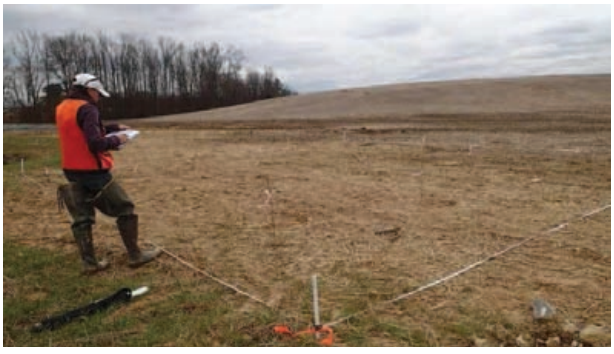
Veg Plot 2



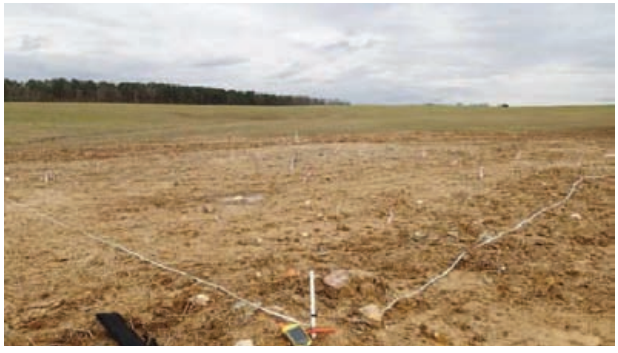
Veg Plot 6

Veg Plot 3

Veg Plot 7



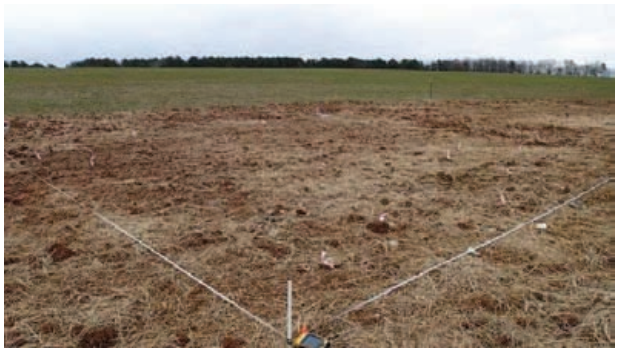
Veg Plot 4



Veg Plot 8

Vegetation Plot Photos

Veg Plot 9



Veg Plot 10

Table 7

EEP Project Code 1. Project Name: 601 East

Scientific Name	Common Name	Species Type	Current Plot Data (MY0 2015)																											Annual Means		
			001-01-0001			001-01-0002			001-01-0003			001-01-0004			001-01-0005			001-01-0006			001-01-0007			001-01-0008			001-01-0009			001-01-0010			MY0 (2015)		
			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	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba	pawpaw	Tree																											2	2	2	2	2	2
Betula nigra	river birch	Tree	4	4	4							3	3	3	1	1	1	1	1	1	2	2	2	4	4	4	9	9	9				24	24	24
Cephalanthus occidentalis	common buttonbush	Shrub																1	1	1	3	3	3							2	2	2	6	6	6
Fraxinus pennsylvanica	green ash	Tree													1	1	1										2	2	2				3	3	3
Liriodendron tulipifera var. tulipifera	Tulip-tree, Yellow Poplar, Whitewood	Tree	1	1	1	2	2	2	7	7	7	4	4	4	4	4	4	1	1	1	7	7	7	1	1	1				3	3	3	30	30	30
Nyssa sylvatica	blackgum	Tree	2	2	2				1	1	1	5	5	5	2	2	2	2	2	2				1	1	1	3	3	3	2	2	2	18	18	18
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree	6	6	6	13	13	13	10	10	10	5	5	5	5	5	5	3	3	3	3	3	3	5	5	5				8	8	8	58	58	58
Populus deltoides var. deltoides	eastern cottonwood					1	1	1		7	7																						1	8	8
Quercus	oak	Tree	3	3	3				1	1	1							4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	12	12	12
Quercus michauxii	swamp chestnut oak	Tree	2	2	2	6	6	6							2	2	2	3	3	3	5	5	5				1	1	1	1	1	1	20	20	20
Quercus phellos	willow oak	Tree	2	2	2							2	2	2	4	4	4	6	6	6	2	2	2	6	6	6				4	4	4	26	26	26
		Stem count	20	20	20	22	22	22	19	26	26	19	19	19	19	19	19	21	21	21	23	23	23	18	18	18	16	16	16	23	23	23	200	207	207
		size (ares)	1			1			1			1			1			1			1			1			1			1			10		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.25		
		Species count	7	7	7	4	4	4	4	5	5	5	5	5	7	7	7	8	8	8	7	7	7	6	6	6	5	5	5	8	8	8	11	11	11
		Stems per ACRE	809.37	809.4	809.4	890.3	890.3	890.3	768.9	1052	1052	768.9	768.9	768.9	768.9	768.9	768.9	849.8	849.8	849.8	930.8	930.8	930.8	728.4	728.4	728.4	647.5	647.5	647.5	930.8	930.8	930.8	809.37	837.7	837.7

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%

Report Prepared By	Catena
Date Prepared	
database name	cvs-eep-entrytool-v2.3.1.mdb
file size	59482112

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	1
project Name	601 East
Description	
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	10

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)
1	601 East	Yadkin-Pee Dee	809

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)
1	601 East	Yadkin-Pee Dee	838

CVS Vigor

vigor	Count	Percent
3	207	100

CVS Vigor by Spp

	Species	CommonName	4	3	2	1	0	Missing	Unknown
	Asimina triloba	pawpaw		2					
	Betula nigra	river birch		24					
	Cephalanthus occidentalis	common buttonbush		6					
	Fraxinus pennsylvanica	green ash		3					
	Liriodendron tulipifera var. tulipifera	Tulip-tree, Yellow Poplar, Whitewood		30					
	Nyssa sylvatica	blackgum		18					
	Platanus occidentalis var. occidentalis	Sycamore, Plane-tree		58					
	Populus deltoides var. deltoides	eastern cottonwood		8					
	Quercus michauxii	swamp chestnut oak		20					
	Quercus phellos	willow oak		26					
	Quercus	oak		12					
TOT:	**11**	**11**		**207**					

CVS Damage

Damage	Count	Percent Of Stems
(no damage)	207	100

CVS Damage by Spp

	Species	CommonName	Count of Damage Categories	(no damage)
	Asimina triloba	pawpaw	0	2
	Betula nigra	river birch	0	24
	Cephalanthus occidentalis	common buttonbush	0	6
	Fraxinus pennsylvanica	green ash	0	3
	Liriodendron tulipifera var. tulipifera	Tulip-tree, Yellow Poplar, Whitewood	0	30
	Nyssa sylvatica	blackgum	0	18
	Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	0	58
	Populus deltoides var. deltoides	eastern cottonwood	0	8
	Quercus	oak	0	12
	Quercus michauxii	swamp chestnut oak	0	20
	Quercus phellos	willow oak	0	26
TOT:	**11**	**11**	**0**	**207**

CVS Damage by Plot

	plot	Count of Damage Categories	(no damage)
	001-01-0001	0	20
	001-01-0002	0	22
	001-01-0003	0	26
	001-01-0004	0	19
	001-01-0005	0	19
	001-01-0006	0	21
	001-01-0007	0	23
	001-01-0008	0	18
	001-01-0009	0	16
	001-01-0010	0	23
TOT:	**10**	**0**	**207**

CVS Steams by Plot and Spp

	Comment	Species	SpType	CommonName	Total Planted Stems	# plots	avg# stems	plot 001-01-0001	plot 001-01-0002	plot 001-01-0003	plot 001-01-0004	plot 001-01-0005	plot 001-01-0006	plot 001-01-0007	plot 001-01-0008	plot 001-01-0009	plot 001-01-0010
		Asimina triloba	Shrub Tree	pawpaw	2	1	2										2
		Betula nigra	Tree	river birch	24	7	3.4	4			3	1	1	2	4	9	
		Cephalanthus occidentalis	Shrub Tree	common buttonbush	6	3	2						1	3			2
		Fraxinus pennsylvanica	Tree	green ash	3	2	1.5					1				2	
		Liriodendron tulipifera var. tulipifera	Tree	Tulip-tree, Yellow Poplar, Whitewood	30	9	3.3	1	2	7	4	4	1	7	1		3
		Nyssa sylvatica	Tree	blackgum	18	8	2.3	2		1	5	2	2		1	3	2
		Platanus occidentalis var. occidentalis	Tree	Sycamore, Plane-tree	58	9	6.4	6	13	10	5	5	3	3	5		8
		Populus deltoides var. deltoides		eastern cottonwood	8	2	4		1	7							
		Quercus	Shrub Tree	oak	12	7	1.7	3		1			4	1	1	1	1
		Quercus michauxii	Tree	swamp chestnut oak	20	7	2.9	2	6			2	3	5		1	1
		Quercus phellos	Tree	willow oak	26	7	3.7	2			2	4	6	2	6		4
TOT:	**0**	**11**	**10**	**11**	**207**	**11**		**20**	**22**	**26**	**19**	**19**	**21**	**23**	**18**	**16**	**23**

Appendix D – Record Drawing Plan Sheets

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RECORD DRAWINGS

601 EAST

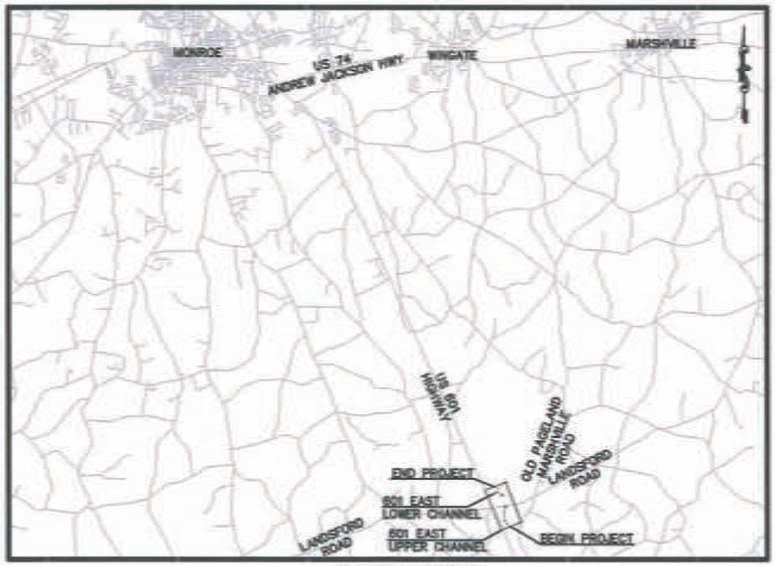
STREAM AND WETLAND RESTORATION PROJECT

UNION COUNTY, NORTH CAROLINA

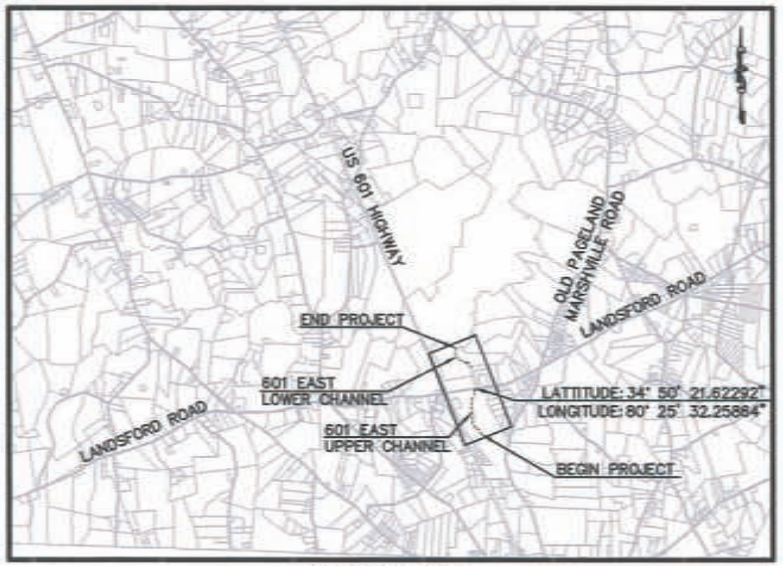
EEP CONTRACT DENR NO:004925

EEP PROJECT NO:95756

RFP 16-004110



VICINITY MAP



LOCATION MAP

INDEX OF SHEETS

STREAM DESIGNER
AND AS-BUILT SURVEY:

Ward Consulting Engineers
4805 Green Road
Raleigh, NC 27616
NC LICENSE NO: C-2619
PH: 919-870-0526
FAX: 919-870-5359

FULL DELIVERY PROVIDER:

Environmental Banc & Exchange
909 Capability Drive, Suite 3100
Raleigh, NC 27606
PH: 919-829-9909
FAX: 919-229-9913

NATURAL SYSTEMS INVESTIGATION:

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

NCEEP CONTACT: PAUL WIESNER (828) 273-1673
WARD CONSULTING ENGINEERS CONTACT: BECKY WARD, PE (919) 870-0526
ENVIRONMENTAL BANC AND EXCHANGE CONTACT: (919) 829-9909

Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-2619
4805 Green Rd., Suite 100 (919) 870-0526
Raleigh, NC 27616-2048 FAX (919) 870-5359

Environmental Banc & Exchange
909 Capability Drive, Suite 3100
Raleigh NC 27606 Phone (919) 829-9909
Fax: (919) 229-9913

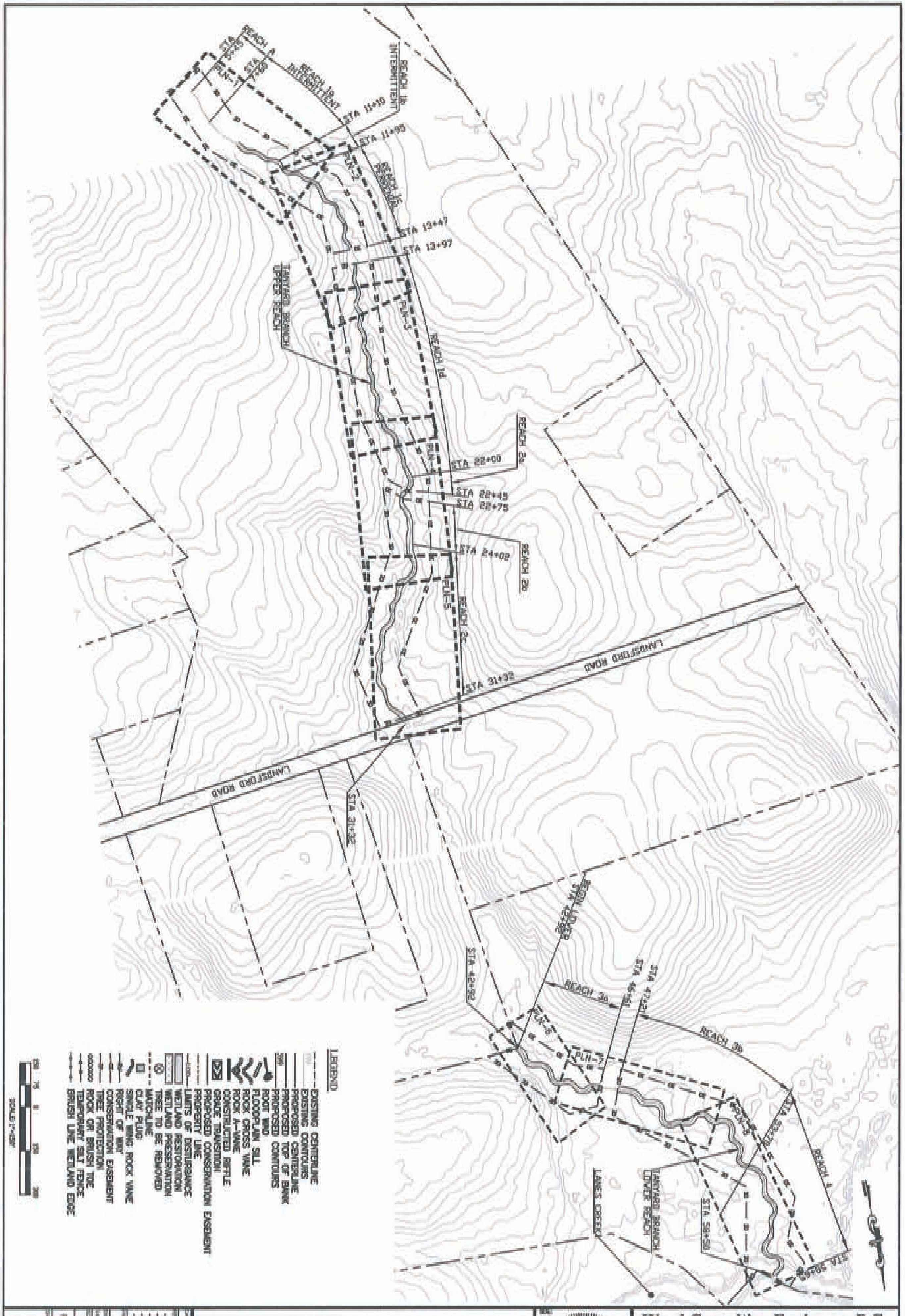
601 EAST
AS-BUILT
TITLE SHEET
UNION COUNTY, NORTH CAROLINA

DATE: 10/15/2015
REVISIONS:

PROJECT NAME: 601 East Creek
DWG NAME: As-Built Title Sheet
SCALE: NTS

RECORD DRAWINGS

SHEET NO:
T1



RECORD DRAWINGS

L1

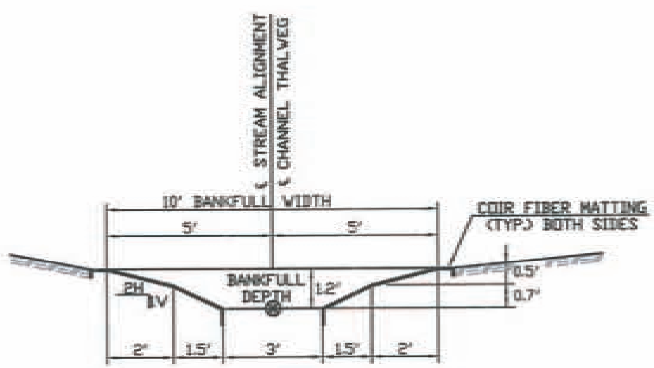
601 EAST
AS-BUILT
LEGENDS, SYMBOLS AND SHEET KEY
UNION COUNTY, NORTH CAROLINA

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL BECKY LYNNE WARD

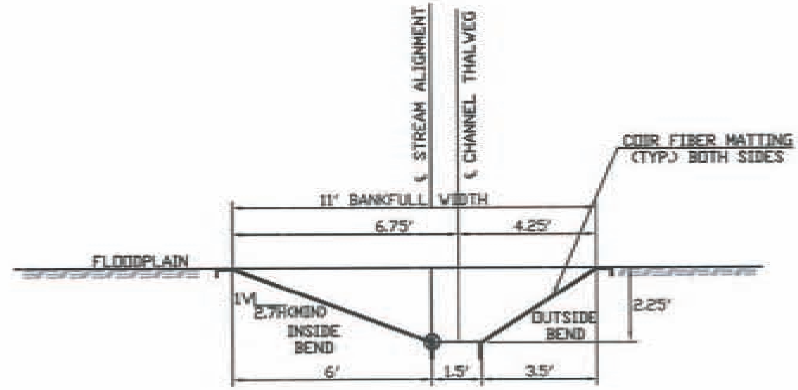
Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-2619
4005 Green Rd, Suite 100 (919) 870-0526
Raleigh, NC 27616-2040 FAX (919) 870-5359

Environmental Banc & Exchange
909 Capability Drive, Suite 3100
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 229-9913

NOTES:
1. CONTRACTOR TO PROVIDE A SMOOTH TRANSITION BETWEEN THE RIFFLE AND POOL SECTIONS SHOWN BELOW.
2. ⊘ INDICATES THE STREAM CENTERLINE ALIGNMENT AS IDENTIFIED ON THE PLAN AND PROFILE SHEETS.
3. ℄ OF STREAM FOR HORIZONTAL LAYOUT AND ℄ OF THALWEG MAYBE AT DIFFERENT LOCATIONS IN POOL SECTIONS.
4. USE 700 GRAM COIR FIBER MATTING BLANKET WESTERN EXCELSIOR CORPORATION COIR MAT 700 OR APPROVED EQUAL.



1 PROPOSED RIFFLE SECTION (REACH 1)
SCALE: NOT TO SCALE



2 PROPOSED POOL SECTION (REACH 1)
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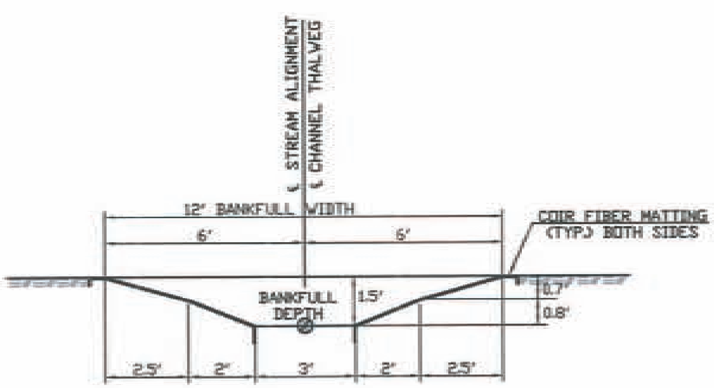

3 PROPOSED RIFFLE SECTION (REACH 2)
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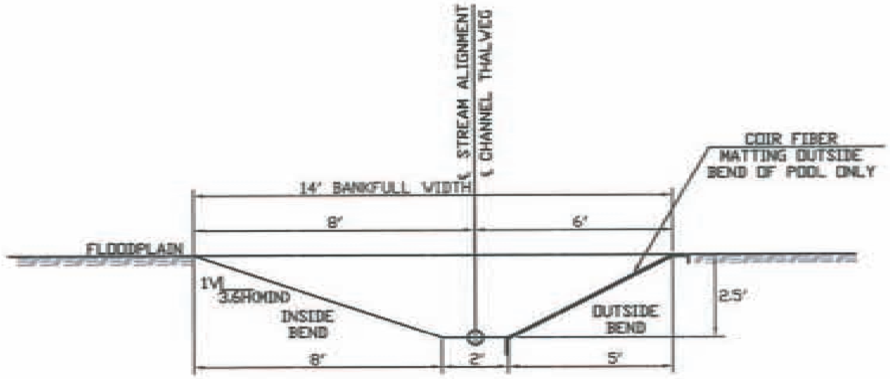


4 PROPOSED POOL SECTION (REACH 2)
SCALE: NOT TO SCALE

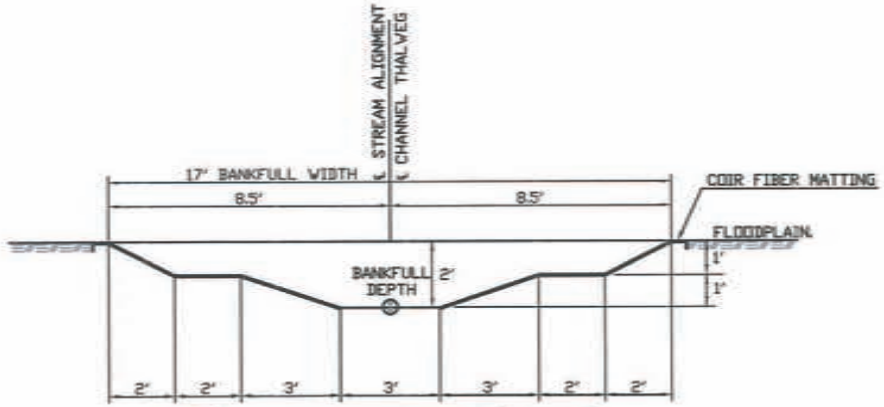
Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-2619
4805 Green Rd, Suite 100 (919) 870-0526
Raleigh, NC 27616 FAX (919) 870-5359

Environmental Banc & Exchange
909 Capability Drive, Suite 3100
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 829-9913

601 EAST
TYPICAL CONSTRUCTED
CROSS SECTIONS WITH LEGENDS
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

TCS1



5 PROPOSED RIFFLE SECTION (REACH 3)
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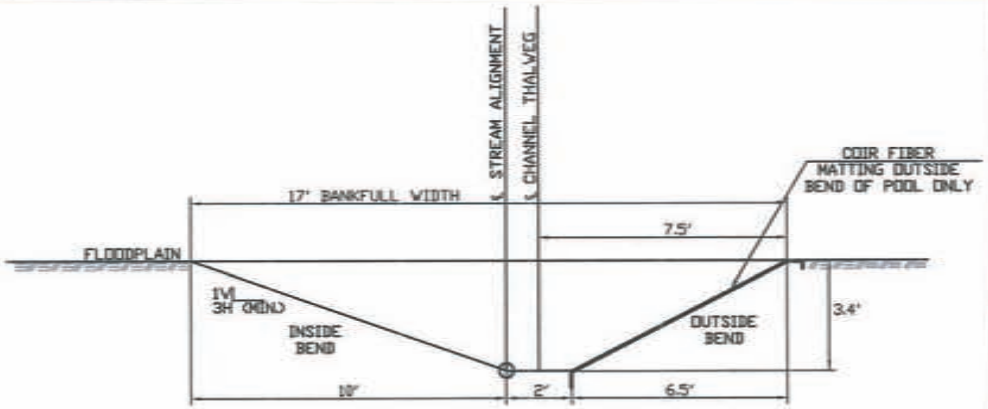

6 PROPOSED POOL SECTION (REACH 3)
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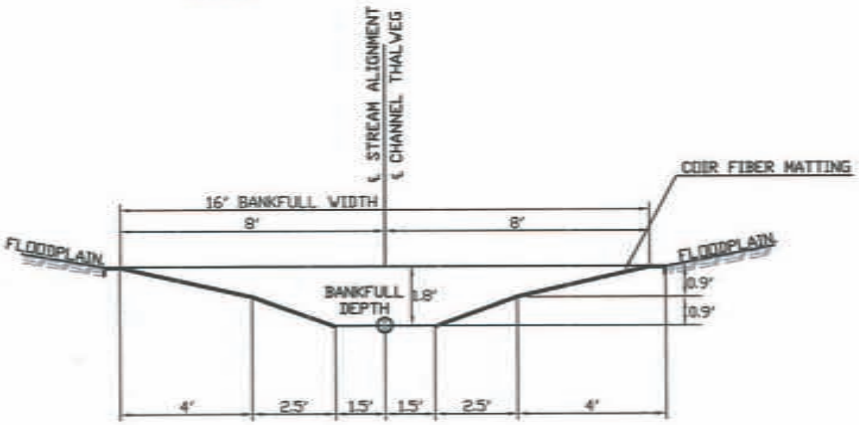

7 PROPOSED RIFFLE SECTION (REACH 4)
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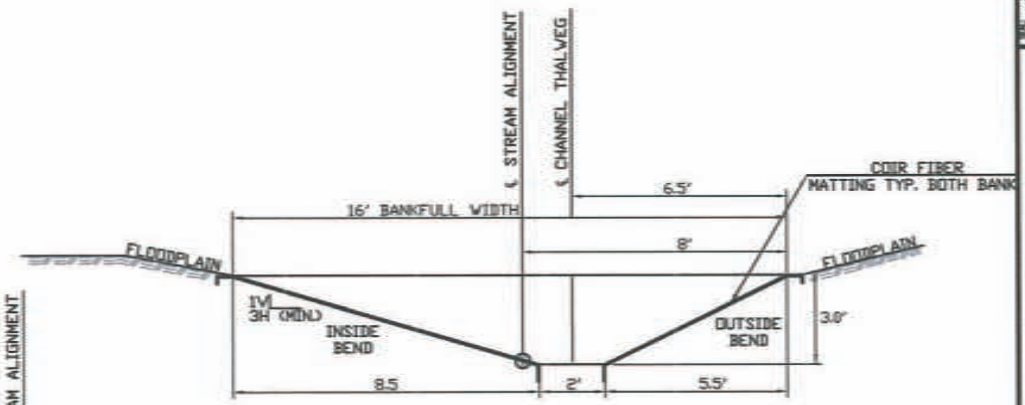

8 PROPOSED POOL SECTION (REACH 4)
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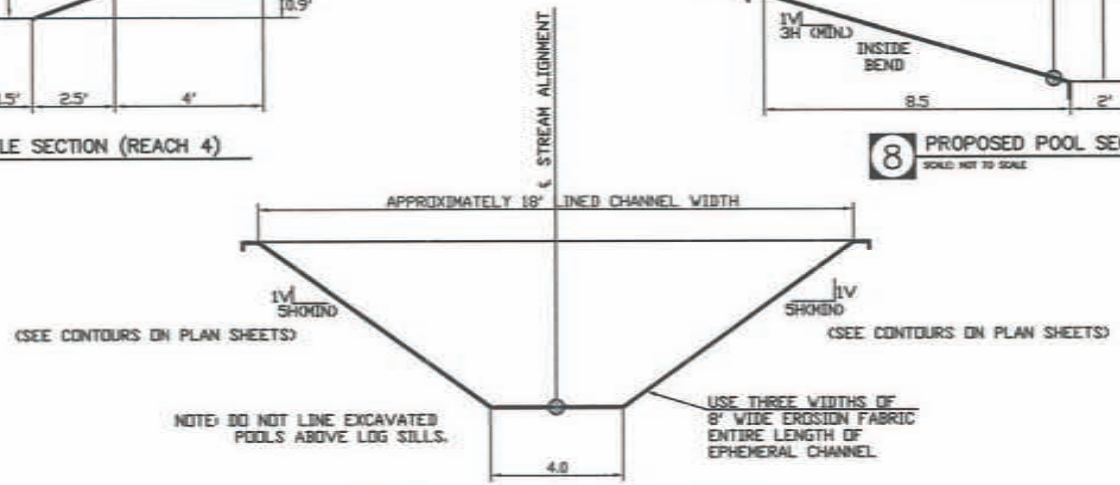


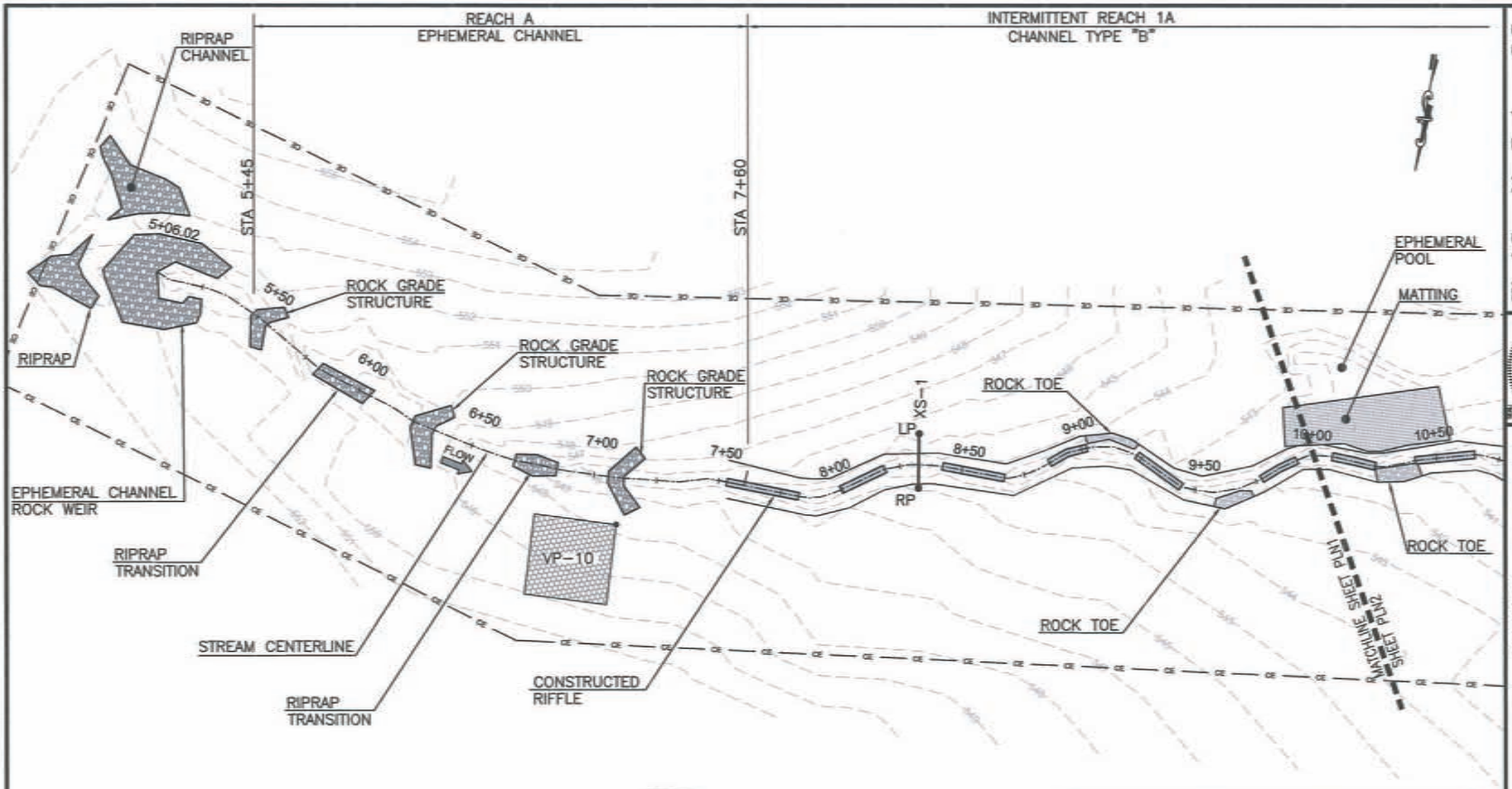
9 TYPICAL EPHEMERAL CROSS SECTION
SCALE: NOT TO SCALE

Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-0619
4809 Green Rd, Suite 100
Raleigh, NC 27616
(919) 870-0926
FAX (919) 870-5359

Environmental Banks & Exchange
909 Capability Drive, Suite 3100
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 233-8913

601 EAST
TYPICAL CONSTRUCTED
CROSS SECTIONS WITH LEGENDS
UNION COUNTY, NORTH CAROLINA

DATE: 10-FEB-2015
REVISIONS:
PROJECT NAME: 601 East Cross
DWG NAME: Typical Cross Sections
SCALE: NTS
RECORD DRAWINGS
SHEET NO.
TCS2



NOTE:
1. BLACK DOT IN CORNER OF PLANT PLOT INDICATES PLOT CORNER LABELED IN TABLE.
2. BENCH MARKERS SHOWN FROM CONSTRUCTION CONTROL SURVEY SET BY TURNER LAND SURVEYING, PLLC. (LABELED TLS)
   3719 BENSON DRIVE
   RALEIGH, NC 27629
   (919)827-0745
3. AS-BUILT SURVEY AND MONITORING FEATURES SET BASED ON TURNER SITE BENCHMARKS.

LEGEND

- AS-BUILT SURFACE
- 57+50 — AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT CONSERVATION EASEMENT
- XS-1 — PERMANENT CROSS SECTION
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT ROCK TOE
- AS-BUILT BRUSH TOE
- VP-10 — VEGETATION PLOT

Veg Plot	Elevation	Northing	Easting
VP10	547.894	397465.1603	1572520.7387

Cross Section	Elevation	Northing	Easting
XS-1 LP	545.333	397511.7551	1572403.9924
XS-1 RP	545.268	397528.5731	1572417.7687

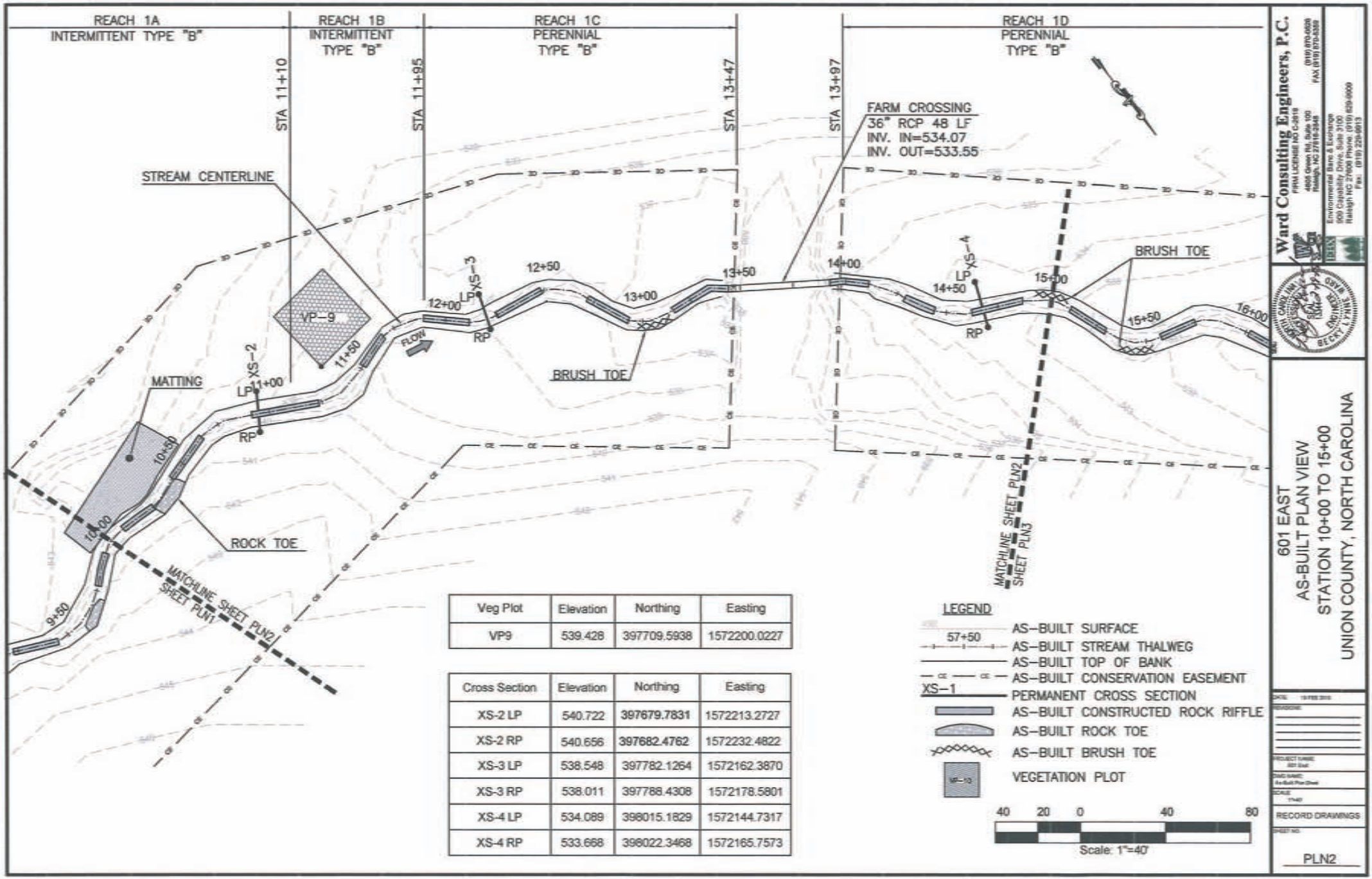
40 20 0 40 80
Scale: 1"=40'

Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-2619
4809 Green Rd, Suite 100
Raleigh, NC 27616-2848
(919) 870-0838
FAX (919) 870-8389
Environmental Land & Exchange
909 Capability Drive, Suite 3100
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 229-6913

601 EAST
AS-BUILT PLAN VIEW
STATION 5+00 TO 10+00
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

PLN1



Veg Plot	Elevation	Northing	Easting
VP9	539.428	397709.5938	1572200.0227

Cross Section	Elevation	Northing	Easting
XS-2 LP	540.722	397679.7831	1572213.2727
XS-2 RP	540.656	397682.4762	1572232.4822
XS-3 LP	538.548	397782.1264	1572162.3870
XS-3 RP	538.011	397788.4308	1572178.5801
XS-4 LP	534.089	398015.1829	1572144.7317
XS-4 RP	533.668	398022.3468	1572165.7573

LEGEND

- AS-BUILT SURFACE
- 57+50 AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- CE CE AS-BUILT CONSERVATION EASEMENT
- XS-1 PERMANENT CROSS SECTION
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT ROCK TOE
- AS-BUILT BRUSH TOE
- VP-9 VEGETATION PLOT

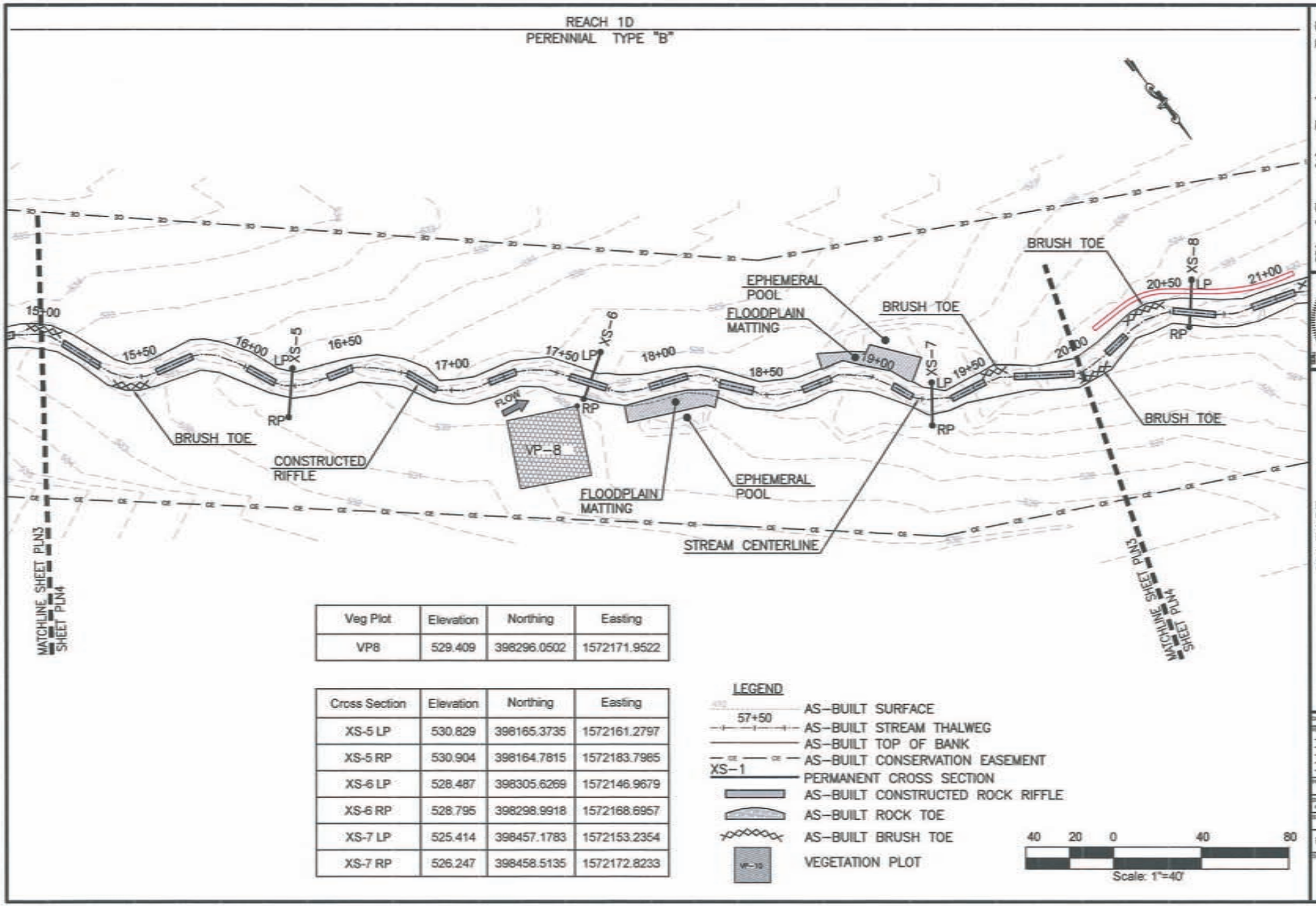
40 20 0 40 80

Scale: 1"=40'

Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-2819
4809 Green Rd, Suite 100
Raleigh, NC 27616-3848
(919) 870-0526
FAX (919) 870-5389
Environmental Bank & Exchange
900 Capability Drive, Suite 3100
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 226-6913

601 EAST
AS-BUILT PLAN VIEW
STATION 10+00 TO 15+00
UNION COUNTY, NORTH CAROLINA

DATE: 19 FEB 2015
REVISIONS:
PROJECT NAME: 601 East
DWG NAME: As-Built Plan Sheet
SCALE: 1"=40'
RECORD DRAWINGS
SHEET NO.
PLN2



Veg Plot	Elevation	Northing	Easting
VP8	529.409	398296.0502	1572171.9522

Cross Section	Elevation	Northing	Easting
XS-5 LP	530.829	398165.3735	1572161.2797
XS-5 RP	530.904	398164.7815	1572183.7965
XS-6 LP	528.487	398305.6269	1572146.9679
XS-6 RP	528.795	398298.9918	1572168.6957
XS-7 LP	525.414	398457.1783	1572153.2354
XS-7 RP	526.247	398458.5135	1572172.8233

LEGEND

- AS-BUILT SURFACE
- 57+50 AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT CONSERVATION EASEMENT
- XS-1 PERMANENT CROSS SECTION
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT ROCK TOE
- AS-BUILT BRUSH TOE
- VEGETATION PLOT

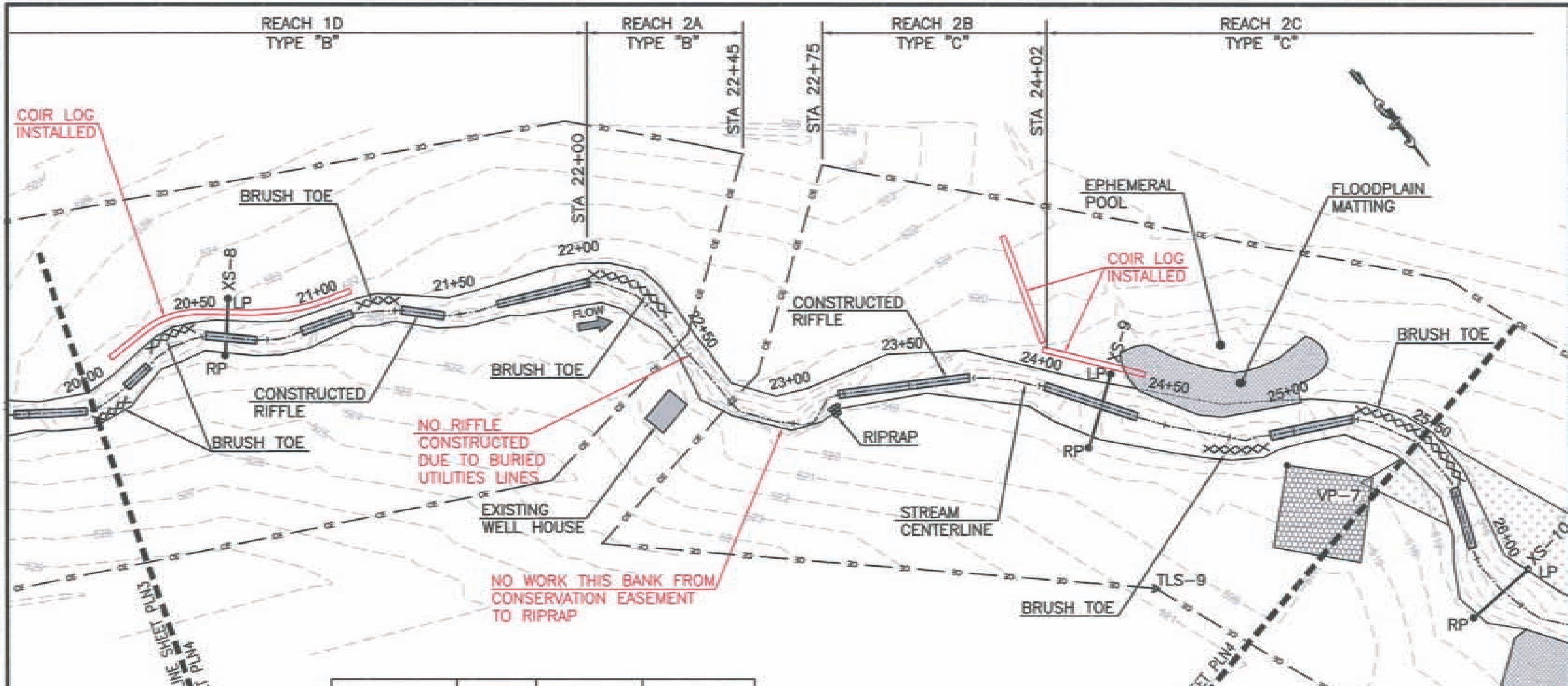
40 20 0 40 80
Scale: 1"=40'

Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-2619
4809 Green Rd, Suite 100
Raleigh, NC 27616-2640
(919) 870-0536
FAX (919) 870-0309
Environmental Bank & Exchange
909 Capability Drive, Suite 3100
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 229-0913

601 EAST
AS-BUILT PLAN VIEW
STATION 15+00 TO 20+00
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

PLN3



Control Point	Elevation	Northing	Easting
TLS-9	521.842	398931.1805	1572192.7040

Veg Plot	Elevation	Northing	Easting
VP7	517.722	398979.0755	1572143.2568

Cross Section	Elevation	Northing	Easting
XS-8 LP	523.059	398573.4555	1572100.3479
XS-8 RP	522.549	398573.3919	1572121.9122
XS-9 LP	518.250	398910.1715	1572111.9904
XS-9 RP	517.718	398903.3405	1572140.5839

LEGEND

- AS-BUILT SURFACE
- 57+50 AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT CONSERVATION EASEMENT
- XS-1 PERMANENT CROSS SECTION
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT ROCK TOE
- AS-BUILT BRUSH TOE
- VP-10 VEGETATION PLOT
- CONTROL POINT

40 20 0 40 80

Scale: 1"=40'

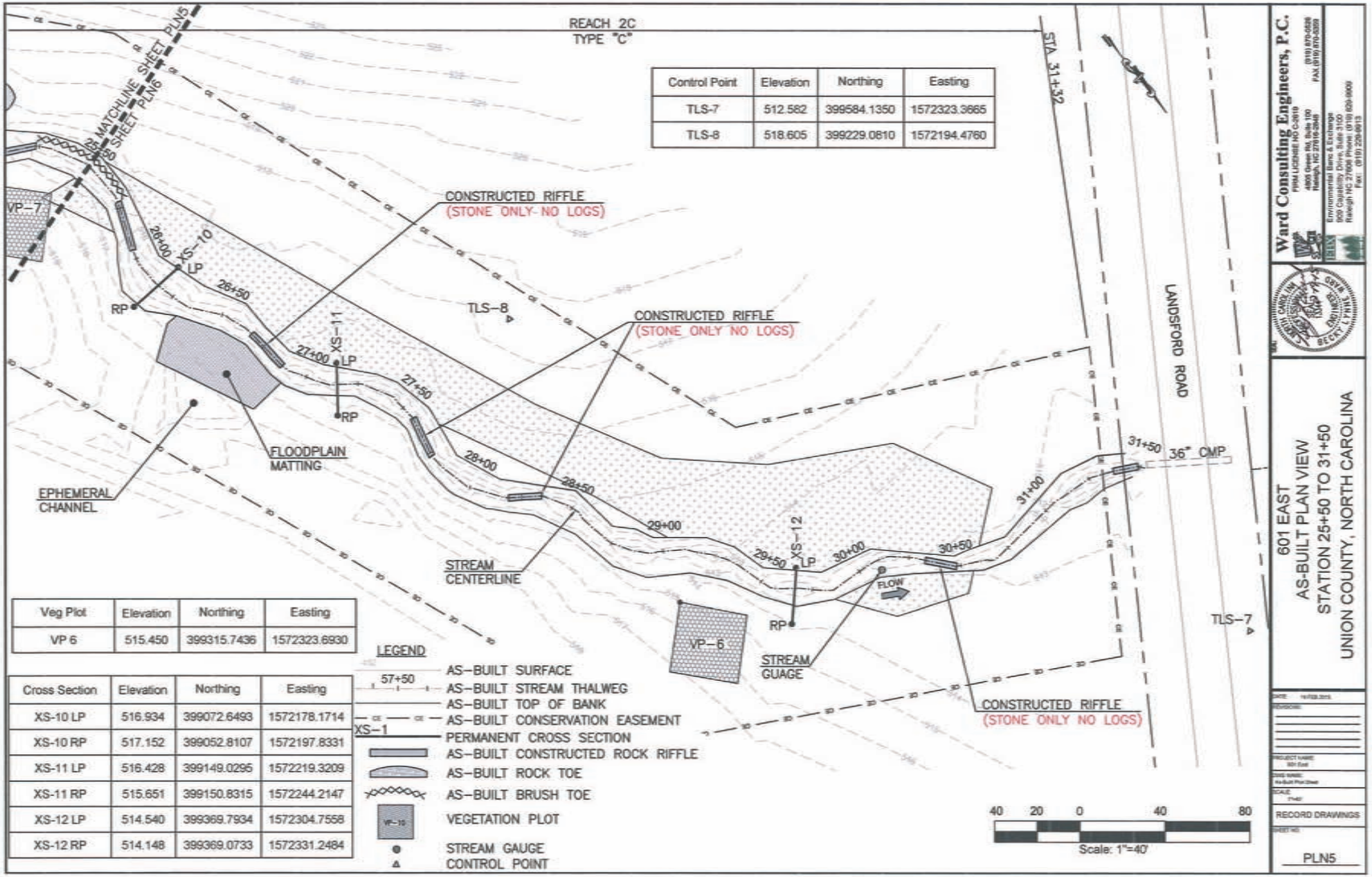
Ward Consulting Engineers, P.C.

Environmental Banc & Exchange

601 EAST
AS-BUILT PLAN VIEW
STATION 20+00 TO 25+50
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

PLN4



Control Point	Elevation	Northing	Easting
TLS-7	512.582	399584.1350	1572323.3665
TLS-8	518.605	399229.0810	1572194.4760

Veg Plot	Elevation	Northing	Easting
VP 6	515.450	399315.7436	1572323.6930

Cross Section	Elevation	Northing	Easting
XS-10 LP	516.934	399072.6493	1572178.1714
XS-10 RP	517.152	399052.8107	1572197.8331
XS-11 LP	516.428	399149.0295	1572219.3209
XS-11 RP	515.651	399150.8315	1572244.2147
XS-12 LP	514.540	399369.7934	1572304.7558
XS-12 RP	514.148	399369.0733	1572331.2484

LEGEND

- AS-BUILT SURFACE
- 57+50 — AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- CE — CE — AS-BUILT CONSERVATION EASEMENT
- XS-1 — PERMANENT CROSS SECTION
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT ROCK TOE
- AS-BUILT BRUSH TOE
- VP-10 — VEGETATION PLOT
- STREAM GAUGE
- CONTROL POINT

40 20 0 40 80
Scale: 1"=40'

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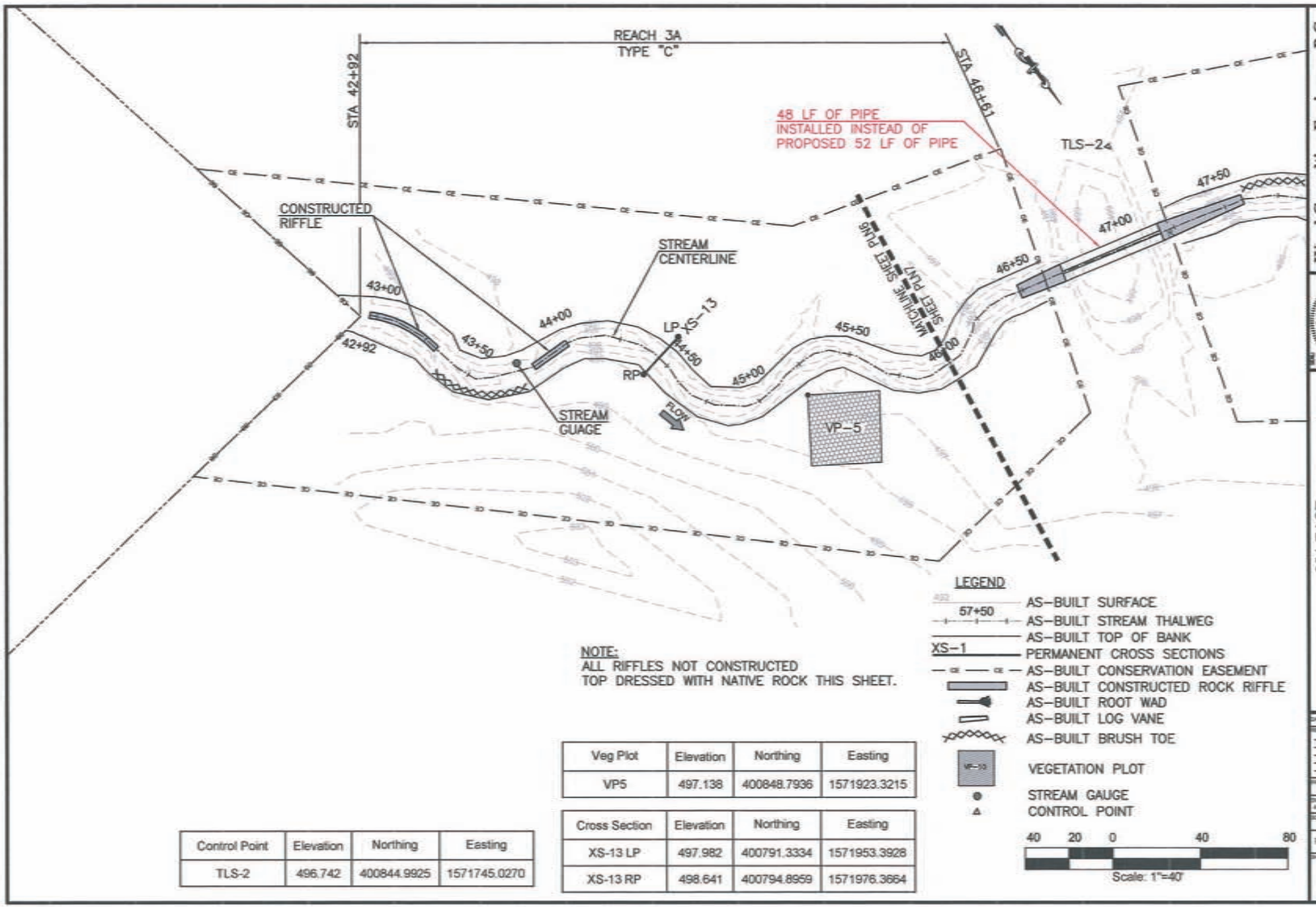
601 EAST
AS-BUILT PLAN VIEW
STATION 25+50 TO 31+50
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

PLN5



LEGEND

- AS-BUILT SURFACE
- 57+50 — AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- XS-1 — PERMANENT CROSS SECTIONS
- AS-BUILT CONSERVATION EASEMENT
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT ROOT WAD
- AS-BUILT LOG VANE
- AS-BUILT BRUSH TOE
- VP-13 — VEGETATION PLOT
- STREAM GAUGE
- CONTROL POINT

40 20 0 40 80
Scale: 1"=40'

NOTE:
ALL RIFFLES NOT CONSTRUCTED
TOP DRESSED WITH NATIVE ROCK THIS SHEET.

Veg Plot	Elevation	Northing	Easting
VP5	497.138	400848.7936	1571923.3215

Cross Section	Elevation	Northing	Easting
XS-13 LP	497.982	400791.3334	1571953.3928
XS-13 RP	498.641	400794.8959	1571976.3664

Control Point	Elevation	Northing	Easting
TLS-2	496.742	400844.9925	1571745.0270

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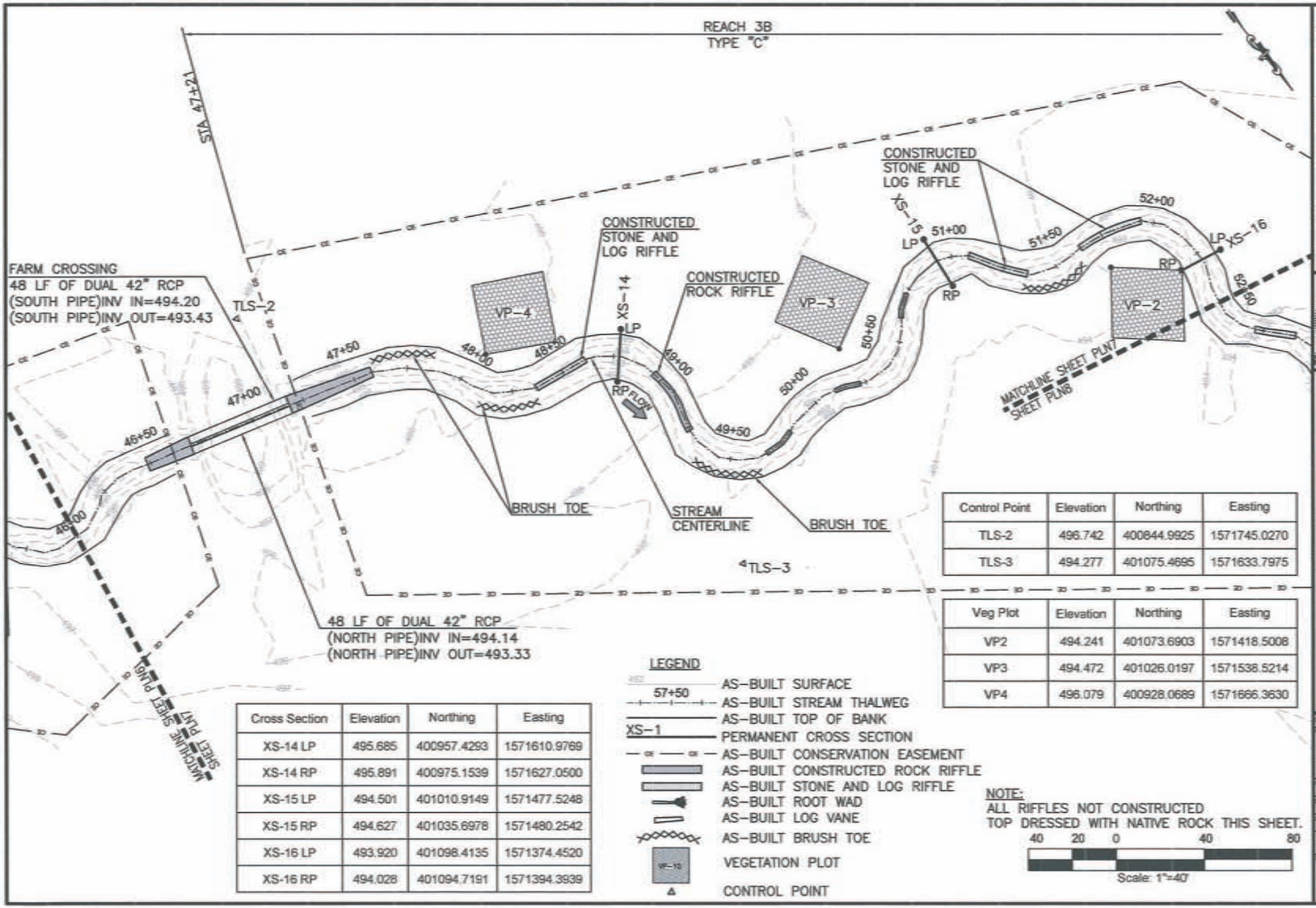
601 EAST
AS-BUILT PLAN VIEW
STATION 42+96 TO 46+00
UNION COUNTY, NORTH CAROLINA

DATE: 19 FEB 2010
REVISIONS:
PROJECT NAME: 601 East
DWG NAME: As-Built Plan Sheet
SCALE: 1"=40'
RECORD DRAWINGS
SHEET NO.
PLN6



Control Point	Elevation	Northing	Easting
TLS-2	496.742	400844.9925	1571745.0270
TLS-3	494.277	401075.4695	1571633.7975

Veg Plot	Elevation	Northing	Easting
VP2	494.241	401073.6903	1571418.5008
VP3	494.472	401026.0197	1571538.5214
VP4	496.079	400928.0689	1571666.3630

Cross Section	Elevation	Northing	Easting
XS-14 LP	495.685	400957.4293	1571610.9769
XS-14 RP	495.891	400975.1539	1571627.0500
XS-15 LP	494.501	401010.9149	1571477.5248
XS-15 RP	494.627	401035.6978	1571480.2542
XS-16 LP	493.920	401098.4135	1571374.4520
XS-16 RP	494.028	401094.7191	1571394.3939

LEGEND

- AS-BUILT SURFACE
- 57+50 — AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- XS-1 — PERMANENT CROSS SECTION
- AS-BUILT CONSERVATION EASEMENT
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT STONE AND LOG RIFFLE
- AS-BUILT ROOT WAD
- AS-BUILT LOG VANE
- AS-BUILT BRUSH TOE
- VP-1/2 — VEGETATION PLOT
- CONTROL POINT

NOTE:
ALL RIFFLES NOT CONSTRUCTED TOP DRESSED WITH NATIVE ROCK THIS SHEET.

40 20 0 40 80
Scale: 1"=40'

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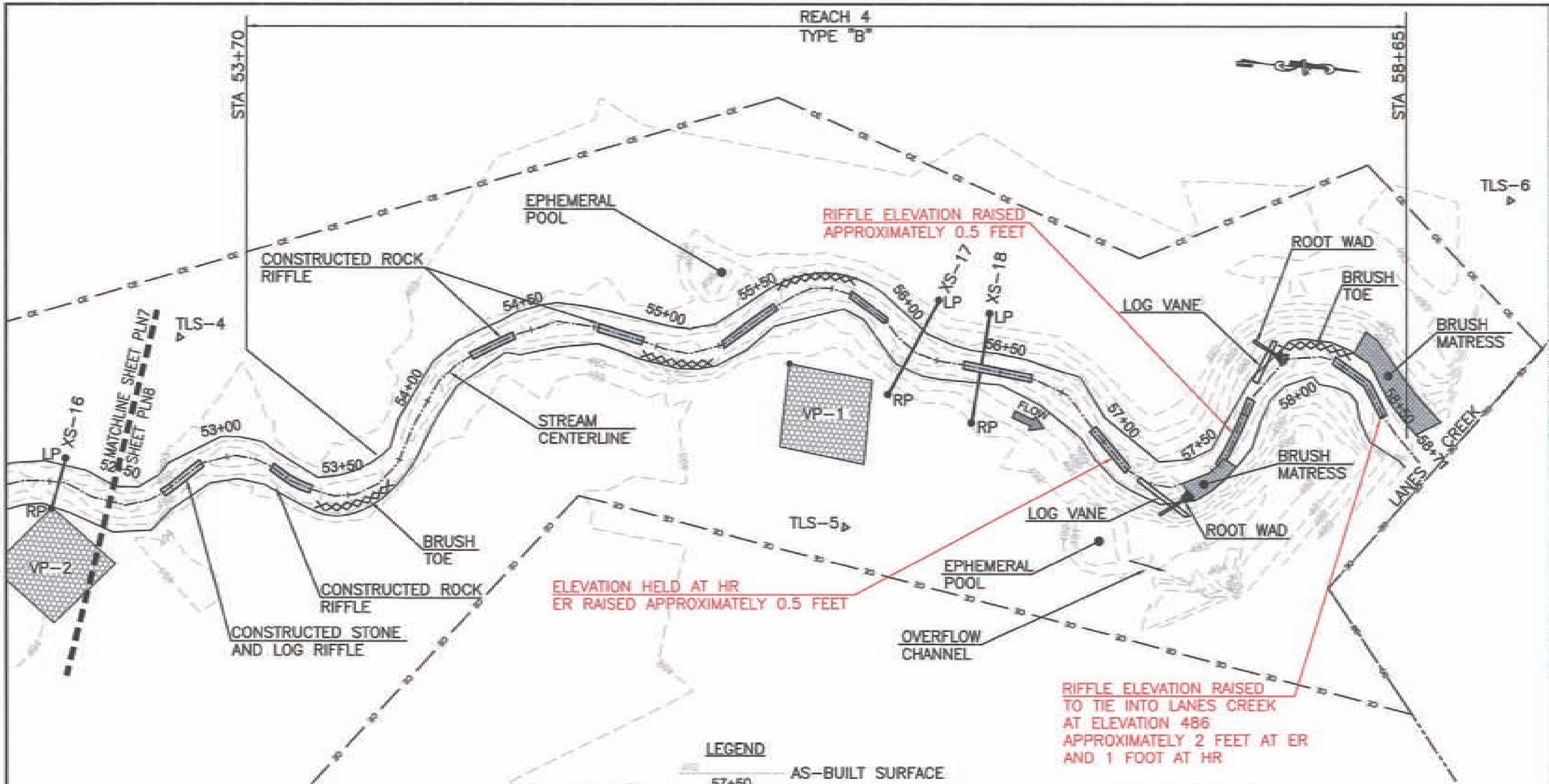
601 EAST
AS-BUILT PLAN VIEW
STATION 46+00 TO 52+50
UNION COUNTY, NORTH CAROLINA

DATE: 19 FEB 2010
REVISIONS:
PROJECT NAME: 601 East
DWG NAME: As-Built Plan Sheet
SCALE: 1"=40'
RECORD DRAWINGS
SHEET NO.
PLN7



Veg Plot	Elevation	Northing	Easting
VP1	492.813	401372.5794	1571314.2501

Cross Section	Elevation	Northing	Easting
XS-17 LP	492.632	401428.0499	1571285.0586
XS-17 RP	492.552	401411.4217	1571323.0802
XS-18 LP	492.830	401448.0254	1571288.6682
XS-18 RP	492.052	401444.4790	1571331.2430

LEGEND

- AS-BUILT SURFACE
- 57+50 — AS-BUILT STREAM THALWEG
- AS-BUILT TOP OF BANK
- CE — AS-BUILT CONSERVATION EASEMENT
- XS-1 — PERMANENT CROSS SECTION
- AS-BUILT CONSTRUCTED ROCK RIFFLE
- AS-BUILT STONE AND LOG RIFFLE
- AS-BUILT ROOT WAD
- AS-BUILT LOG VANE
- AS-BUILT BRUSH TOE
- VP-10 — VEGETATION PLOT
- BRUSH MATRESS
- CONTROL POINT

Control Point	Elevation	Northing	Easting
TLS-4	493.573	401137.9405	1571324.1755
TLS-5	492.575	401399.1475	1571375.3980
TLS-6	493.382	401643.8610	1571228.0080

NOTE:
ALL RIFFLES NOT CONSTRUCTED
TOP DRESSED WITH NATIVE ROCK THIS SHEET.

40 20 0 40 80
Scale: 1"=40'

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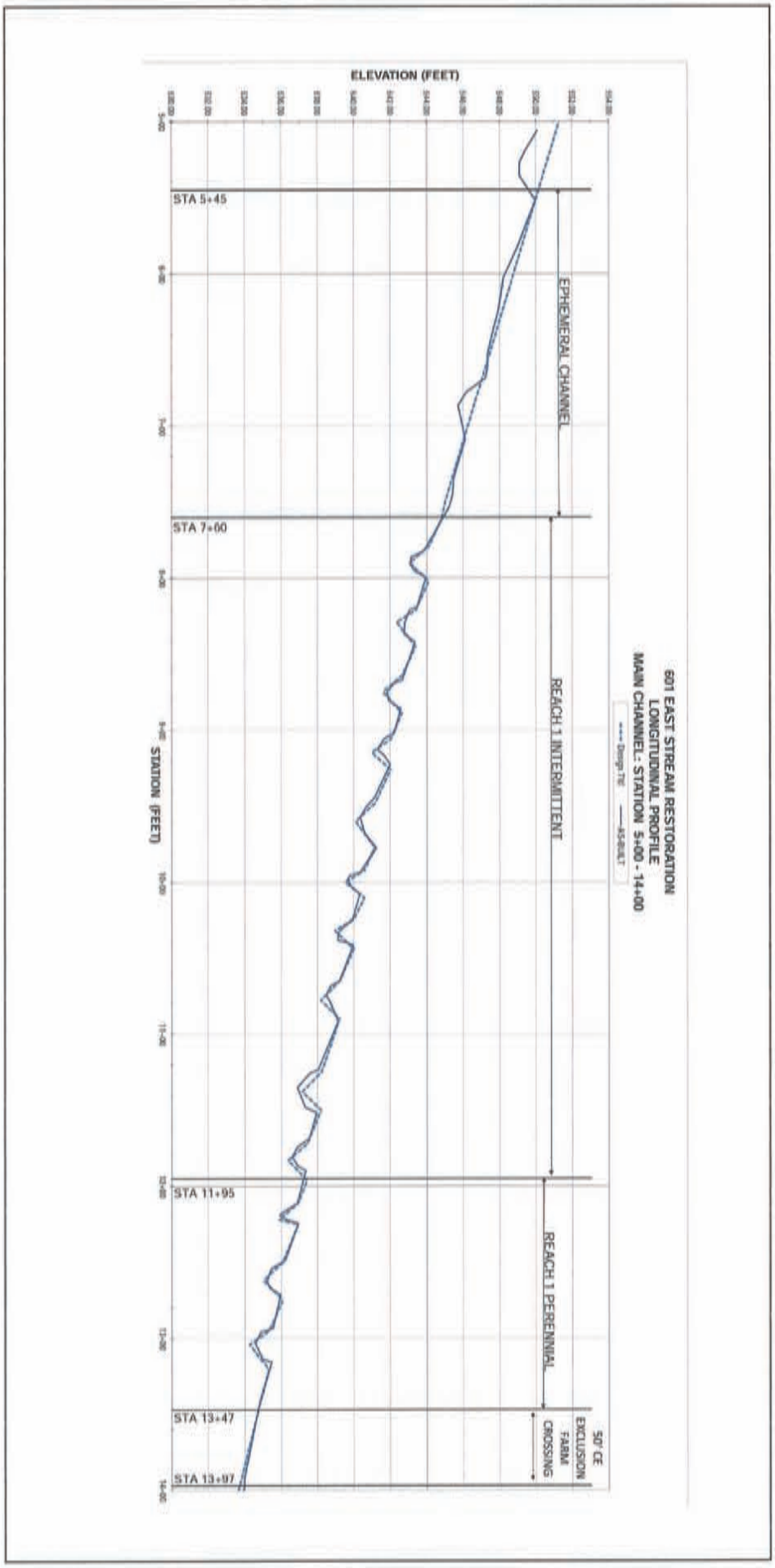
601 EAST
AS-BUILT PLAN VIEW
STATION 52+50 TO 58+71
UNION COUNTY, NORTH CAROLINA

DATE: 19 FEB 2010
RECORD DRAWINGS
PLN8



601 EAST
AS-BUILT
REACH 1 LONGITUDINAL PROFILE
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

P1

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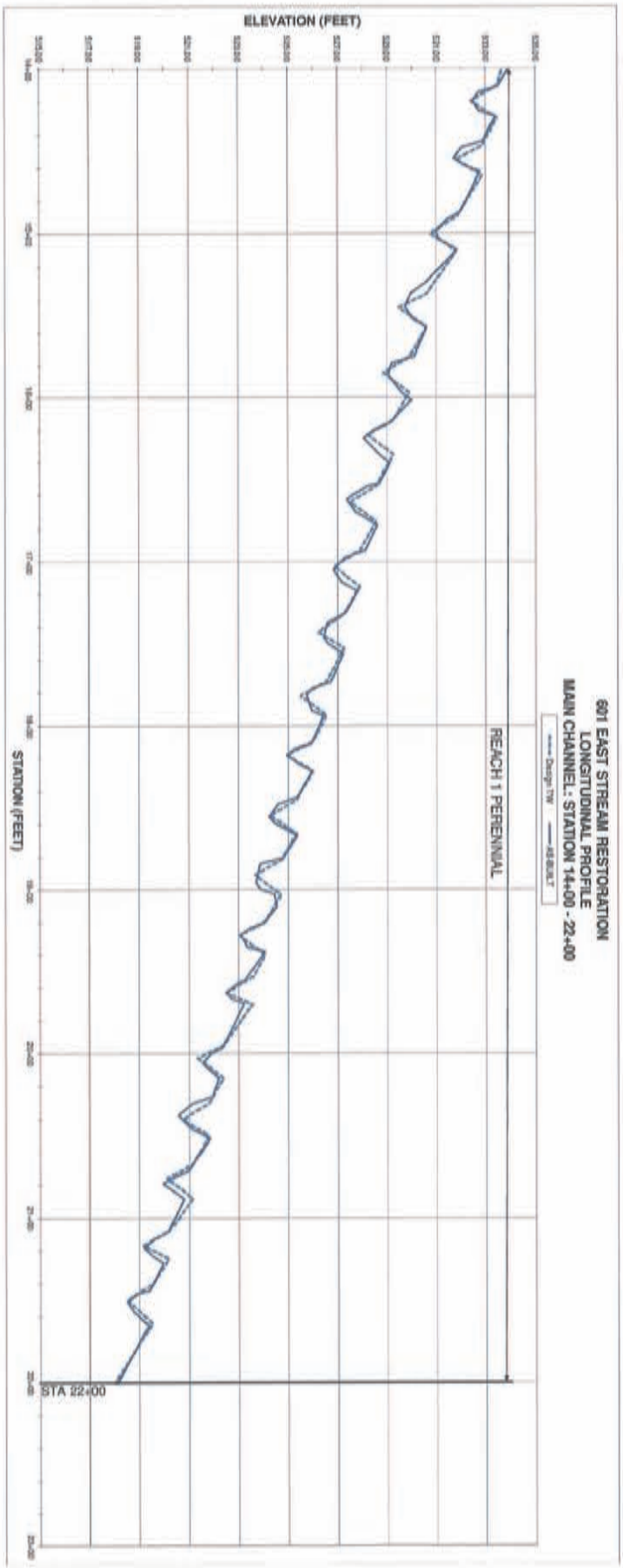

601 EAST
AS-BUILT
REACH 1 LONGITUDINAL PROFILE
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

P2

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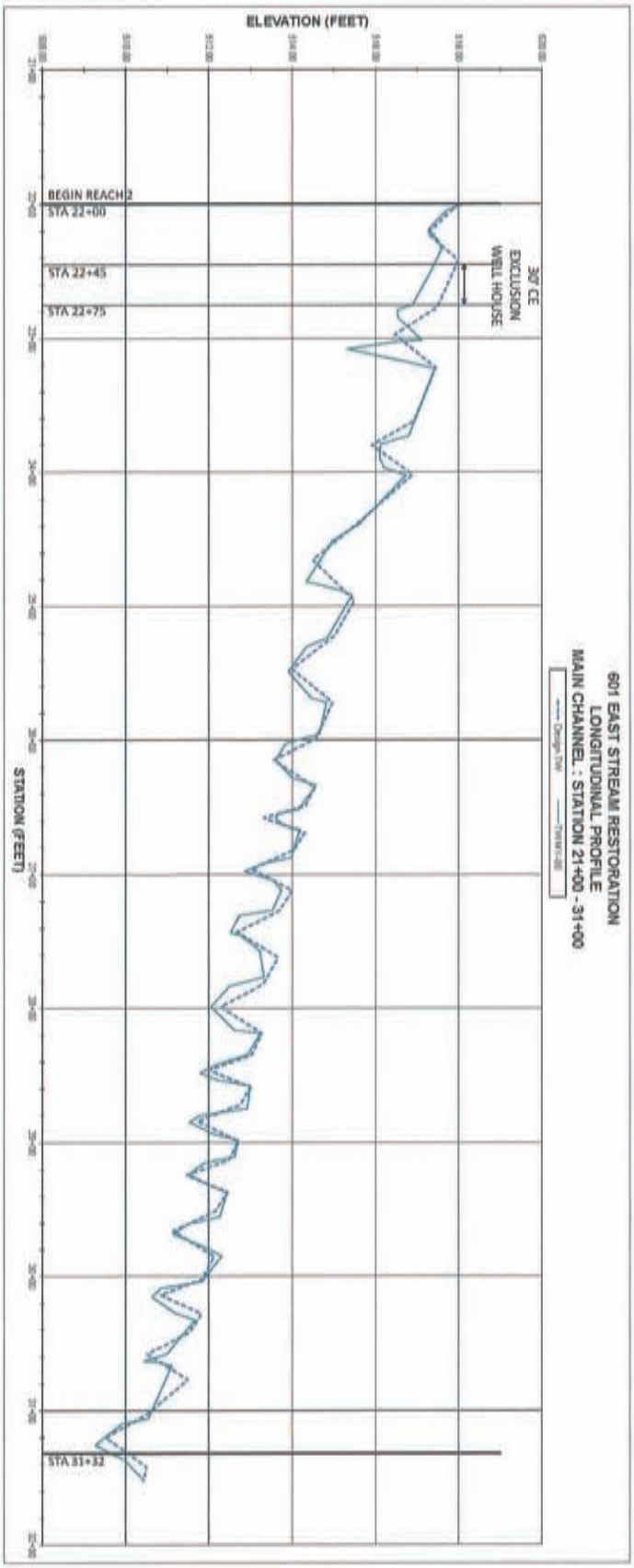

P3

RECORD DRAWINGS

601 EAST
AS-BUILT
REACH 2 LONGITUDINAL PROFILE
UNION COUNTY, NORTH CAROLINA

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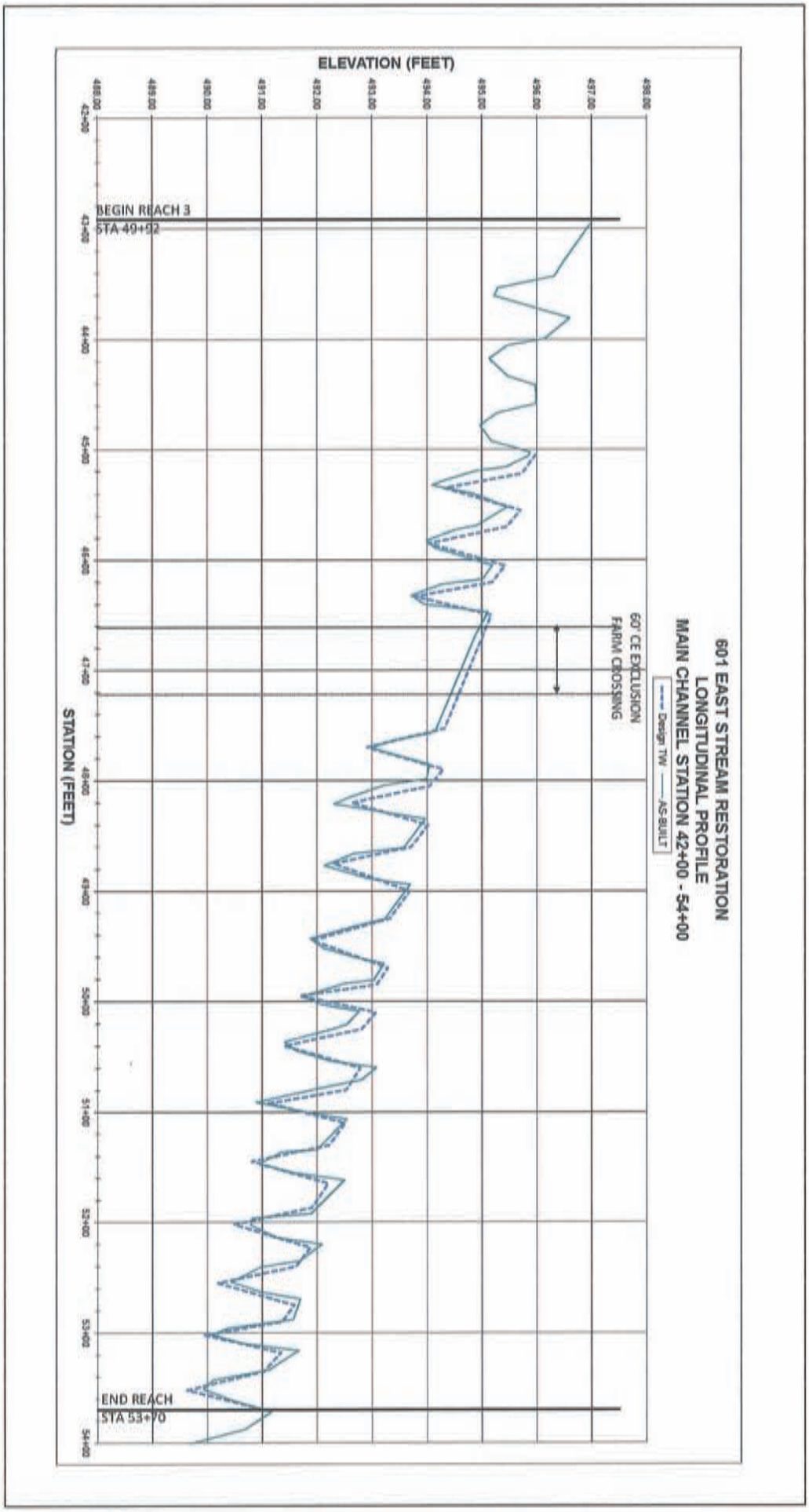
Fax: (919) 229-0913



601 EAST
AS-BUILT
REACH 3 LONGITUDINAL PROFILE
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

P4

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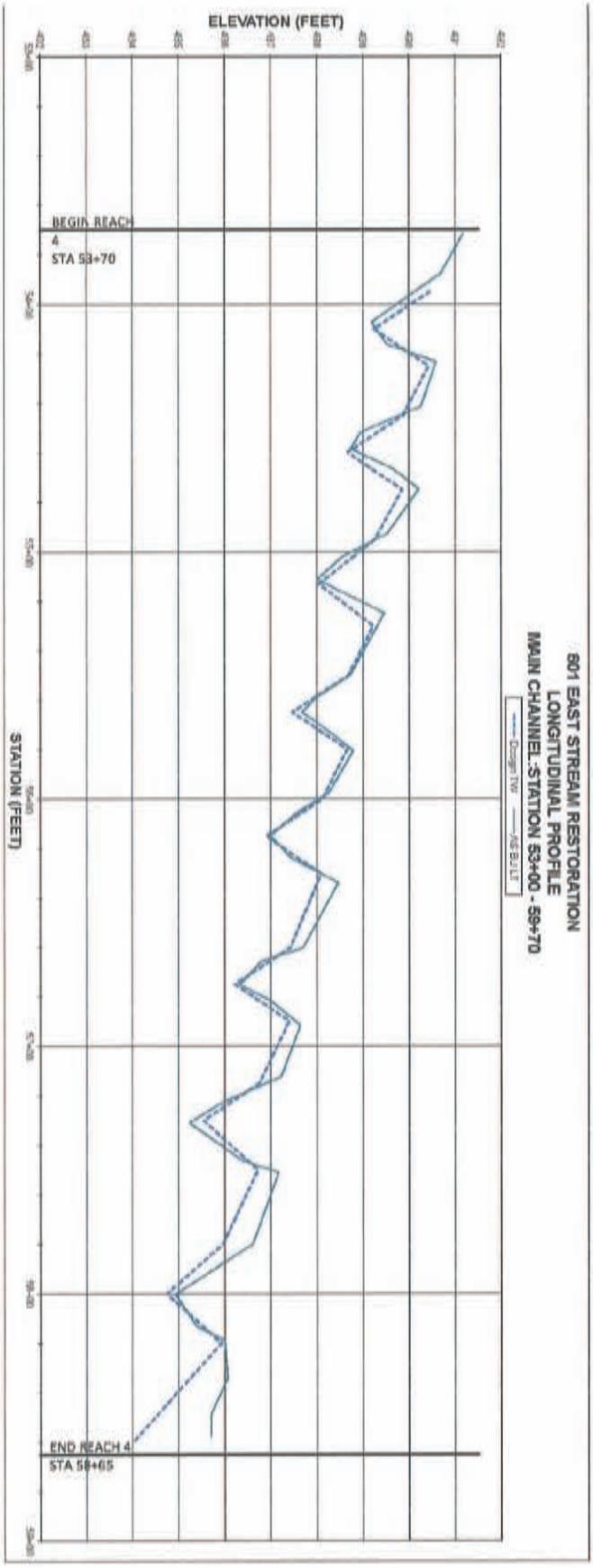

601 EAST
AS-BUILT
REACH 4 LONGITUDINAL PROFILE
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

P5

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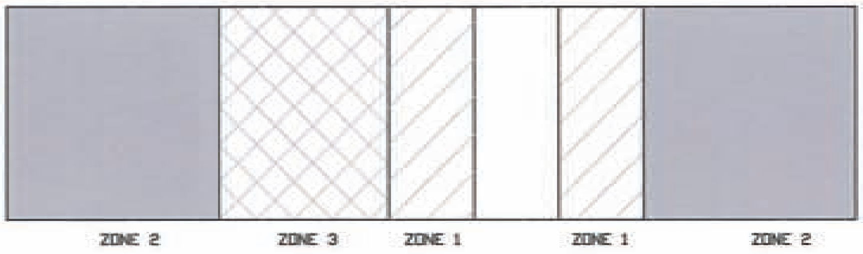
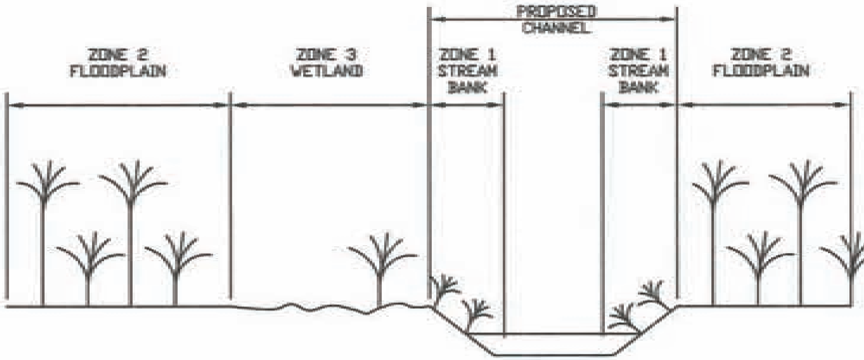


PLAN VIEW



PLANTING ZONE PROFILE SCHEMATIC
NOT TO SCALE

Wetland Planting Zones - Permanent Seed Mix

Recommended application rate: 20 lbs. per acre		
Species	Common Name	Percent
Agrostis stolonifera	Creeping bentgrass	35
Carex vulpinoidea	Fox sedge	25
Elymus virginicus	Virginia wild rye	25
Juncus effusus	Soft Rush	5
Rudbeckia hirta	Black-eyed susan	5
Verbena hastata	Blue vervain	5
	Total:	100

0.37 Total Acres
20 lbs./acre
8 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

10.37 Total Acres
20 lbs./acre
208 Total lbs.

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&3 - STREAM BUFFER: THE STREAM BUFFER INCLUDES THE AREA FROM THE BANKFULL ELEVATION TO THE CONSERVATION EASEMENT LIMIT.
   - ZONE 4 - WETLAND: THE WETLAND ZONES INCLUDE POCKETS OF ENHANCED EXISTING WETLAND AREAS WITHIN ZONE 2.
   - ZONE 5 - TEMPORARY ACCESS AREA TO BE STABILIZED WITH TEMPORARY SEED ONLY WITHIN CROP PRODUCTION AREAS.

601 East Planting Summary

January 20 – January 21, 2015

H&J Forest Service

Clear Skies low 40's high mid 60's; saturated ground conditions for 60%.

700 Swamp Chestnut Oak were not loaded on the trailer by accident at Arborgen they will be used at Buffalo Branch to replace the 1,000 extra Sycamore that were used at 601 East.

Bare Roots

Blackgum	400
Buttonbush	200
Southern Red Oak	500
Swamp Chestnut Oak	300
White Oak	400
Willow Oak	2,100 (300 taken from 481NA order)
Paw Paw	700
Persimmon	200
Yellow Poplar	1,200
River Birch	200 + 1,000 (300 taken from 481NA order, 1,000 from NCFS Nursery)
Green Ash	700 (NCFS Nursery)
Sycamore	2,000 (NCFS Nursery)
Total Bare Roots	8,500

Livestakes

Cottonwood	2,300
Black Willow	4,000
Total Livestakes	6,300

Planted by New Forest Services

Bare roots were planted 12x12 on the first day to allow for a follow up planting of Sycamore, River Birch and Green Ash on an approximate 12x12 spacing to fill in the gaps to equate to roughly 680 stems per acre. Livestakes were planted along the stream banks at the edge of water line and roughly 1 foot above that in 2 rows of 3'x3' except at the top of the project and around BMP's where they were planted as dense as 1'x1' or 2'x2'. Livestakes were planted in the floodplain pools in the lower third of the project which is the floodplain for Lane's Creek. These livestakes should thrive in these conditions and will be included as part of the stem counts in the vegetation plots.

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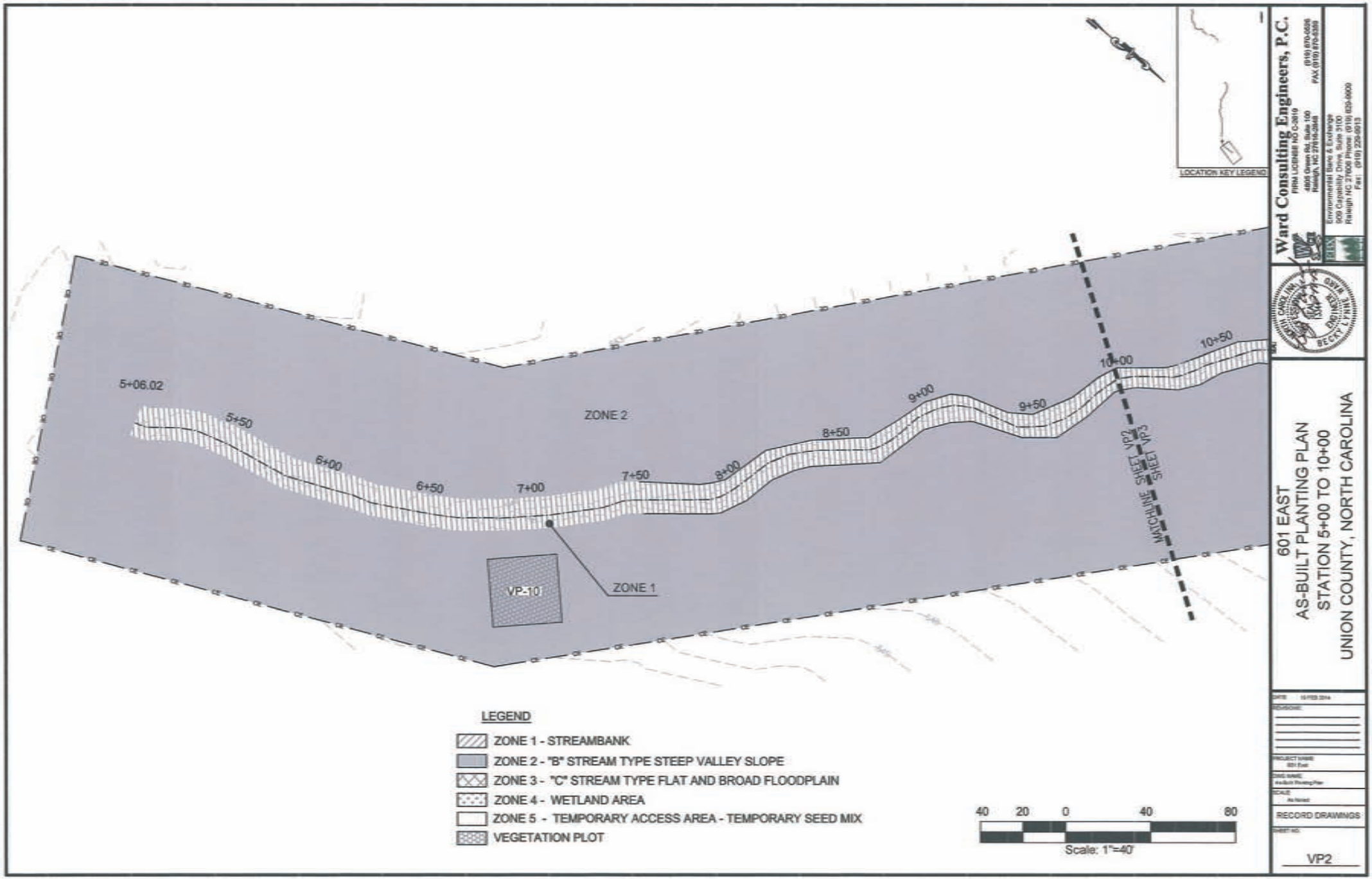
Raleigh NC 27606 Phone (919) 829-9909
Fax: (919) 229-9913

BECKY LYNNE WARD

601 EAST
AS-BUILT PLANTING NOTES
UNION COUNTY, NORTH CAROLINA

DATE: 19 FEB 2015
REVISIONS:
PROJECT NAME: 601 East
DWG NAME: Planting Notes
SCALE: NTS
RECORD DRAWINGS
SHEET NO.: VP1



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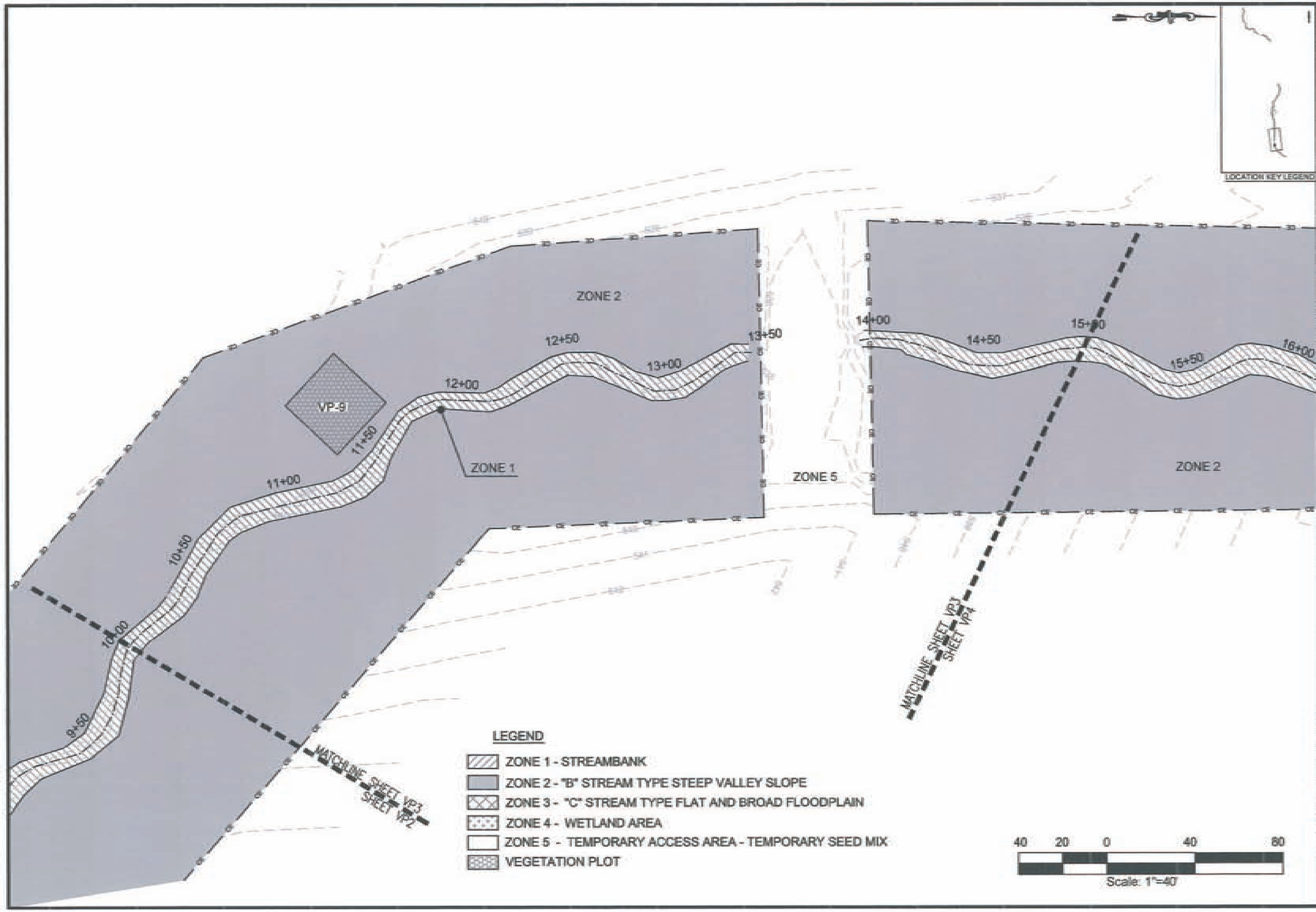
Fax: (919) 229-0013

601 EAST
AS-BUILT PLANTING PLAN
STATION 5+00 TO 10+00
UNION COUNTY, NORTH CAROLINA

DATE: 10 FEB 2014
REVISIONS:
PROJECT NAME: 601 East
DWG NAME: As-Built Planting Plan
SCALE: As Noted
RECORD DRAWINGS
SHEET NO.
VP2

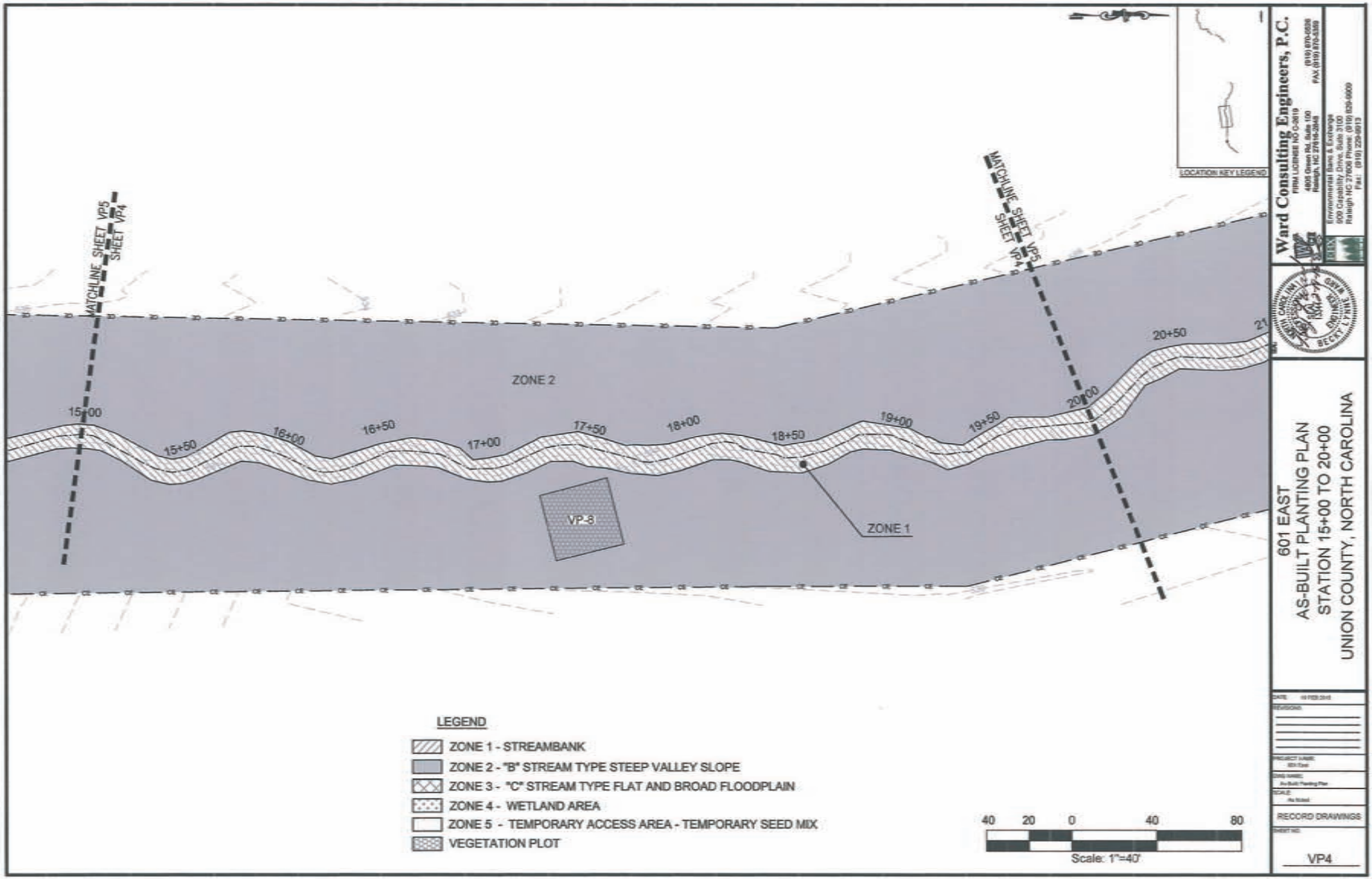


Ward Consulting Engineers, P.C.

601 EAST
AS-BUILT PLANTING PLAN
STATION 10+00 TO 15+00
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

VP3



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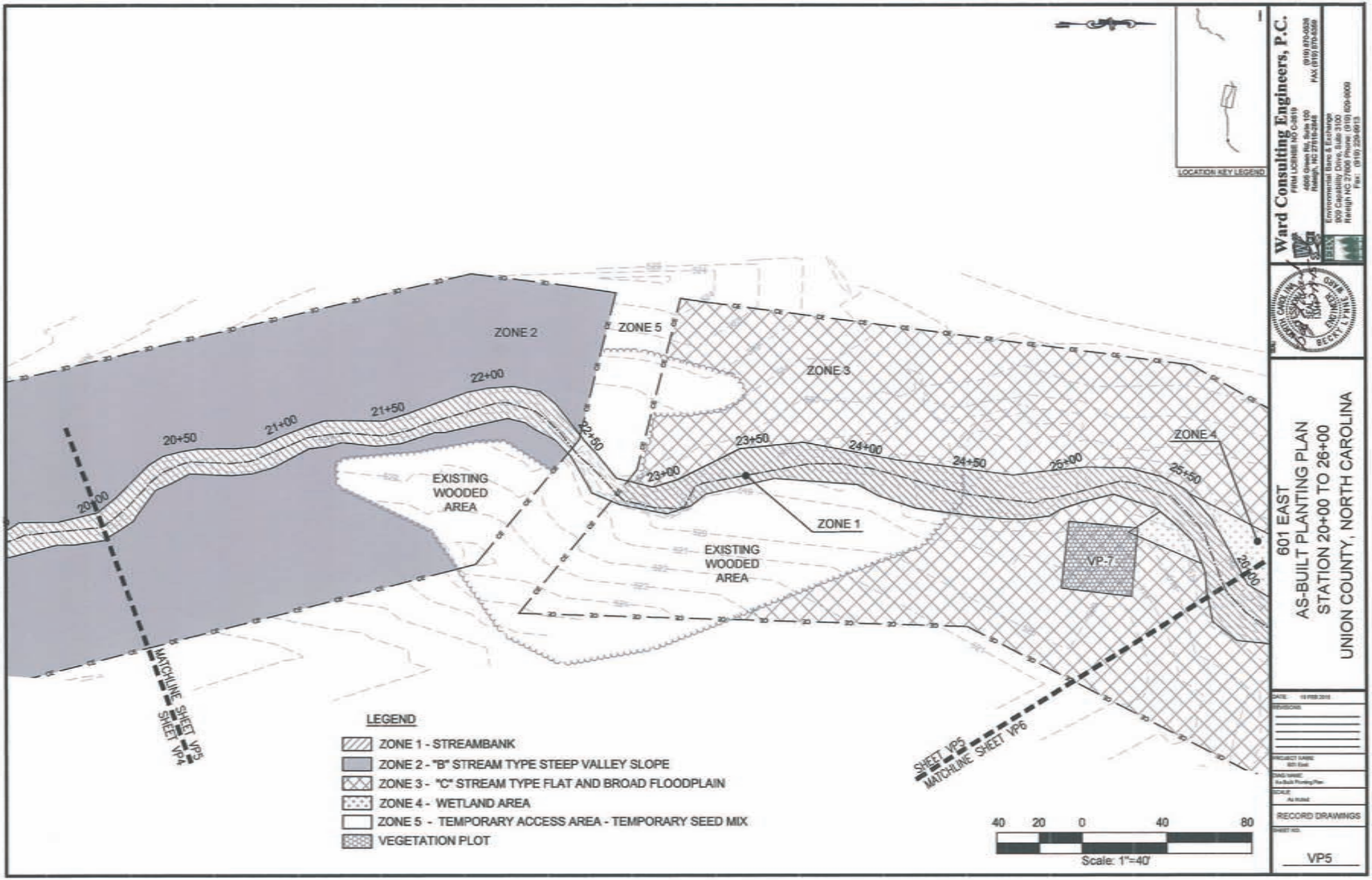
Fax: (919) 229-6913

601 EAST
AS-BUILT PLANTING PLAN
STATION 15+00 TO 20+00
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

VP4



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4609 Green Rd, Suite 100
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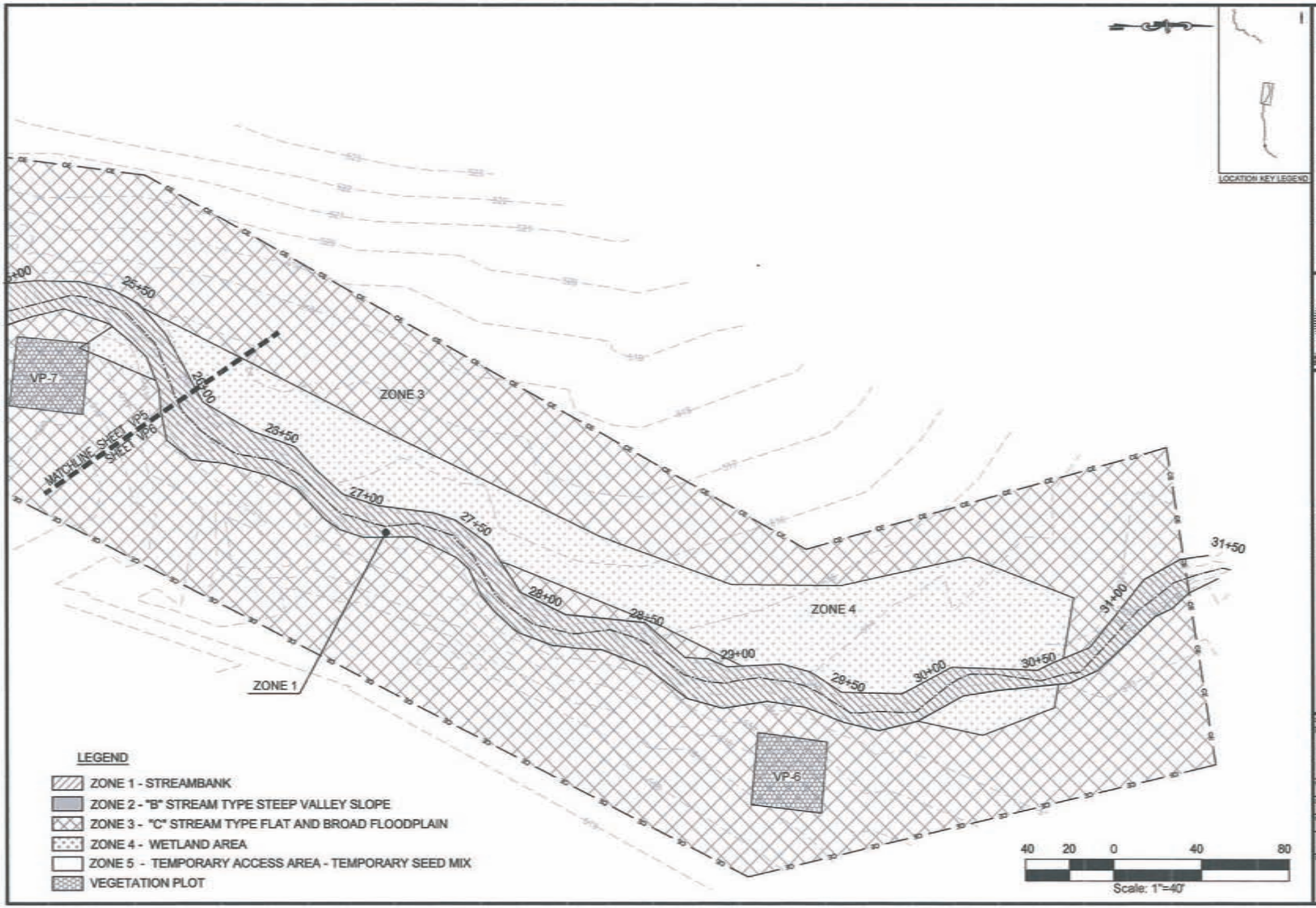
Raleigh NC 27606 Phone (919) 609-9009
Fax: (919) 229-6913

601 EAST
AS-BUILT PLANTING PLAN
STATION 20+00 TO 26+00
UNION COUNTY, NORTH CAROLINA

DATE: 19 FEB 2010
REVISIONS:
PROJECT NAME: 601 East
DWG NAME: As-Built Planting Plan
SCALE: As Noted
RECORD DRAWINGS
SHEET NO.
VP5



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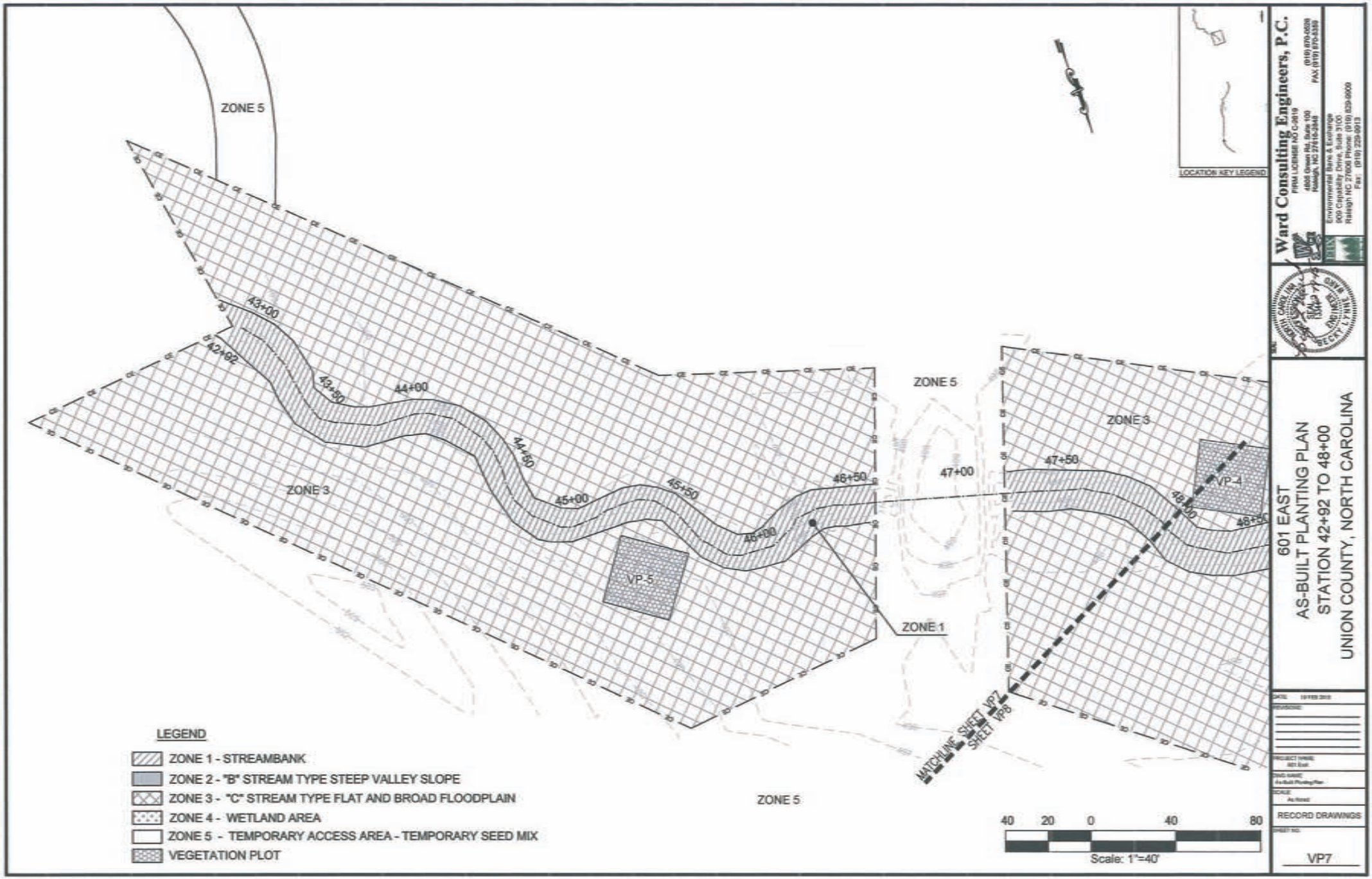
Raleigh NC 27606 Phone: (919) 829-9500
Fax: (919) 229-9913

601 EAST
AS-BUILT PLANTING PLAN
STATION 26+00 TO 31+45.18
UNION COUNTY, NORTH CAROLINA

DATE: 19 FEB 2014
REVISIONS:
PROJECT NAME: 601 East
DWG NAME: As-Built Planting Plan
SCALE: As Stated
RECORD DRAWINGS
SHEET NO.
VP6



Ward Consulting Engineers, P.C.
FIRM LICENSE NO C-2619
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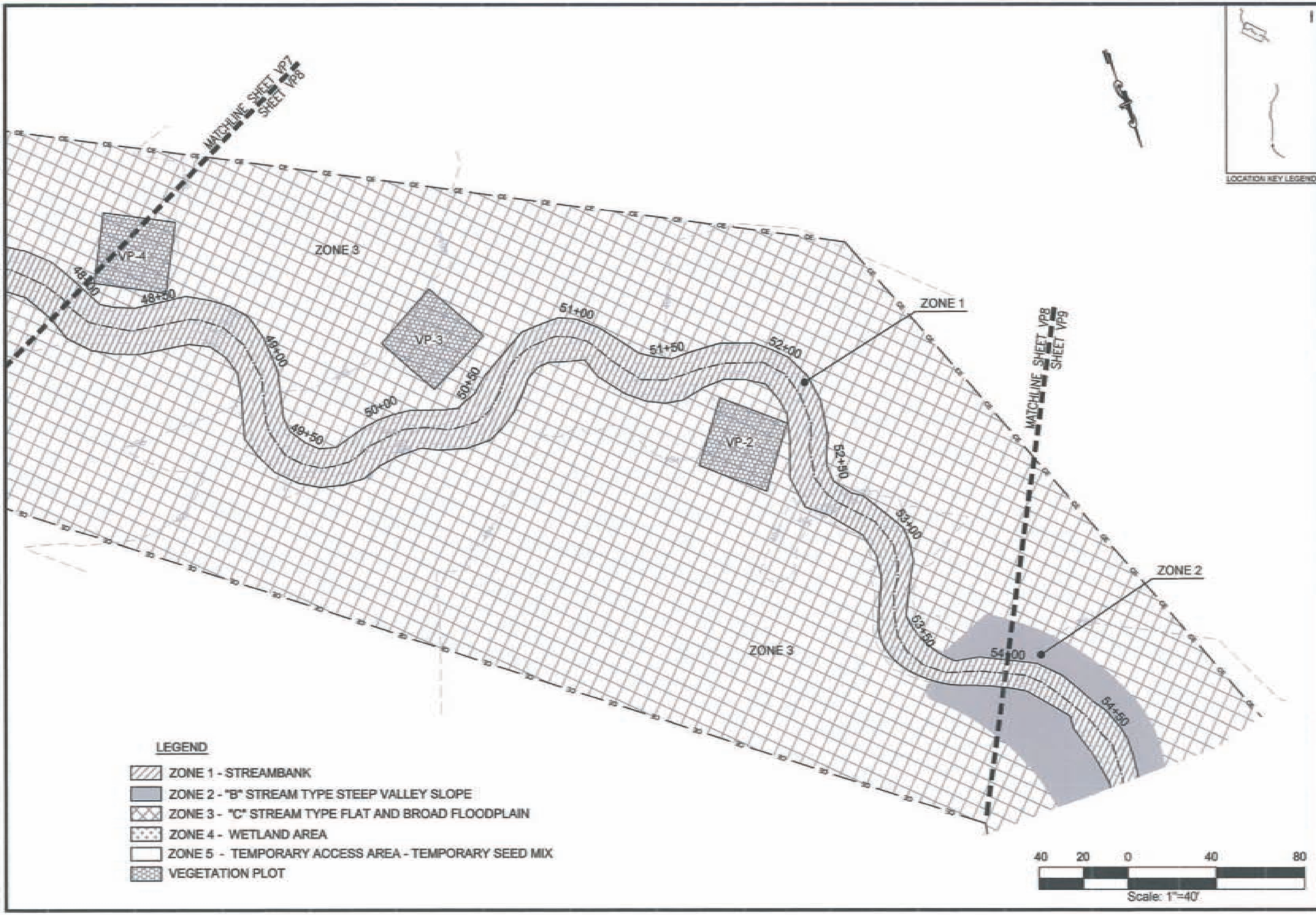
Raleigh NC 27606 Phone: (919) 829-9909
Fax: (919) 229-0913

601 EAST
AS-BUILT PLANTING PLAN
STATION 42+92 TO 48+00
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

VP7



Ward Consulting Engineers, P.C.

FIRM LICENSE NO C-2619
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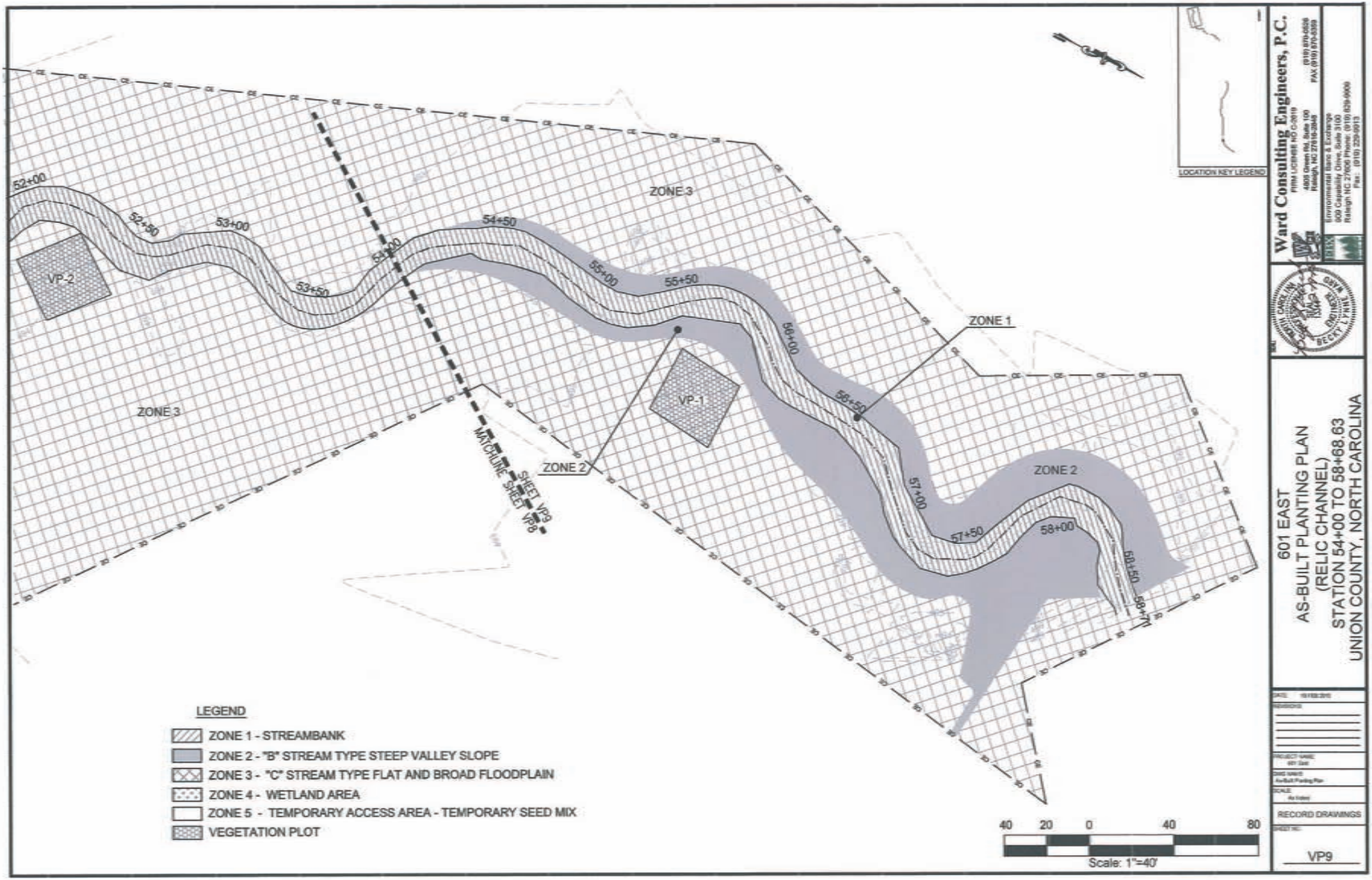
601 EAST
AS-BUILT PLANTING PLAN
(RELIC CHANNEL)
STATION 48+00 TO 54+00
UNION COUNTY, NORTH CAROLINA

RECORD DRAWINGS

VP8



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601 EAST
AS-BUILT PLANTING PLAN
(RELIC CHANNEL)
STATION 54+00 TO 58+68.63
UNION COUNTY, NORTH CAROLINA

DATE: 10/15/2015

RECORD DRAWINGS

VP9