

**Monitoring Baseline Report
Final
Unnamed Tributary to Crab Creek
Stream & Wetland Restoration Site**

**NCEEP Project Number: 857
Alleghany County, North Carolina**

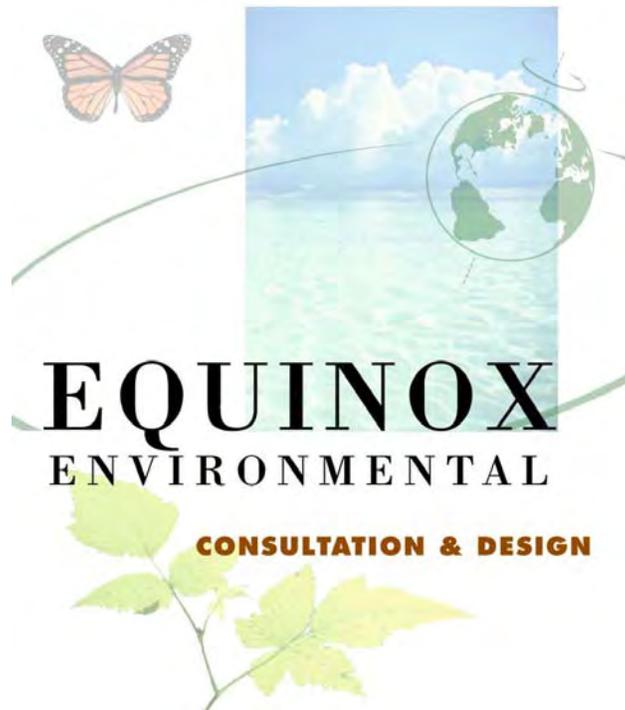


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1.0 EXECUTIVE SUMMARY

The project resides on an Unnamed Tributary to Crab Creek (UTCC) and involved the restoration, enhancement, and preservation of 6,928 linear feet of stream and 16.8 acres of wetlands. The goals of the project included water quality improvement, enhancement and preservation of riparian buffers, enhancement of aquatic and terrestrial habitat, and improvement of wetland function and habitat components. Project objectives to accomplish the goals involved the restoration of stream channel pattern, profile, and dimension. Additionally, bed heterogeneity and habitat corridor continuity were re-established through restoration of stream features and replacement of an existing culvert. Riparian area function was restored by revegetating with native trees, shrubs, and herbaceous plant species. Wetland hydrology and vegetation were restored in areas historically utilized for croplands.

The project site was delineated into three primary stream reaches that include unnamed tributary 1 (UT1), unnamed tributary to Crab Creek upstream (UTCC-US), and unnamed tributary to Crab Creek downstream (UTCC-DS). A total of 1,775 linear feet of restoration and 496 linear feet of enhancement were implemented on UT1. The UTCC-US reach included 2,485 linear feet of restoration and the UTCC-DS reach included 2,172 linear feet of stream preservation.

The primary focus of the revegetation element of the project was to restore natural plant communities within the Southern Appalachian Bog and Swamp Forest-Bog Complex areas as well as the UT1 and UTCC floodplains. Planting plans for six distinct planting zones were implemented to restore native species composition commonly associated with the various stream and wetland habitat types on the project site. Additionally, invasive species control was implemented during construction to minimize the impacts of multiflora rose *Rosa multiflora* on the restored plant communities.

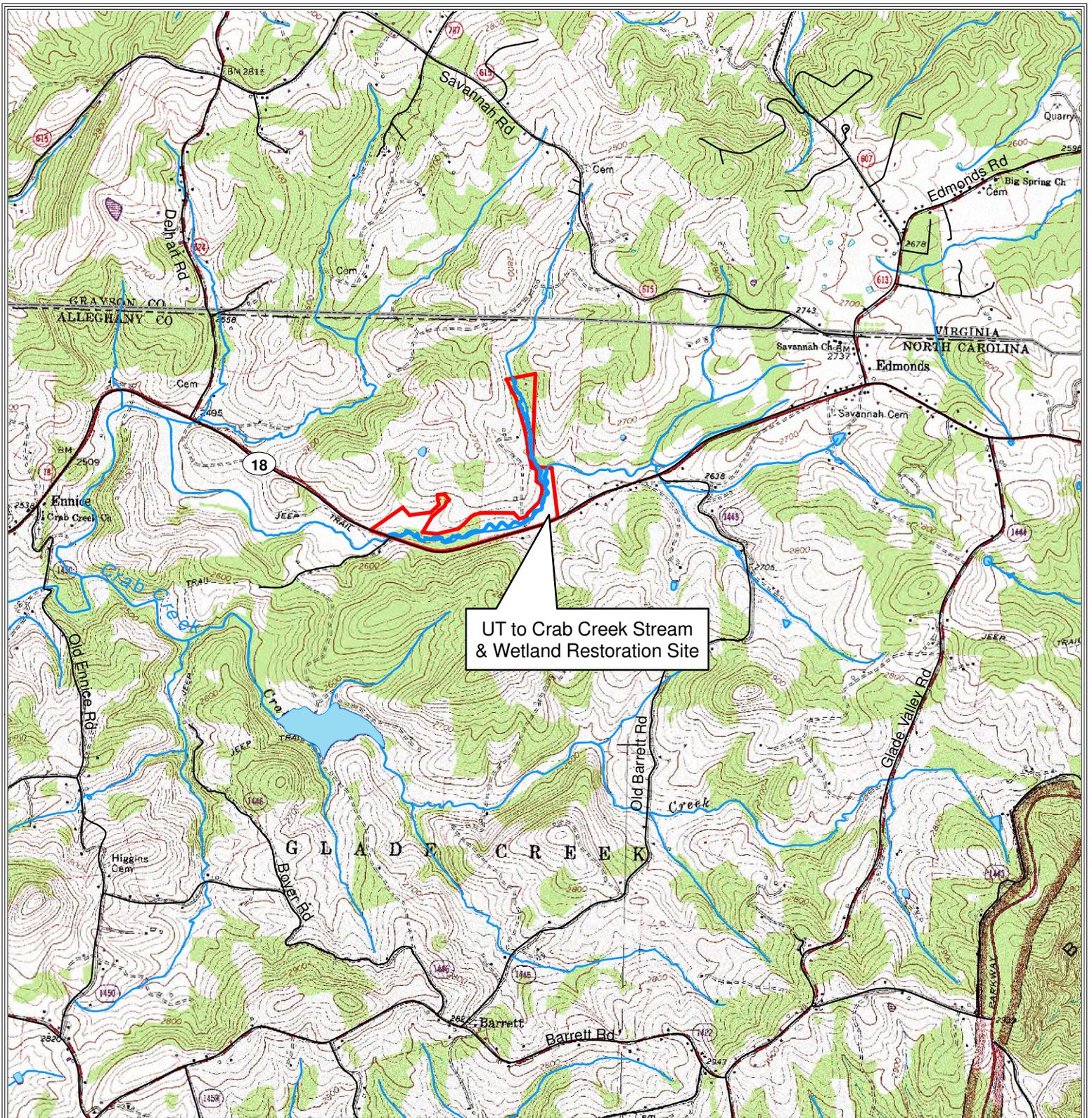
Eight separate wetland areas were identified within the project site which included Montane Alluvial Forest, Southern Appalachian Bog, and Swamp Forest-Bog complex types (Schafale and Weakley 1990). Targeted wetland project components included approximately 8.0 acres of wetland restoration, 3.1 acres of wetland enhancement, 0.2 acres of wetland creation, and 5.3 acres of wetland preservation.

Annual monitoring will begin during the 2010 growing season and will include stream, wetland, and vegetation monitoring components as established within this document. Annual monitoring will occur for five years or until project success criteria have been achieved.

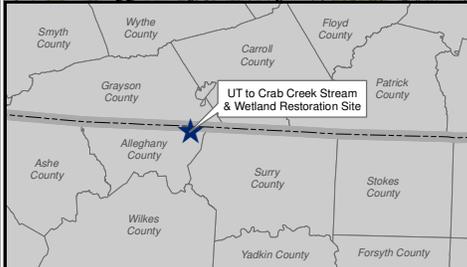
2.0 PROJECT BACKGROUND

2.1 Location and Setting

The Unnamed Tributary to Crab Creek (UTCC) restoration site is on a parcel owned by Mr. Keith Andrews (Figure 1). It is situated within the Little River watershed (14-digit HUC - 05050001030020) of the New River basin cataloging unit (8-digit HUC – 05050001). The Little River watershed was identified by the North Carolina Ecosystem Enhancement Program (NCEEP) as a Targeted Local Watershed with significant stream and wetland restoration needs (NCEEP 2009). The site is located approximately 6 miles west of the intersection of NC 89 and NC 18 in Alleghany County, North Carolina. Prior to project implementation, portions of the streams and wetlands within the site had been heavily degraded due to historical and active agricultural practices.



UT to Crab Creek Stream
& Wetland Restoration Site



Directions: From Raleigh, proceed west on I-40 towards Winston Salem. Take Exit 193 B (NC-8N/US-52N) towards Mount Airy. Proceed on US-52N to I-74W towards Wytheville, VA. Take Exit 5 (I-77S) and proceed to Exit 100 (Mount Airy/Galax/NC-89). Turn left and proceed west on NC-89. Turn left at NC-18 and go approximately 6 miles to the project site. The site is located on the north side of NC-18.

Figure 1 - Vicinity Map

UT to Crab Creek Stream & Wetland Restoration Site

Project No. 857

Alleghany County, North Carolina



0 1,250 2,500 5,000 Feet

7.5 Minute Series Cumberland Knob Quadrangle

2.2 Project Goals and Objectives

The goals and objectives stated in the UT to Crab Creek Restoration Site Restoration Plan (NCEEP 2007) are as follows:

Project Goals:

- Reduce bank sediment export and nutrient inputs to the receiving watershed of Crab Creek, a Class C Trout Water;
- Enhance and preserve riparian buffers of a headwater trout stream;
- Enhance aquatic and terrestrial habitat along an intact stream corridor;
- Improve wetland functions by connecting and expanding the following wetland communities: Swamp Forest-Bog Complex, Southern Appalachian Bog, and Montane Alluvial Forest; and
- Improve and expand Southern Appalachian Bog wetland habitat for the Bog Turtle *Clemmys muhlenburgii*.

Project Objectives:

- Restore 4,026 linear feet of stream channel with appropriate pattern, profile, and dimension to support a gravel transport system;
- Re-establish the natural stream features (bed heterogeneity) to restore aquatic habitat;
- Improve aquatic organism passage and habitat corridor continuity by replacing the culvert; and
- Convert existing croplands into Swamp Forest-Bog Complex and Southern Appalachian Bog Communities.

2.3 Project Structure, Restoration Type, and Approach

Prior to project implementation, agricultural use and un-forested riparian buffers in the watershed led to increased surface runoff, erosion, and sedimentation in the UT1 and UTCC stream reaches. Additionally, agriculture impacts such as ditching and cultivation within the existing wetlands resulted in degraded wetland habitats associated with the project site.

Work on UT1 involved restoring and enhancing a total of 2,271 linear feet of B4c/C4 stream types. A Priority Level 3 approach was implemented for the upper portion (1,336 linear feet) of UT1 restoration reaches while a Priority Level 1 approach was utilized for the lower portion (439 linear feet) of UT1 (Rosgen 1997). Because an appropriate reference reach could not be found for UT1, the stream dimensions were based on an analytical design approach for a B4c/C4 stream type. The design pattern and profile were developed from detailed morphological criteria and hydraulic geometry relationships taken from stable sections of UT1. Additionally, a total of 496 linear feet of enhancement Level II (revegetation and stream bank stabilization) occurred within four areas along UT1.

The design for UTCC-US included a Priority 1 restoration of 2,485 linear feet of meandering C4 stream channel and associated floodplain. The Priority Level 1 approach established a bankfull channel with a new floodplain, a channel bed at the original elevation, and a cross-section dimension necessary to provide stable flow maintenance and sediment transport.

The restored channels of UT1 and UTCC-US were stabilized with in-stream structures, including step pools and riffle grade control. These structures were designed to reduce bank erosion, influence secondary circulation in the near-bank region of the stream bends, and provide grade control. Riffle areas were enhanced with graded gravel material to mimic existing stable riffle features.

The project also included the preservation of 2,172 linear feet of stream within the UTCC-DS reach. Overall, this reach has a stable pattern with extensive forested buffers.

Wetland and buffer community improvements included plugging ditches, grading, and replanting with native plant species. The targeted buffer communities included Montane Alluvial Forest, Southern Appalachian Bog, and Swamp Forest-Bog Complex. Wetland restoration practices were implemented for 0.8 acres of Montane Alluvial Forest and 7.2 acres of Southern Appalachian Bog. Wetland enhancement practices were applied to 3.1 acres of Montane Alluvial Forest. An additional 0.2 acre Southern Appalachian Bog was created to expand this habitat type within the project site. Fully functional wetlands identified within the project site; including 2.1 acres of Southern Appalachian Bog and 3.2 acres of Swamp Forest Bog, were preserved through a permanent conservation easement.

The project components and summations are reported in Tables 1a and 1b and illustrated in Figure 2 below.

Table 1a. Project Components
UT Crab Creek Stream & Wetland / Project No. 857

Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Buffer Acres	BMP Elements	Comment		
UT1	2,313 lf	R	P3	1,775 lf	100+00 - 101+71		Existing culvert and crossing removed.	Stream channel stabilized with in-stream structures, including step pools and riffle grade control.		
					103+00 - 104+35					
					105+34 - 112+29					
					113+51 - 116+88					
		E	EII	496 lf	120+26 - 124+65			101+71 - 103+00	Existing culvert and crossing replaced with open bottom arch culvert.	Stream channel stabilized with in-stream structures, including step pools and riffle grade control.
					104+35 - 105+34					
					112+29 - 113+51					
				116+88 - 118+34			Included revegetation and stream bank stabilization.			
UTCC-US	2,086 lf	R	P2	2,485 lf	10+00 - 34+85		Existing culvert and crossing replaced with open bottom arch culvert.	Stream channel stabilized with in-stream structures, including step pools and riffle grade control.		
UTCC-DS	2,172 lf	P		2,172 lf	34+85 - 56+57					
Wetland 1	0.5 ac	P		0.5 ac				Intact Swamp Forest-Bog Complex. UT1 restoration and enhancement reach goes through this wetland. Wetland preservation limited to areas outside of the stream buffer.		
Wetland 2	1.0 ac	R		1.0 ac				Overfill cropland soil removed and site graded to restore Southern Appalachian Bog Community hydrology.		
Wetland 3	3.0 ac	R		3.2 ac				Cropland drainage ditches filled to restore Southern Appalachian Bog Community hydrology.		
Wetland 4	2.7 ac	R		2.7 ac				Overfill cropland soil removed, ditch filled, and wellhead removed to restore Southern Appalachian Bog Community hydrology.		
Wetland 5	0.7 ac	P		0.7 ac				Preservation of Swamp Forest-Bog Complex along UTCC-DS reach.		
Wetland 6	2.0 ac	P		2.0 ac				Preservation of Swamp Forest-Bog Complex along UTCC-DS reach.		
Wetland 7	0.9 ac	R		0.8 ac				Ditch filled and existing fill, debris, and culvert drain removed. Existing seep heads developed and additional hardwood trees planted to restore and enhance Montane Alluvial Forest.		
	3.1 ac	E		3.1 ac						
Wetland 8	0.3 ac	R		0.3 ac				Overfill cropland soil removed, groundwater springs exposed, and bog wetland species planted to restore and create Southern Appalachian Bog Community hydrology.		
	0.0 ac	C		0.2 ac						
Wetland 9	2.2 ac	P		2.2 ac				Preservation of Southern Appalachian Bog Community.		

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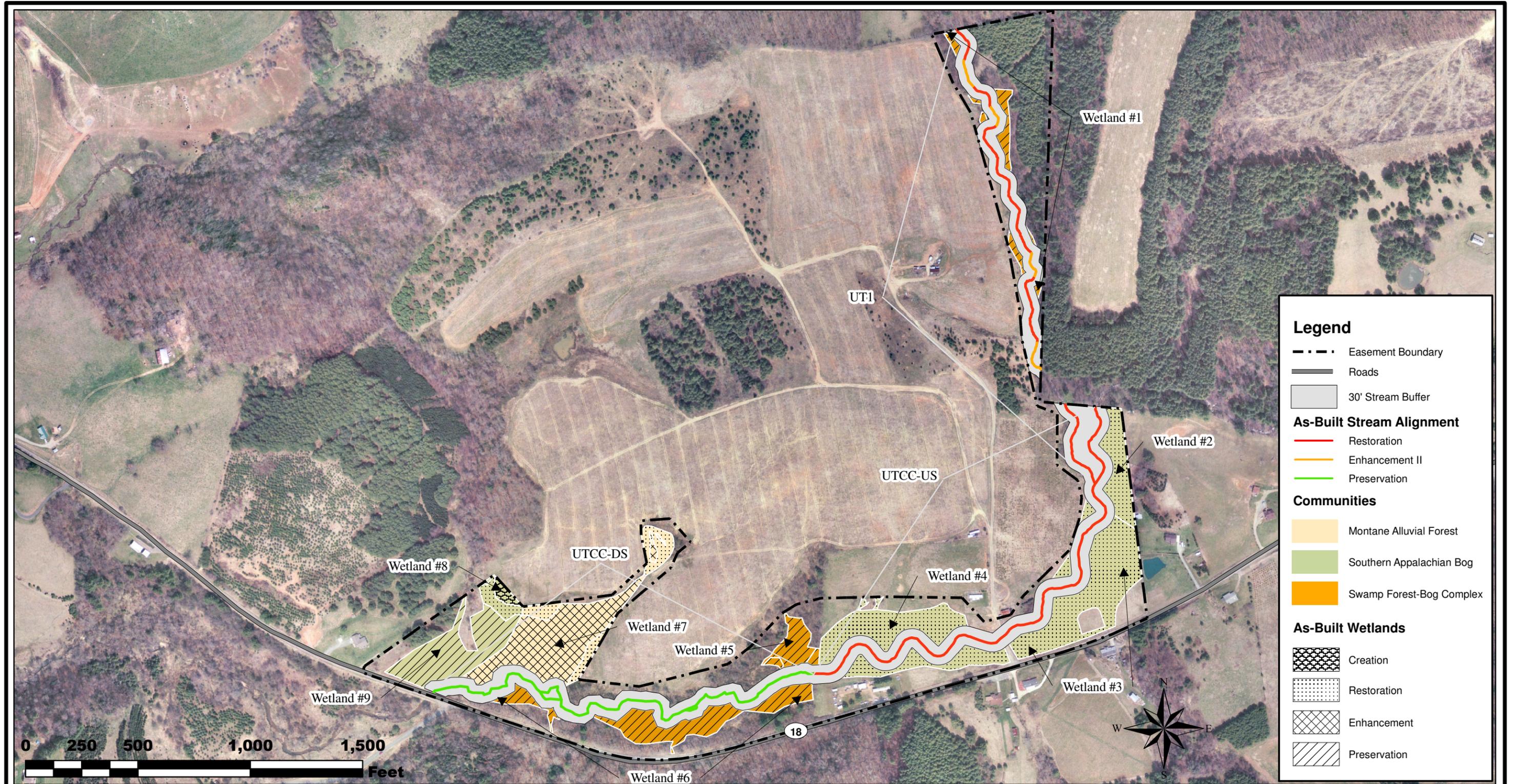
Non-Applicable

**Table 1b. Component Summations
UT Crab Creek Stream & Wetland / Project No. 857**

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Riparian (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	4,260	8.0					
Enhancement		3.1					
Enhancement I	0						
Enhancement II	496						
Creation		0.2					
Preservation	2,172	5.3					
HQ Preservation	0	0	0				
		16.6	0.0				
Totals	6,928	16.6		0	0	0	0

Non-Applicable

Figure 2: Project Components and Assets Map



Prepared for	Project: UT to Crab Creek Stream and Wetland Restoration Mitigation Plan	Notes: 1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A.	Prepared by
	Alleghany County, North Carolina	2) 2005 Aerial Photo	
	Sheet 1 of 1		
	Date	Project Number	
	February 2011	NCEEP # 857	

2.4 Project History, Contacts, and Attribute Data

The NCEEP contracted KCI Associates of NC to initiate project planning and data collection for the Environmental Resources Technical Report in 2006. The Restoration Plan was completed by KCI in December 2007 (NCEEP 2007) and construction was initiated in August 2009.

Construction was completed in April 2010 with baseline data collection initiated in April 2010.

The project activity and reporting history are reported in Table 2 below. Project personnel and contact information for the design and monitoring components is presented in Table 3. Table 4 presents background project attribute information for the site.

Table 2. Project Activity & Reporting History UT Crab Creek Stream & Wetland / Project No. 857		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Land Acquisition	N/A	5/9/2006
Environmental Resource Technical Report	2006	May 2007
Restoration Plan	2007	Dec 2007
Permit Date	N/A	4/30/2008
Final Design - Construction Plans	N/A	Aug 2008
Construction	N/A	April 2010
Temporary S&E mix applied	N/A	2009 - 2010
Permanent seed mix applied	N/A	April 2010
Planting	N/A	April 2010
Initial Wetland Monitoring Gauges & Rain Gauge Installed	N/A	April 2010
Morphological Data Collection	June 2010	N/A
Mitigation Plan / As-built (Year 0 Monitoring - Baseline)	June 2010	Feb 2011
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

N/A - Item does not apply.

Table 3. Project Contacts UT Crab Creek Stream & Wetland / Project No. 857	
Designer	KCI Associates of North Carolina Landmark Center II, Suite 220 4601 Six Forks Road Raleigh, NC 27609
Primary Project Design POC	April Davis (919) 783-9214
Construction Contractor	Carolina Environmental Contracting Inc. P.O. Box 1905 Mount Airy, NC 27030
Construction Contractor POC	Stephen James (336) 320-3849
Planting Contractor	Carolina Environmental Contracting Inc. P.O. Box 1905 Mount Airy, NC 27030
Planting Contractor POC	Stephen James (336) 320-3849
Seeding Contractor	Carolina Environmental Contracting Inc. P.O. Box 1905 Mount Airy, NC 27030
Seeding Contractor POC	Stephen James (336) 320-3849
Seed Mix Sources	Green Resources
Nursery Stock Suppliers	Mellow Marsh Farm (919) 742-1200
Monitoring Performers (Y0) - 2009	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Steve Melton (828) 253-6856
Vegetation Monitoring POC	Win Taylor (828) 253-6856
Wetland Monitoring POC	Win Taylor (828) 253-6856
Monitoring Performers (Y1) - 2010	
Stream Monitoring POC	
Vegetation Monitoring POC	
Wetland Monitoring POC	
Monitoring Performers (Y2) - 2011	
Stream Monitoring POC	
Vegetation Monitoring POC	
Wetland Monitoring POC	
Monitoring Performers (Y3)- 2012	
Stream Monitoring POC	
Vegetation Monitoring POC	
Wetland Monitoring POC	
Monitoring Performers (Y4)- 2013	
Stream Monitoring POC	
Vegetation Monitoring POC	
Wetland Monitoring POC	
Monitoring Performers (Y5)- 2014	
Stream Monitoring POC	
Vegetation Monitoring POC	
Wetland Monitoring POC	

Table 4. Project Attributes
UT Crab Creek Stream & Wetland / Project No. 857

Project County	Alleghany		
Physiographic Region	Blue Ridge		
Ecoregion	New River Plateau		
River Basin	Little River		
USGS HUC	05050001030020		
NCDWQ Sub-Basin	05-07-03		
Within Extent of EEP Watershed Plan	Little River and Laurel Branch Local Watershed Plans		
WRC Class	Cold		
% of Project Easement Fenced or Demarcated	0%		
Beaver Activity Observed During Design Phase	No		
Restoration Component Attributes			
	UT1	UTCC-US	UTCC-DS
Drainage Area (sq.mi.)	0.53	1.65	2.64
Stream Order	First	Second	Second
Restored Length (feet)	1,775	2,485	N/A
Perennial or Intermittent	Perennial	Perennial	Perennial
Watershed Type	Rural		
Watershed LULC Distribution			
Forest/Wetland	53%		
Pasture/Managed Herbaceous	45%		
Other	2%		
Watershed Impervious Cover	-	-	-
NCDWQ AU/Index Number	10-9-12	10-9-12	10-9-12
NCDWQ Classification	C; Tr	C; Tr	C; Tr
303d Listed	No	No	No
Upstream of 303d Listed Segment	No	No	No
Reasons for 303d Listing or Stressor	N/A	N/A	N/A
Total Acreage of Easement	47.8		
Total Vegetated Acreage within Easement	9.0	10.6	19.7
Total Planted Acreage as Part of Restoration	3.3	10.6	1.5
Rosgen Classification of Pre-Existing	G4/C4	C4	E4
Rosgen Classification of As-Built	Cb/C	C	N/A
Valley Type	-	-	-
Valley Slope	0.025	0.010	-
Valley Side Slope Range	-	-	-
Valley Toe Slope Range	-	-	-
Cowardin Classification	N/A	N/A	N/A
Trout Waters Designation	Yes	Yes	Yes
Species of Concern, Endangered, Etc.	Bog Turtle, American Speedwell, and Canadian Burnet		
Dominant Soil Series and Characteristics			
Series	Nikwasi		
Depth	-	-	-
Clay%	-	-	-
K	-	-	-
T	-	-	-

- Information unavailable.

N/A - Item does not apply.

3.0 SUCCESS CRITERIA

3.1 Morphometric Parameters and Channel Stability

Considering the typical 5-year timeframe for mitigation monitoring, the determination of success for stream projects is often based primarily on the degree of morphological stability. The complete absence of any change over these timeframes will certainly be interpreted as stability, but is not a pre-requisite. To the contrary, it is typical for streams to demonstrate variation over a 5-year monitoring period in the form of sustainable rates of change or stable patterns of variation (dynamic stability). Considering the young state of woody buffers and the fact that design parameters are estimates and therefore never a perfect match for the watershed regimes, restored streams typically adjust or shift to some extent after their exposure to varying flows in the years that immediately follow construction. However, these changes should be moderate and exhibit little discernable trends. Annual variation is to be expected, but over time and with buffer development should generally demonstrate a reduction in amplitude and demonstrate dynamic maintenance around some central tendency that represents acceptable distributions for design parameters and/or stable stream types. Key among these are parameters that indicate lateral and vertical stability and intended levels of floodplain connection. If some trends or patterns become evident, they should be modest or indicate migration toward another stable form. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed over the monitoring period.

3.1.1 Dimension

Dimensional stability will be based on comparisons of overlays of annual cross-section plots and their calculated parameters to the as-built conditions, design distributions, and distributions for stable stream types. Parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modest overall change and patterns of variation that are in keeping with above description of dynamic stability. The stream dimension should not demonstrate trends of enlargement either through downcutting or widening, however, modest year-to-year variation or oscillation in channel elevation or width demonstrating maintenance around baseline or design distributions is acceptable. Changes from depositional processes resulting in the development of constructive features on the banks and floodplain, such as an inner berm, channel narrowing, natural levees, and general floodplain deposition will be acceptable forms of change and indicative of stability.

The entire project will also be visually cataloged for areas of bank instability and represented as proportions of overall bank footage. The overall proportion, severity, spatial distribution, and temporal trends in this parameter will be assessed to serve as an additional indicator of dimensional stability. In general, stability proportions (stable bank/total bank) below 85% would be of concern. Considering temporal trends, a higher percentage in a given year may also be of concern if it represents a data point in a trend of decreasing stability. Instability dominated by surface scour versus mass wasting would be an example of differing severity and the latter would be more concerning than the former. Erosion in meanders versus riffle reaches would generate differing levels of concern because erosion in the former is more likely given greater bank shear stress, whereas instability concentrated in riffle/run reaches might be more indicative of an overall design flaw.

3.1.2 Pattern and Profile

Reach profiles should not exhibit any consistent trends in thalweg degradation over any significant continuous portion of its length. Some aggradation will be acceptable and will not be actionable unless it is apparently causal for widening/bank erosion. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) more in keeping with reference level diversity and distributions for the stream type in question. It should also provide a meaningful contrast in terms of bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so with maintenance around design/as-built size distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallower with greater water surface slopes.

3.1.3 Substrate

Pebble count data should indicate the progression towards or the maintenance of the known size distributions from the design phase. The absence of any significant trends in bed aggradation or deposition should represent stable conditions in terms of sediment input and transport functionality.

While stream projects are designed to transport bedload in equilibrium and carry overall sediment loads at bankfull, fines can be transported even at low discharges and upstream instability beyond design projections can also lead to deposition as storm events recede in areas of energy dissipation such as restoration reaches. This can have the effect of obscuring bedform and fining of riffles especially in the first few years after the implementation of a stream project. In many cases subsequent narrowing and reduction of width/depth ratios as a project develops/stabilizes can then increase transport efficiency and return bedform to intended distributions, but some fining can persist due to upstream disturbance.

3.2 Hydrology

3.3.1 Stream

A minimum of two bankfull events must occur within separate years during the five-year monitoring period.

3.3.2 Wetland

Wetland hydrology will be considered established if groundwater monitoring data indicates saturated soils within 12 inches of the soil surface for 5% of the growing season under normal weather conditions. The growing season for the site was based on the Natural Resource Conservation Service (NRCS) data set for Ashe County (NRCS 2009). The Alleghany County data set is based on a site with elevations approximately 1,000 feet different from the project site. According to NRCS, the growing season for Ashe County is defined to be the period with a 50% probability that the daily minimum temperature is higher than 28°F. At the project site, this period extends from May 2nd to October 5th for a total of 157 days (NRCS 2009). Based on this, wetland hydrology success will be achieved if the water table is within 12 inches of the soil surface for 8 consecutive days or more during the growing season.

3.3 Vegetation

The success of the riparian and wetland vegetation plantings will be determined by planted stem densities within established monitoring plots. Survival of planted woody species must meet a minimum survival success criterion of 320 stems per acre through year three and 260 stems per acre after year five. Two planting zones (Zones D and E1) were subject to low density planting efforts. Planting zone D is classified as a Southern Appalachian Bog community in which vegetation establishment consisted of an open shrub layer with areas dominated by herbaceous vegetation. Zone E1 classified as Montane Alluvial Forest community consisted of a supplemental planting to enhance the existing vegetative community. To capture planting zones with lower, planted woody stem densities, data will be collected from temporary, random circular plots in Zone D to document species presence biannually during the five-year monitoring period. Random circular plots will not be employed in Zone E1 due to the presence of existing mature trees within this zone.

4.0 MAINTENANCE AND CONTINGENCY PLAN

During annual monitoring efforts any potential constraints to project success criteria will be documented and reported. Maintenance recommendations will be based on the severity of the problem and in consultation with NCEEP. The site will be subject to invasive vegetation species control to suppress and eliminate isolated areas currently containing high threat invasive vegetation species. Any maintenance activities and corrective measures deemed necessary will be documented within the annual reports.

5.0 PROJECT MONITORING and AS-BUILT CONDITIONS

5.1 Feature Monitoring Details

Features established for baseline data collection and future annual monitoring purposes included stream cross-sectional and longitudinal profiles, substrate assessment sites, stream and wetland hydrological monitoring stations, vegetation monitoring plots, and photographic monitoring stations (Appendix A – Monitoring Plan View).

5.1.1 Stream

Ten permanent cross-sections were established throughout the restoration reaches. Cross-sections transecting three riffles and two pools were established on both UT1 and UTCC-US. Cross-section locations were marked on both banks with rebar and PVC conduit with fluorescent pink flagging tape. Cross-section data will be collected annually to document changes in dimensions such as area, width to depth ratios, and entrenchment ratios.

Longitudinal profile monitoring reaches were established for 3,352 linear feet of restored channel. UT1 included two reaches (UT1 – Upper and UT1 – Lower) for a total of 897 linear feet and UTCC-US included 2,455 linear feet. The beginning and ending locations of the longitudinal profile reaches were marked on both banks with rebar and PVC with blue and white

striped flagging tape. Annual measurements will be compared with as-built conditions to document trends in the stream profile occurring throughout the monitoring period. A total station will be used to collect annual cross-sectional and longitudinal profile data. Visual monitoring will be conducted for all additional stream segments.

Bed material composition will be documented through annual pebble counts at each cross-section location.

5.1.2 Hydrology

Two crest gauges were installed within the project site, one at the downstream end of on UT1 and one at the downstream end of UTCC-US. Crest gauges were marked with red and white striped flagging tape, whereas wetland gauges were marked with PVC and fluorescent green flagging tape. Crest gauge readings will be collected during each site visit to document bankfull events.

Eight wetland gauges were installed throughout the project site and included seven restoration areas and one reference gauge in the preservation area. Additionally, an automated rain gauge was installed on site. Wetland and rain data will be collected monthly during the growing season to document groundwater hydrology and site precipitation.

5.1.3 Vegetation

Nine riparian and wetland vegetation monitoring plots were established based on the CVS-EEP protocol and include five non-standard 5 x 20 meter plots and four standard 10 x 10 meter plots. Approximately 0.025-acre in size, vegetation plots were established and data was collected to document baseline vegetation conditions. Annual monitoring will determine the success of planted vegetation and the overall trajectory of woody plant restoration and regeneration at the project site. Plots were placed within the applicable planting zones to capture the heterogeneity of the designed vegetative communities. Vegetation monitoring plot corners were marked with rebar and PVC pipe, and recorded with a handheld GPS unit. Plot corners and planted stems were also marked with fluorescent orange flagging tape. The vegetation plot origin was labeled with the plot number. Data for the baseline report was collected according to the CVS-EEP Level I protocol and entered into the CVS-EEP Data Entry Tool (Version 2.2.7). Subsequent annual monitoring data collections will follow Level II (Lee et al. 2008).

In order to capture planting zones with lower, planted woody stem densities, CVS-EEP data collection efforts and visual surveys will be supplemented with eight temporary, random 200m² circular plots in Zone D. The purpose of these plots is to detect changes in stem density over time. Only species presence data will be collected biannually in Year 2 and Year 4 monitoring. Plot placement in Year 4 monitoring will be independent of Year 2.

5.1.4 Permanent Photo Locations

Permanent photo stations were established at each cross-section to digitally document annual conditions of the left and right banks. Each vegetation monitoring plot includes a photo station taken diagonally from the origin towards the opposite plot corner. Additionally, 16 permanent photo stations were established throughout the project area to provide representative digital

documentation of stream features and vegetation conditions. Permanent photo stations were marked with labeled wooden stakes and red flagging tape.

5.1.5 Visual Assessment

Visual stream assessments will occur during annual monitoring to summarize performance percentages of morphological and structural feature categories. Visual vegetation assessments will occur to catalog the extent and type of vegetation issue areas as compared to the total planted acreage within the project site.

5.2 As-Built Conditions

The project's as-built conditions are included in Appendix B – As-built Plan View.

5.2.1 Streams

Baseline stream monitoring data were collected in June 2010. Data are summarized in Tables 5 and 6, while cross-section and longitudinal profile graphics are located in Appendices C & D. In general, the restored and enhanced stream pattern was similar to the proposed design. The design Rosgen classification for UT1 was a B4c/C4. Based on the as-built conditions, the UT1-Upper reach classifies as a Cb and the UT1-Lower reach classifies as a C with both having low width to depth ratios for these stream types. A portion of one stream reach within UT1, originally designed for enhancement, was actually restored. Additionally, a step-pool structure and three log sills were added during construction of UT1.

5.2.2 Hydrology

The grading originally proposed for wetland area 5 was deemed unnecessary during construction; additional grading occurred in wetland area 3 to compensate for this change. Stream and wetland hydrological monitoring will be initiated prior to the beginning of the 2010 growing season.

5.2.3 Vegetation

Baseline vegetation monitoring data were collected in April 2010. Vegetation plot attribute data are included in Table 7 and Table 8, whereas individual plot photos are included in Appendix E. Individual plant species by plot and plot means are reported in Table 9. Stem counts for each of the nine vegetation monitoring plots were recorded by species.

Approved substitutions from the proposed planting plan included black gum *Nyssa sylvatica* for sweet birch *Betula lenta*, common three square *Schoenoplectus pungens* for green bulrush *Scirpus atrovirens*, hop sedge *Carex lupulina* for nut sedge *Cyperus esculentus*, lurid sedge *Carex lurida* for prickly bog sedge *Carex atlantica*, and cardinal flower *Lobelia cardinalis* for spotted jewelweed *Impatiens capensis*. Additionally, coralberry *Symphoricarpos orbiculatus* was planted in Zones C, D, and E1/E2. Undisturbed forested areas within some planting zones were not planted, resulting in a planted area of 15.4 acres out of a total of 23.9 vegetated acres within the easement area.

Results from the baseline documentation indicate a planted stem density ranging from 121 to 768 stems per acre. The average stem density for the entire restoration site is 450 stems per acre; of these, 85% were noted to have either good or excellent vigor values. However, vegetation plots

4, 5, and 6 do not meet the interim success criteria of 320 stems per acre. In addition, invasive exotic plants such as Japanese honeysuckle *Lonicera japonica*, Chinese privet *Ligustrum sinense*, and multiflora rose *Rosa multiflora* were recorded in dense patches adjacent to vegetation plots 8 and 9.

5.2.4 Permanent Photo Stations

Photos were collected during April 2010 at the 16 permanent photo stations established throughout the project area to provide representative digital documentation of baseline stream and vegetation conditions (Appendix F – Permanent Photo Station Photos). Pre-construction photos are included in Appendix F where available.

Table 5. Baseline Stream Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Upper (500 feet)

Parameter	Regional Curve			Pre-Existing Condition					Reference Reach Data					**Design			As-Built / Baseline							
	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N
Dimension & Substrate - Riffle																								
Bankfull Width (ft)	-	-	-	9.9	13.5	13.6	15.8	2.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	13.1	-	14.8	15.3	15.3	15.7	NA	2
Floodprone Width (ft)				18.2	N/A	N/A	>55	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	22	-	33	>100	>100	>100	>100	NA	2
Bankfull Mean Depth (ft)	-	-	-	0.90	1.20	1.20	1.50	0.23	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.10	-	1.30	1.50	1.50	1.60	NA	2
Bankfull Max Depth (ft)				1.20	1.80	1.80	2.40	0.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	2.00	-	2.40	2.50	2.50	2.50	NA	2
Bankfull Cross Sectional Area (ft ²)			14.0	14.1	15.1	15.0	15.9	0.72	5	N/A	N/A	N/A	N/A	N/A	N/A	-	14.8	-	20.3	22.2	22.2	24.0	NA	2
Width/Depth Ratio				6.5	12.2	11.7	16.7	4.12	5	N/A	N/A	N/A	N/A	N/A	N/A	-	12.0	-	9.2	10.7	10.7	12.2	NA	2
Entrenchment Ratio				1.2	3.4	3.3	>5.6	1.56	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.7	-	>6.4	>6.6	>6.6	>6.7	NA	2
Bank Height Ratio				1.0	1.6	1.7	2.4	0.54	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	1.0	1.1	1.1	1.1	NA	2
d50 (mm)				19	40	45	56	16.70	5	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	5.8	28.7	22.6	68.2	23.42	7
Riffle Slope (ft/ft)				0.023	-	-	0.057	-	-	0.014	-	-	0.03	-	-	0.014	-	0.03	0.014	0.023	0.022	0.033	0.007	7
Pool Length (ft)				7.0	-	-	13.0	-	-	14	-	-	47	-	-	14.0	-	47.0	3.5	8.6	8.1	19.8	4.44	13
Pool Max Depth (ft)				1.9	2.1	2.1	2.2	0.13	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	3.2	3.2	3.2	3.2	NA	1
Pool Spacing (ft)				60.0	-	-	65.0	-	-	54	-	-	126	-	-	54.0	-	126.0	6.8	38.9	34.0	113.1	30.33	12
Pool Volume (ft ³)				-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				21.0	-	-	58.0	-	-	32	-	-	58	-	-	32.0	-	58.0	26.8	37.4	40.1	44.4	7.06	6
Radius of Curvature (ft)				11.0	-	-	37.0	-	-	20	-	-	37	-	-	20.0	-	37.0	28.7	34.7	32.4	51.3	8.35	6
Rc: Bankfull Width (ft)				0.7	-	-	3.7	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1.5	-	2.8	1.9	2.3	2.1	3.3	NA	NA
Meander Wavelength (ft)				90.0	-	-	191.0	-	-	90.0	-	-	191.0	-	-	90.0	-	191.0	117.9	135.5	130.7	162.6	20.10	4
Meander Width Ratio				1.3	-	-	5.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	2.4	-	4.4	2.6	2.6	2.6	2.7	NA	2
Substrate, Bed and Transport Parameters																								
Ri% / Ru% / P% / G% / S%																								
SC% / Sa% / G% / C% / B% / Be%																								
d16 / D35 / d50 / d84 / d95 / d ₉₀ / d ₉₅ / d ₉₀ (mm)																								
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 (mi ²)							0.53																	
Impervious Cover Estimate (%)																								
Rosgen Classification							G4/C4											B4c/C4						
Bankfull Velocity (fps)							3.9 - 4.7											4.5						
Bankfull Discharge (cfs)							62											66						
Valley Length (ft)																								
Channel Thalweg Length (ft)																								
Sinuosity																								
Water Surface Slope (ft/ft)																								
Bankfull Slope (ft/ft)																								
Bankfull Floodplain Area (acres)																								
Proportion Over Wide (%)																								
Entrenchment Class (ER Range)																								
Incision Class (BHR Range)																								
BEHI																								
Channel Stability or Habitat Metric																								
Biological or Other																								

- Information unavailable.

N/A - Item does not apply.

* Numbers reported are the mean percentages from the riffle surface pebble counts.

** The design cross-section criteria were developed using an analytical design approach. Pattern and profile data derived from stable enhancement reaches from the existing UT1 data.

Non-Applicable.

Table 5. Baseline Stream Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Lower (397 feet)

Parameter	Regional Curve			Pre-Existing Condition					Reference Reach Data					**Design			As-Built / Baseline									
	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N		
Dimension & Substrate - Riffle																										
Bankfull Width (ft)	-	-	-	9.9	13.5	13.6	15.8	2.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	13.1	-	11.5	11.5	11.5	11.5	NA	1		
Floodprone Width (ft)				18.2	N/A	N/A	>55	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	22.0	-	33.0	>100	>100	>100	>100	NA	1		
Bankfull Mean Depth (ft)	-	-	-	0.90	1.20	1.20	1.50	0.23	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.1	-	1.50	1.50	1.50	1.50	NA	1		
Bankfull Max Depth (ft)				1.20	1.80	1.80	2.40	0.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	2.0	-	2.50	2.50	2.50	2.50	NA	1		
Bankfull Cross Sectional Area (ft ²)			14.0	14.1	15.1	15.0	15.9	0.72	5	N/A	N/A	N/A	N/A	N/A	N/A	-	14.8	-	17.6	17.6	17.6	17.6	NA	1		
Width/Depth Ratio				6.5	12.2	11.7	16.7	4.12	5	N/A	N/A	N/A	N/A	N/A	N/A	-	12.0	-	7.5	7.5	7.5	7.5	NA	1		
Entrenchment Ratio				1.2	3.4	3.3	>5.6	1.56	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.7	-	>8.7	>8.7	>8.7	>8.7	NA	1		
Bank Height Ratio				1.0	1.6	1.7	2.4	0.54	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	1.0	1.0	1.0	1.0	NA	1		
d50 (mm)				19	40	45	56	16.7	5	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-		
Profile																										
Riffle Length (ft)				-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	21.0	37.6	40.2	52.6	15.19	5		
Riffle Slope (ft/ft)				0.023	-	-	0.057	-	-	0.014	-	-	0.030	-	-	0.014	-	0.030	0.020	0.026	0.027	0.033	0.005	5		
Pool Length (ft)				7.0	-	-	13.0	-	-	14.0	-	-	47.0	-	-	14.0	-	47.0	11.8	17.4	17.4	27.1	6.24	5		
Pool Max Depth (ft)				1.9	2.1	2.1	2.2	0.13	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	2.6	2.6	2.6	2.6	NA	1		
Pool Spacing (ft)				60.0	-	-	65.0	-	-	54.0	-	-	126.0	-	-	54.0	-	126.0	45.0	71.3	73.4	93.6	21.55	4		
Pool Volume (ft ³)				-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-		
Pattern																										
Channel Belt Width (ft)				21.0	-	-	58.0	-	-	32	-	-	58	-	-	32.0	-	58.0	57.2	62.9	64.2	66.2	3.9	4		
Radius of Curvature (ft)				11.0	-	-	37.0	-	-	20	-	-	37	-	-	20.0	-	37.0	31.2	36.6	37.8	39.7	3.8	4		
Rc: Bankfull Width (ft)				0.7	-	-	3.7	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1.5	-	2.8	2.71	3.18	3.28	3.45	NA	NA		
Meander Wavelength (ft)				90.0	-	-	191.0	-	-	90.0	-	-	191.0	-	-	90.0	-	191.0	142.0	196.0	202.0	244.0	NA	3		
Meander Width Ratio				1.3	-	-	5.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	2.4	-	4.4	5.58	5.58	5.58	5.58	NA	1		
Substrate, Bed and Transport Parameters																										
Ri% / Ru% / P% / G% / S%																									48% / 5% / 22% / 25% / 1%	
SC% / Sa% / G% / C% / B% / Be%																										* <1% / 10% / 59% / 28% / 3% / 0%
d16 / D35 / d50 / d84 / d95 / d ₉₅ / d ₉₅ / d ₉₅ (mm)																										* 7.2 / 22.2 / 40.0 / 103.0 / 197.0 / - / -
Reach Shear Stress (Competency) lb/ft ²																										N/A
Max Part Size (mm) Mobilized at Bankfull																										N/A
Stream Power (Transport Capacity) W/m ²																										N/A
Additional Reach Parameters																										
Drainage Area (mi ²)							0.53																			N/A
Impervious Cover Estimate (%)																										N/A
Rosgen Classification							G4/C4												B4c/C4							N/A
Bankfull Velocity (fps)							3.9 - 4.7												4.5							N/A
Bankfull Discharge (cfs)							62												66							N/A
Valley Length (ft)																										N/A
Channel Thalweg Length (ft)																										N/A
Sinuosity																										N/A
Water Surface Slope (ft/ft)																										N/A
Bankfull Slope (ft/ft)																										N/A
Bankfull Floodplain Area (acres)																										N/A
Proportion Over Wide (%)																										N/A
Entrenchment Class (ER Range)																										N/A
Incision Class (BHR Range)																										N/A
BEHI																										N/A
Channel Stability or Habitat Metric																										N/A
Biological or Other																										N/A

- Information unavailable.

N/A - Item does not apply.

* Numbers reported are the mean percentages from the riffle surface pebble counts.

** The design cross-section criteria were developed using an analytical design approach. Pattern and profile data derived from stable enhancement reaches from the existing UT1 data.

Non-Applicable.

Table 5. Baseline Stream Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UTCC - US (2,455 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline						
	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N	
Dimension & Substrate - Riffle																									
Bankfull Width (ft)	-	-	-	17.6	20.4	19.8	24.5	2.91	4	59.7	62.3	62.3	64.9	NA	2	-	24.0	-	25.0	26.7	26.5	28.7	NA	3	
Floodprone Width (ft)	-	-	-	65	-	-	>80	-	4	200	248	248	296	NA	2	-	54.0	-	>200	>200	>200	>200	NA	3	
Bankfull Mean Depth (ft)	-	-	-	1.40	1.65	1.70	1.80	0.17	4	3.30	3.35	3.35	3.40	NA	2	-	1.4	-	1.40	1.53	1.50	1.70	NA	3	
Bankfull Max Depth (ft)	-	-	-	2.40	2.78	2.75	3.20	0.33	4	5.00	5.40	5.40	5.80	NA	2	-	2.3	-	2.40	2.50	2.50	2.60	NA	3	
Bankfull Cross Sectional Area (ft ²)	-	-	-	39.0	30.8	33.1	33.7	34.2	1.57	4	198.0	208.0	208.0	218.0	NA	2	-	34.2	-	37.0	40.5	42.1	42.4	NA	3
Width/Depth Ratio	-	-	-	10.0	12.7	11.5	17.9	3.52	4	18.1	18.6	-	19.1	-	-	-	17.1	-	14.7	17.7	19.0	19.5	NA	3	
Entrenchment Ratio	-	-	-	3.1	-	-	>4.1	-	4	3.1	4.0	-	5.0	-	-	-	2.3	-	>7.0	>7.5	>7.5	>8.0	NA	3	
Bank Height Ratio	-	-	-	1.0	1.1	1.0	1.2	0.10	4	1.0	1.0	1.0	1.0	NA	-	-	1.0	-	1.0	1.0	1.0	1.1	NA	3	
d50 (mm)	-	-	-	38	44	41	56	8.29	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Profile																									
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.9	60.5	64.9	100.0	22.55	19	
Riffle Slope (ft/ft)	-	-	-	0.020	-	-	0.042	-	-	0.015	0.029	0.027	0.048	0.012	5	0.014	-	0.045	0.006	0.013	0.012	0.021	0.005	19	
Pool Length (ft)	-	-	-	29.0	-	-	53.0	-	-	-	-	-	-	-	-	21.0	-	105.0	10.7	46.0	52.7	103.5	24.73	19	
Pool Max Depth (ft)	-	-	-	3.0	3.1	3.1	3.3	NA	3	-	-	-	-	-	-	-	1.9	-	2.7	2.9	2.9	3.0	NA	2	
Pool Spacing (ft)	-	-	-	-	95.0	-	-	-	-	116.0	190.0	161.0	188.0	93.70	4	45.0	-	136.0	51.7	130.7	113.2	241.7	52.31	18	
Pool Volume (ft ³)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pattern																									
Channel Belt Width (ft)	-	-	-	13.0	-	-	43.0	-	-	-	500	-	-	NA	1	75.0	-	211.0	54.7	101.7	102.5	132.8	23.59	15	
Radius of Curvature (ft)	-	-	-	**0.0	-	-	**51	-	-	-	55.1	-	-	NA	1	43.0	-	128.0	37.5	51.1	42.5	146.7	26.21	16	
Re: Bankfull Width (ft)	-	-	-	**0.0	-	-	**2.9	-	-	0.88	0.88	0.88	0.88	-	-	1.7	-	5.1	1.5	1.9	1.6	5.1	NA	NA	
Meander Wavelength (ft)	-	-	-	**	-	-	**	-	-	51.3	159.0	61.6	540.0	213.0	5	20.0	-	228.0	204.4	238.7	234.4	314.2	32.62	15	
Meander Width Ratio	-	-	-	0.5	-	-	2.4	-	-	8.0	8.0	8.0	8.0	NA	-	3.0	-	8.4	3.6	3.9	3.9	4.1	NA	3	
Substrate, Bed and Transport Parameters																									
R% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47%	9%	32%	12%	0%	-	
SC% / Sa% / G% / C% / B% / Be%	-	-	-	* 0%	1%	62%	36%	<1%	0%	0%	18%	5%	48%	18%	11%	-	-	-	-	-	-	-	-	-	
d16 / D35 / d50 / d84 / d95 / d ₉₅ / d ₉₅ ^p / d ₉₅ ^q (mm)	-	-	-	* 11	23	44	104	150	-	-	1.4	-	144	512	-	-	-	-	-	-	-	-	-	-	
Reach Shear Stress (Competency) lb/ft ²	-	-	-	-	-	-	0.89	-	-	-	-	-	-	-	-	-	0.73	-	-	-	-	0.71	-		
Max Part Size (mm) Mobilized at Bankfull	-	-	-	-	-	-	130	-	-	-	-	-	-	-	-	-	125	-	-	-	-	118	-		
Stream Power (Transport Capacity) W/m ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Additional Reach Parameters																									
Drainage Area (mi ²)	-	-	-	-	-	-	1.65	-	-	-	-	-	24.8	-	-	-	-	-	-	-	-	-	-		
Impervious Cover Estimate (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Rosgen Classification	-	-	-	-	-	-	C4	-	-	-	-	-	C3	-	-	-	-	-	C4	-	-	-	C		
Bankfull Velocity (fps)	-	-	-	-	-	-	3.3 - 3.8	-	-	-	-	-	-	-	-	-	-	-	3.3	-	-	-	-		
Bankfull Discharge (cfs)	-	-	-	197	-	-	111 - 130	-	-	-	-	-	-	-	-	-	-	-	117	-	-	-	-		
Valley Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Channel Thalweg Length (ft)	-	-	-	-	-	-	2,086	-	-	-	-	-	1,034	-	-	-	-	-	2,405	-	-	-	2,455		
Sinuosity	-	-	-	-	-	-	1.04	-	-	-	-	-	1.20	-	-	-	-	-	1.20	-	-	-	1.21		
Water Surface Slope (ft/ft)	-	-	-	-	-	-	0.0090	-	-	-	-	-	0.0088	-	-	-	-	-	0.0080	-	-	-	0.0080		
Bankfull Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0083		
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Proportion Over Wide (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Entrenchment Class (ER Range)	-	-	-	-	-	-	3.1 - 4.1	-	-	-	-	-	3.1 - 5.0	-	-	-	-	-	-	-	-	-	-		
Incision Class (BHR Range)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
BEHI	-	-	-	-	-	-	High (33.8)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

- Information unavailable.
N/A - Item does not apply.
* Numbers reported are the mean percentages from the riffle surface pebble counts.
** Existing stream has been channelized and does not have a natural meander pattern with distinct pool and riffle features.
Non-Applicable.

**Table 6. Baseline Morphology & Hydraulic Monitoring Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Upper (500 Feet)**

Parameter	Cross Section 1 Riffle						Cross Section 2 Pool						Cross Section 3 Riffle					
	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	15.7						18.4						14.8					
Floodprone Width (ft)	>100						>100						>100					
Bankfull Mean Depth (ft)	1.3						1.9						1.6					
Bankfull Max Depth (ft)	2.4						3.2						2.5					
Bankfull Cross Sectional Area (ft ²)	20.3						34.3						24.0					
Bankfull Width/Depth Ratio	12.2						9.9						9.2					
Bankfull Entrenchment Ratio	>6.4						>5.4						>6.7					
Bankfull Bank Height Ratio	1.0						1.1						1.1					
Cross Sectional Area between End Pins (ft ²)	20.3						34.3						24.3					
d50 (mm)	N/A						N/A						N/A					

N/A - Item does not apply.

**Table 6. Baseline Morphology & Hydraulic Monitoring Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Lower (397 Feet)**

Parameter	Cross Section 4 Pool						Cross Section 5 Riffle					
	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	16.7						11.5					
Floodprone Width (ft)	>100						>100					
Bankfull Mean Depth (ft)	1.1						1.5					
Bankfull Max Depth (ft)	2.6						2.5					
Bankfull Cross Sectional Area (ft ²)	18.8						17.6					
Bankfull Width/Depth Ratio	14.8						7.5					
Bankfull Entrenchment Ratio	>6.0						>8.7					
Bankfull Bank Height Ratio	1.0						1.0					
Cross Sectional Area between End Pins (ft ²)	18.9						21.1					
d50 (mm)	N/A						N/A					

N/A - Item does not apply.

**Table 6. Baseline Morphology & Hydraulic Monitoring Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UTCC-US (2,455 Feet)**

Parameter	Cross Section 6 Riffle						Cross Section 7 Pool						Cross Section 8 Riffle						Cross Section 9 Pool						Cross Section 10 Riffle					
	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	25.0						27.7						28.7						23.5						26.5					
Floodprone Width (ft)	>200						>200						>200						>200						>200					
Bankfull Mean Depth (ft)	1.7						1.7						1.5						1.7						1.4					
Bankfull Max Depth (ft)	2.6						3						2.5						2.7						2.4					
Bankfull Cross Sectional Area (ft ²)	42.4						47.3						42.1						40.7						37.0					
Bankfull Width/Depth Ratio	14.7						16.3						19.5						13.5						19.0					
Bankfull Entrenchment Ratio	>8.0						>7.2						>7.0						>8.5						>7.5					
Bankfull Bank Height Ratio	1.0						1.1						1.1						1.0						1.0					
Cross Sectional Area between End Pins (ft ²)	42.4						47.3						43.2						41.5						38.6					
d50 (mm)	N/A						N/A						N/A						N/A						NA					

N/A - Item does not apply.

**Table 7. Vegetation Plot Attribute Data
UT Crab Creek Stream & Wetland / Project No. 857**

Plot ID	Community Type	Planting Zone ID	Reach ID	Associated Gauges	CVS Level
VP 1	Swamp Forest Bog Floodplain	B	UT1	N/A	I
VP 2	Swamp Forest Bog Floodplain	B	UT1	N/A	I
VP 3	Swamp Forest Bog Floodplain	B	UT1	N/A	I
VP 4	Southern Appalachian Bog Floodplain	C	UT1 / UTCC-US	UTC-1	I
VP 5	Southern Appalachian Bog Floodplain	C	UTCC-US	UTC-2	I
VP 6	Southern Appalachian Bog Floodplain	C	UTCC-US	UTC-3	I
VP 7	Southern Appalachian Bog Floodplain	C	UTCC-US	UTC-4	I
VP 8	Montane Alluvial Forest	E2	Wetland #7	UTC-7	I
VP 9	Montane Alluvial Forest	E2	Wetland #7	UTC-8	I

**Table 8. CVS Vegetation Plot Metadata
UT Crab Creek Stream & Wetland / Project No. 857**

Report Prepared By	Sarah Marcinko
Date Prepared	4/28/2010 1:12:54 PM
Database Name	UT-CrabCk-v2.2.7.mdb
Database Location	Z:\ES\S&WM\EEP Monitoring\EEP-UT Crab Ck\UTC-MY0-2009\Data\Veg
Computer Name	D16TNK71
File Size	37613568
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project 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	857
Project Name	UT-Crab Creek Stream & Wetland Restoration
Description	
River Basin	New
Length (ft)	
Stream to Edge Width (ft)	
Area (sq mi)	
Required Plots (calculated)	
Sampled Plots	9

**Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means)
UT Crab Creek Stream & Wetland / Project No. 857**

			Current Plot Data (MY0 2010)																								Annual Means					
Scientific Name	Common Name	Species Type	857-01-0001			857-01-0002			857-01-0003			857-01-0004			857-01-0005			857-01-0006			857-01-0007			857-01-0008			857-01-0009			MY0 (2010)		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
<i>Alnus serrulata</i>	Hazel alder	Shrub Tree				3	3		2	2		1	1		2	2								2	2		1	1				
<i>Aronia arbutifolia</i>	Red chokeberry	Shrub																			6	6										
<i>Betula lenta</i> var. <i>lenta</i>	Sweet birch	Shrub Tree																1	1		1	1		9	9		4	4		15	15	
<i>Carpinus caroliniana</i> var. <i>virginiana</i>	Inland American hornbeam	Shrub Tree		1	1	4	4		7	7		1	1					4	4		1	1		3	3		4	4		22	22	
<i>Ilex verticillata</i>	Common winterberry	Shrub Tree				3	3					2	2		1	1		1	1													
<i>Lindera benzoin</i> var. <i>benzoin</i>	Northern spicebush	Shrub Tree		3	3				4	4								1	1		3	3		2	2		10	10		23	23	
<i>Viburnum nudum</i>	Possumhaw	Shrub Tree		7	7	1	1																							8	8	
Unknown	unknown	unknown				5	5																							5	5	
Stem count			0	11	11	0	16	16	0	13	13	0	4	4	0	3	3	0	7	7	0	11	11	0	16	16	0	19	19	0	97	97
size (ares)			1			1			1			1			1			1			1			1			9					
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.22					
Species count			0	3	3	0	5	5	0	3	3	0	3	3	0	2	2	0	4	4	0	4	4	0	4	4	0	4	4	0	8	8
Stems per ACRE			0	445.2	445.2	0	647.5	647.5	0	526.1	526.1	0	161.9	161.9	0	121.4	121.4	0	283.3	283.3	0	445.2	445.2	0	647.5	647.5	0	768.9	768.9	0	436	436

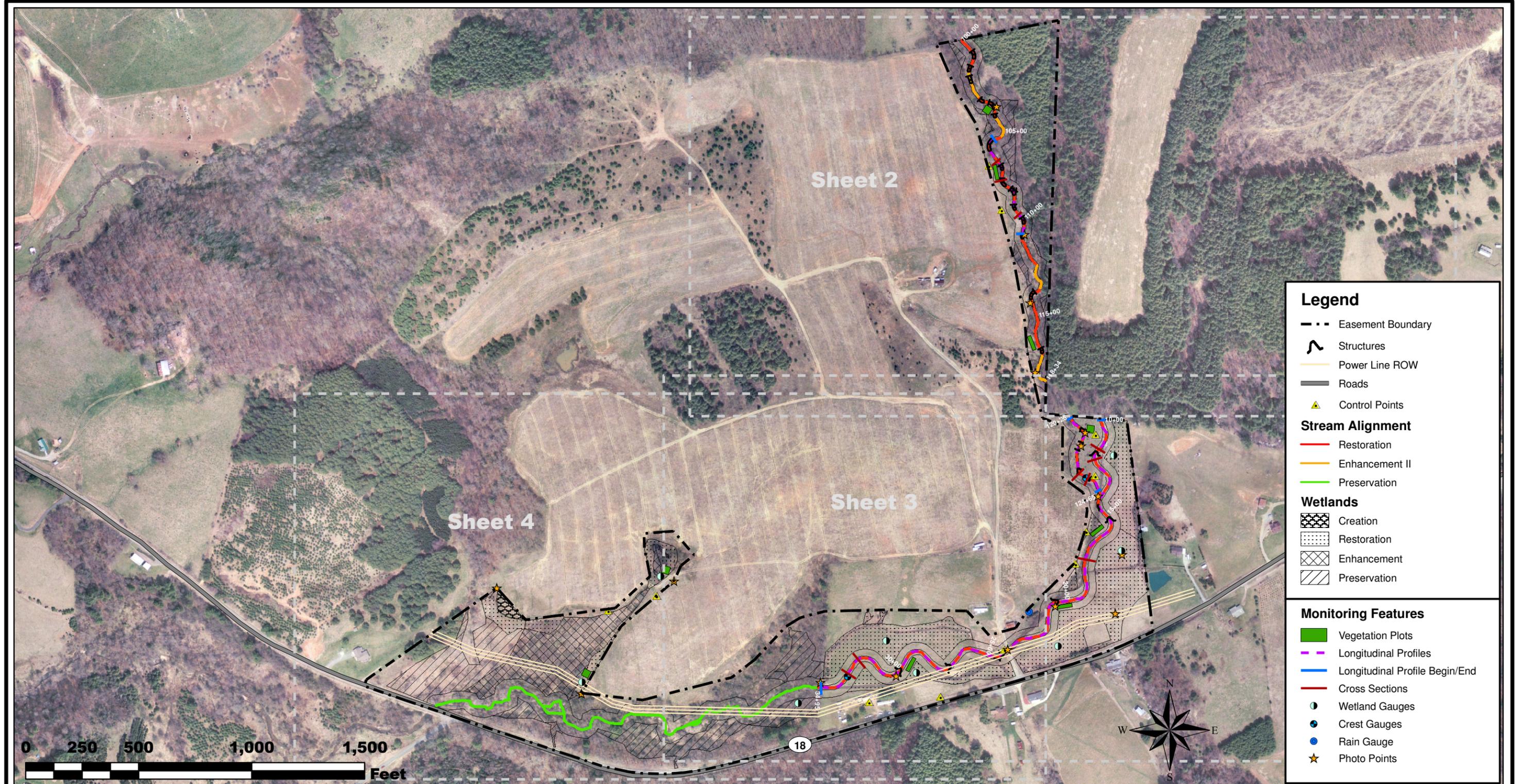
6.0 REFERENCES

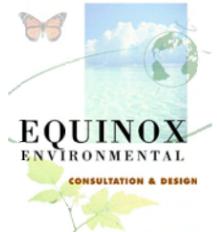
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- Schafale, M.P. and A.S. Weakley. 1990. Classification of Natural Communities of North Carolina, 3rd Approximation. North Carolina Natural Heritage Program, NCDEHNR, Division of Parks and Recreation. Raleigh, NC.

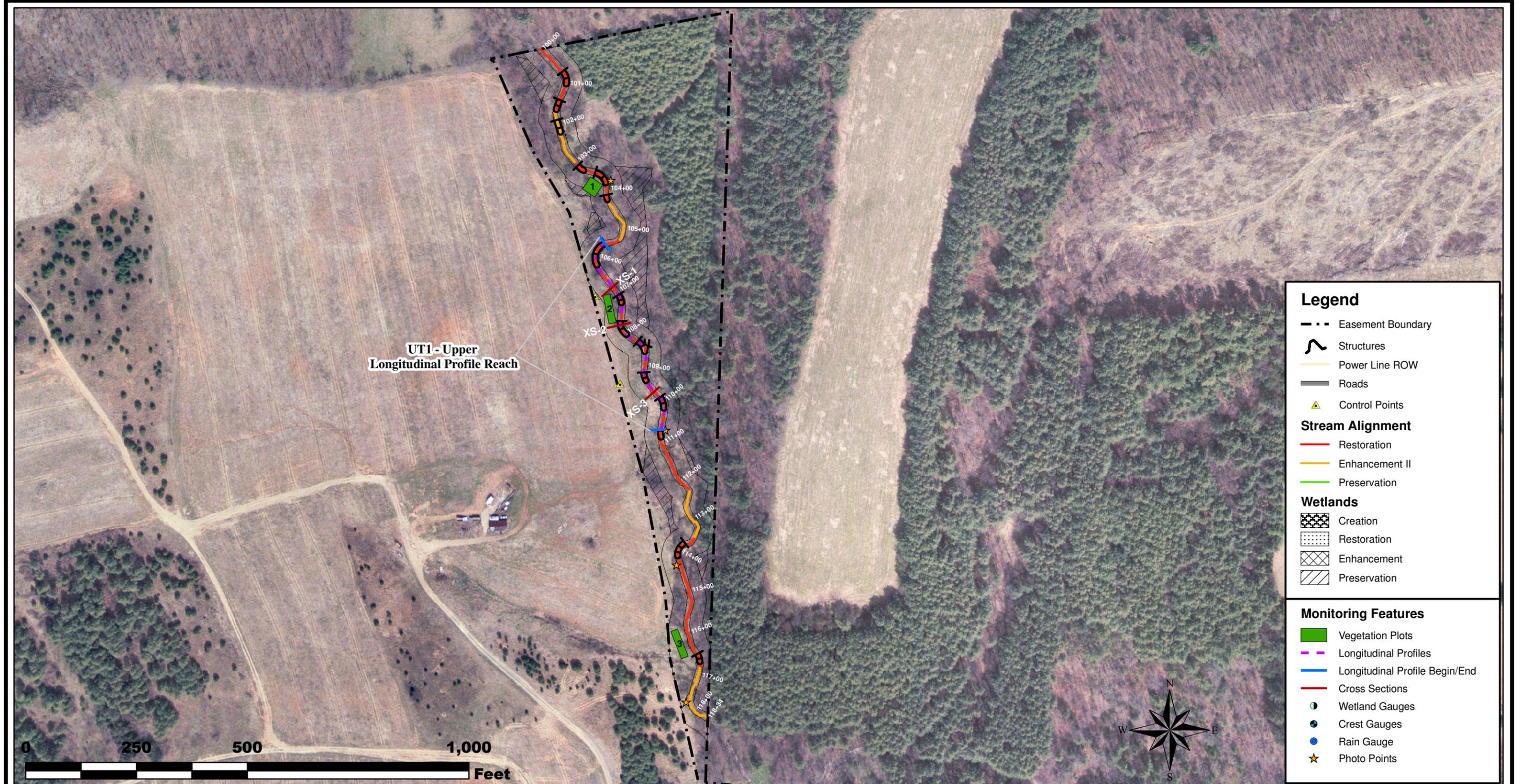
Appendix A

Monitoring Plan View

Monitoring Plan View

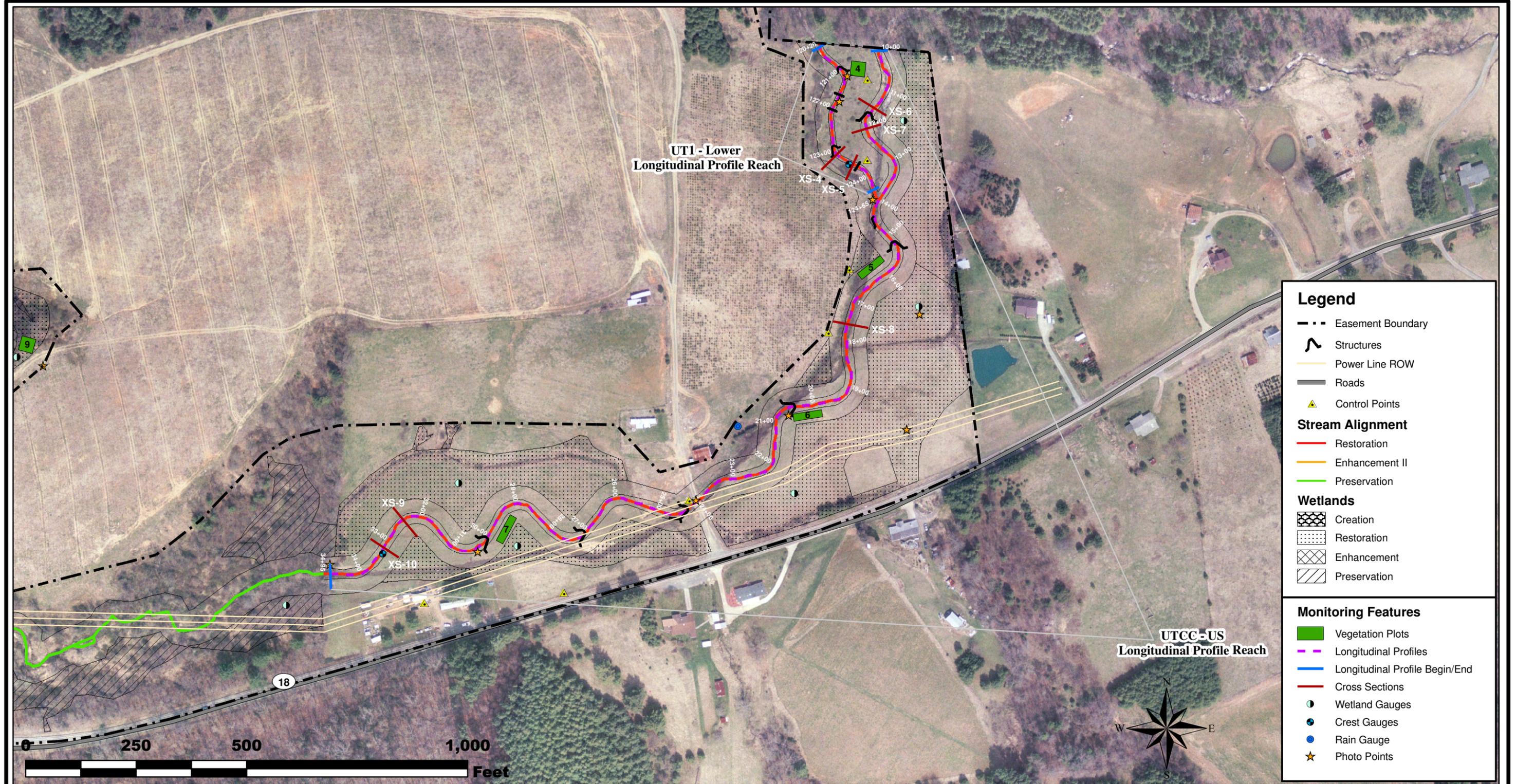


Prepared for	Project: UT to Crab Creek Stream and Wetland Restoration	Notes: 1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A.	Prepared by
	Monitoring Plan View Alleghany County, North Carolina	2) 2005 Aerial Photo	
	Sheet 1 of 4		
	Date	Project Number	
	January 2011	NCEEP # 857	



Prepared for	Project: UT to Crab Creek Stream and Wetland Restoration Monitoring Plan View Alleghany County, North Carolina	Notes: 1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A. 2) 2005 Aerial Photo	Prepared by
	Sheet 2 of 4		
	Date	Project Number	
	January 2011	NCEEP # 857	

Monitoring Plan View



Legend

- - - Easement Boundary
- ~ Structures
- Power Line ROW
- Roads
- ▲ Control Points

Stream Alignment

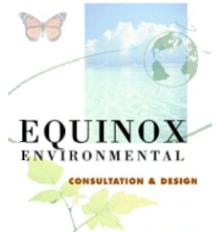
- Restoration
- Enhancement II
- Preservation

Wetlands

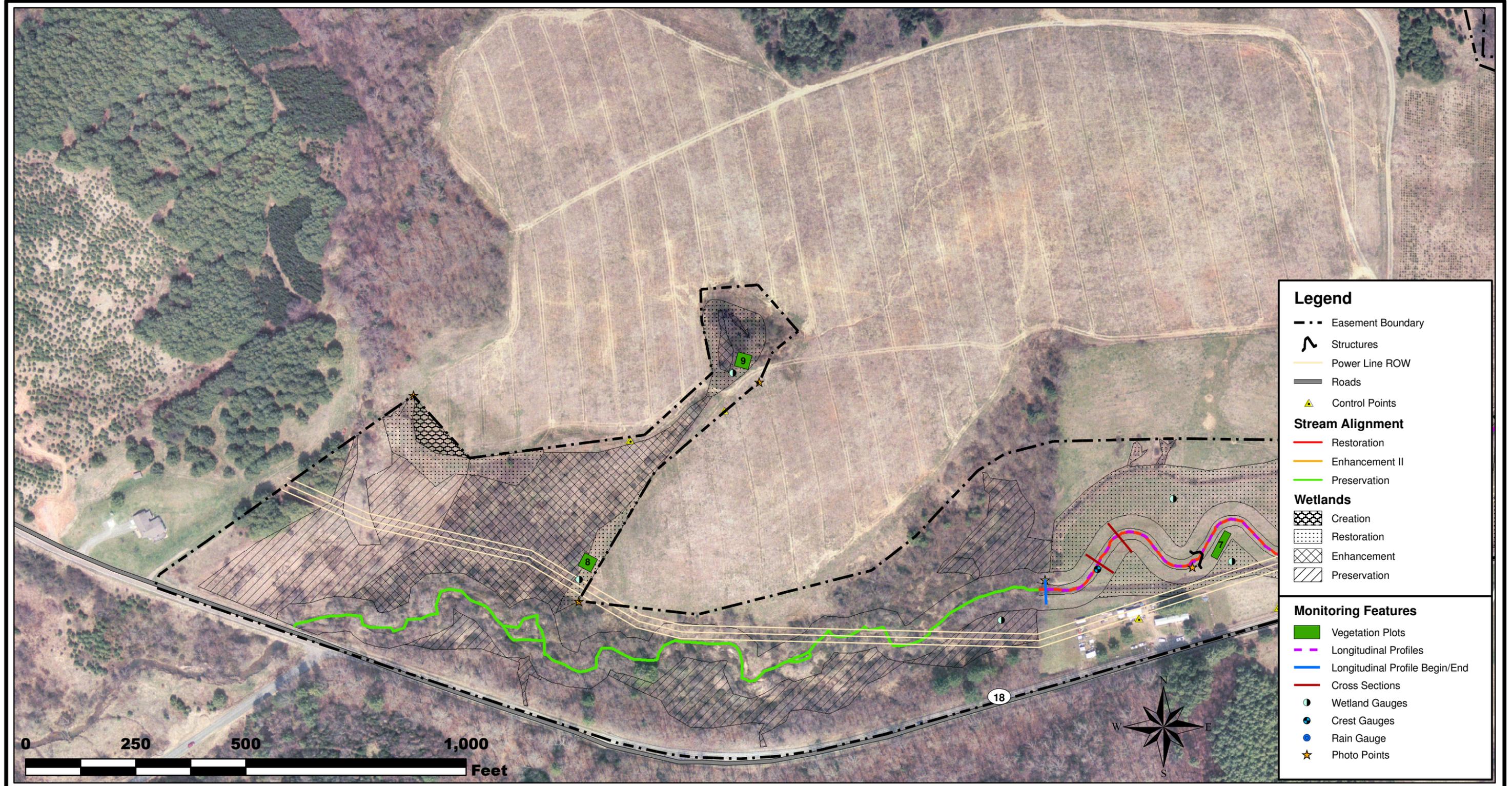
- ▨ Creation
- ▨ Restoration
- ▨ Enhancement
- ▨ Preservation

Monitoring Features

- Vegetation Plots
- Longitudinal Profiles
- Longitudinal Profile Begin/End
- Cross Sections
- Wetland Gauges
- Crest Gauges
- Rain Gauge
- ★ Photo Points

Prepared for	Project: UT to Crab Creek Stream and Wetland Restoration	Notes: 1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A.	Prepared by
	Monitoring Plan View Alleghany County, North Carolina	2) 2005 Aerial Photo	
	Sheet 3 of 4		Project Number
	Date		NCEEP # 857
	January 2011		

Monitoring Plan View



Legend

- - - Easement Boundary
- ~ Structures
- Power Line ROW
- Roads
- ▲ Control Points

Stream Alignment

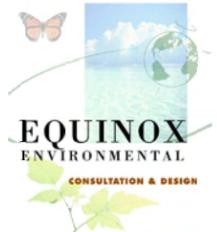
- Restoration
- Enhancement II
- Preservation

Wetlands

- ▨ Creation
- ⋯ Restoration
- ▧ Enhancement
- ▩ Preservation

Monitoring Features

- Vegetation Plots
- Longitudinal Profiles
- Longitudinal Profile Begin/End
- Cross Sections
- Wetland Gauges
- Crest Gauges
- Rain Gauge
- ★ Photo Points

Prepared for	Project: UT to Crab Creek Stream and Wetland Restoration	Notes: 1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A.	Prepared by
	Monitoring Plan View Alleghany County, North Carolina	2) 2005 Aerial Photo	
	Sheet 4 of 4		
	Date	Project Number	
	January 2011	NCEEP # 857	

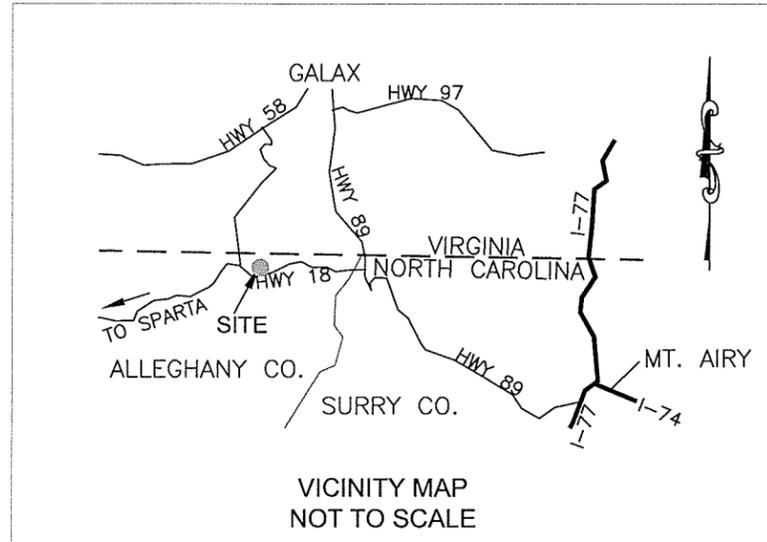
Appendix B

As-Built Plan View

AS-BUILT SURVEY OF UT TO CRAB CREEK STREAM & WETLAND RESTORATION SCO# 06-06784-01A

I, DAVID S. TURNER, AS A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF NORTH CAROLINA, HEREBY CERTIFY THAT THE DATA SHOWN ON THIS DRAWING, WAS OBTAINED UNDER MY SUPERVISION, IS AN ACCURATE AND COMPLETE REPRESENTATION OF WHAT WAS CONSTRUCTED IN THE FIELD, AND THAT THE PHYSICAL DIMENSIONS OR ELEVATIONS SHOWN THUS ARE AS-BUILT CONDITIONS EXCEPT WHERE OTHERWISE NOTED HERON. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 30th DAY OF June, 2010.

David S. Turner
DAVID S. TURNER, P.L.S. #L-4551



GENERAL NOTES

1. ALL DISTANCES ARE HORIZONTAL UNLESS OTHERWISE NOTED.
2. THE VERTICAL DATUM IS NAVD 88.
3. THE BASIS OF BEARINGS IS NCGS STATE PLANE GRID COORDINATES NAD83 DATUM.
4. THIS MAP IS NOT FOR RECORDATION, SALES, OR CONVEYENCES AND DOES NOT COMPLY WITH G.S. 47-30 MAPPING REQUIREMENTS.
5. SEE SHEETS 7-10 FOR LONGITUDINAL PROFILE DATA.
6. REPRESENTATIVE CROSS-SECTIONS ARE PRESENTED ON THE SHEET WHERE THE CROSS-SECTION WAS TAKEN. ALL CROSS-SECTIONS ARE SHOWN FROM LEFT BANK TO RIGHT BANK.
7. THE 30' POWER LINE EASEMENT DEPICTED IS CENTERED ON EXISTING & RELOCATED POWER POLES AND IS SHOWN FOR REFERENCE ONLY. THIS AS-BUILT SURVEY IS NOT INTENDED TO ADJUST OR RELOCATE THE EASEMENT LINE NOR MODIFY THE EASEMENT AGREEMENT. ANY CHANGES TO THE EASEMENT SHOULD BE PERFORMED UNDER A SEPERATE DOCUMENT.

REFERENCES:

DEVELOPER/OWNER:
NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM
1652 MAIL SERVICE CENTER
RALEIGH, NC 27099-1652
(919)715-0476
EEP PROJ. MGR.: HARRY TSOMIDES
EEP REVIEW COORDINATOR: SALAM MUTADA

PROPERTY OWNERSHIP:
WILLOW INVESTMENTS, LLC
GALAX, VA
DEED BOOK 305, PAGE 165 (ALLEGHANY CO., NC REGISTER OF DEEDS)
PLAT BOOK 9, PAGE 456
PIN: 4022-25-6945 & 4022-05-9623

CONSTRUCTION BY:
CAROLINA ENVIRONMENTAL CONTRACTING, INC.
MT. AIRY, NC
(336)320-3849

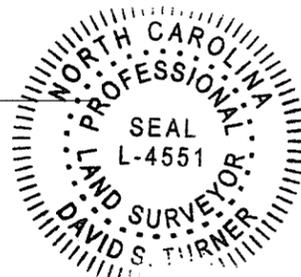
EXISTING CONDITIONS INFORMATION & BOUNDARY PROVIDED BY DESIGNER:
KCI ASSOCIATES OF NC
RALEIGH, NC
(919)783-9214

SHEET INDEX

- SHEET 1 - TITLE
- SHEET 2 - SITE PLAN VIEW - SMALL TRIB
- SHEET 3 - SITE PLAN VIEW - MAIN STEM & SMALL TRIB
- SHEET 4 - SITE PLAN VIEW - MAIN STEM
- SHEET 5 - SITE PLAN VIEW - MAIN STEM
- SHEET 6 - SITE PLAN VIEW - WETLAND AREAS 5 & 6
- SHEET 7 - LONGITUDINAL PROFILE - SMALL TRIB
- SHEET 8 - LONGITUDINAL PROFILE - SMALL TRIB
- SHEET 9 - LONGITUDINAL PROFILE - MAIN STEM & SMALL TRIB
- SHEET 10 - LONGITUDINAL PROFILE - MAIN STEM
- SHEET 11 - STRUCTURE POINT TABLE

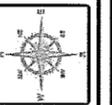
I, DAVID S. TURNER, CERTIFY THAT THESE PLANS WERE DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION AND THAT THE RATIO OF PRECISION AS CALCULATED IS 1: 10,000 +. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 30th DAY OF June, 2010.

David S. Turner
DAVID S. TURNER, P.L.S. #L-4551



REVISIONS, DATE AND INITIAL:

TURNER LAND SURVEYING, PLLC
3201 Glenridge Drive, Raleigh, NC 27604 -- (919)785-1378
Lturner@tlr.com -- Dturner119@tlr.com
www.TURNERLANDSURVEYING.com



TITLE

AS-BUILT SURVEY OF
UT TO CRAB CREEK STREAM & WETLAND RESTORATION
SCO# 06-06784-01A

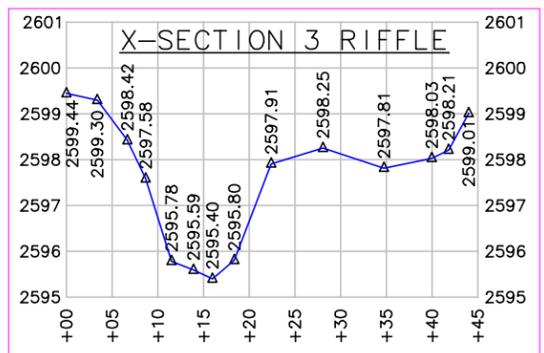
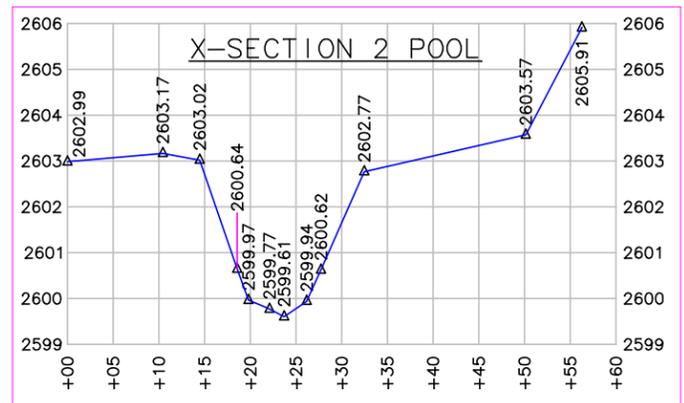
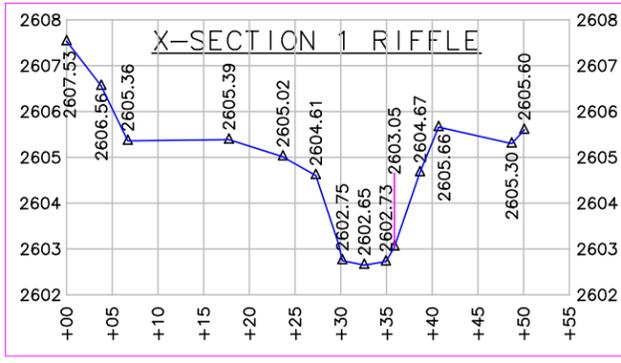
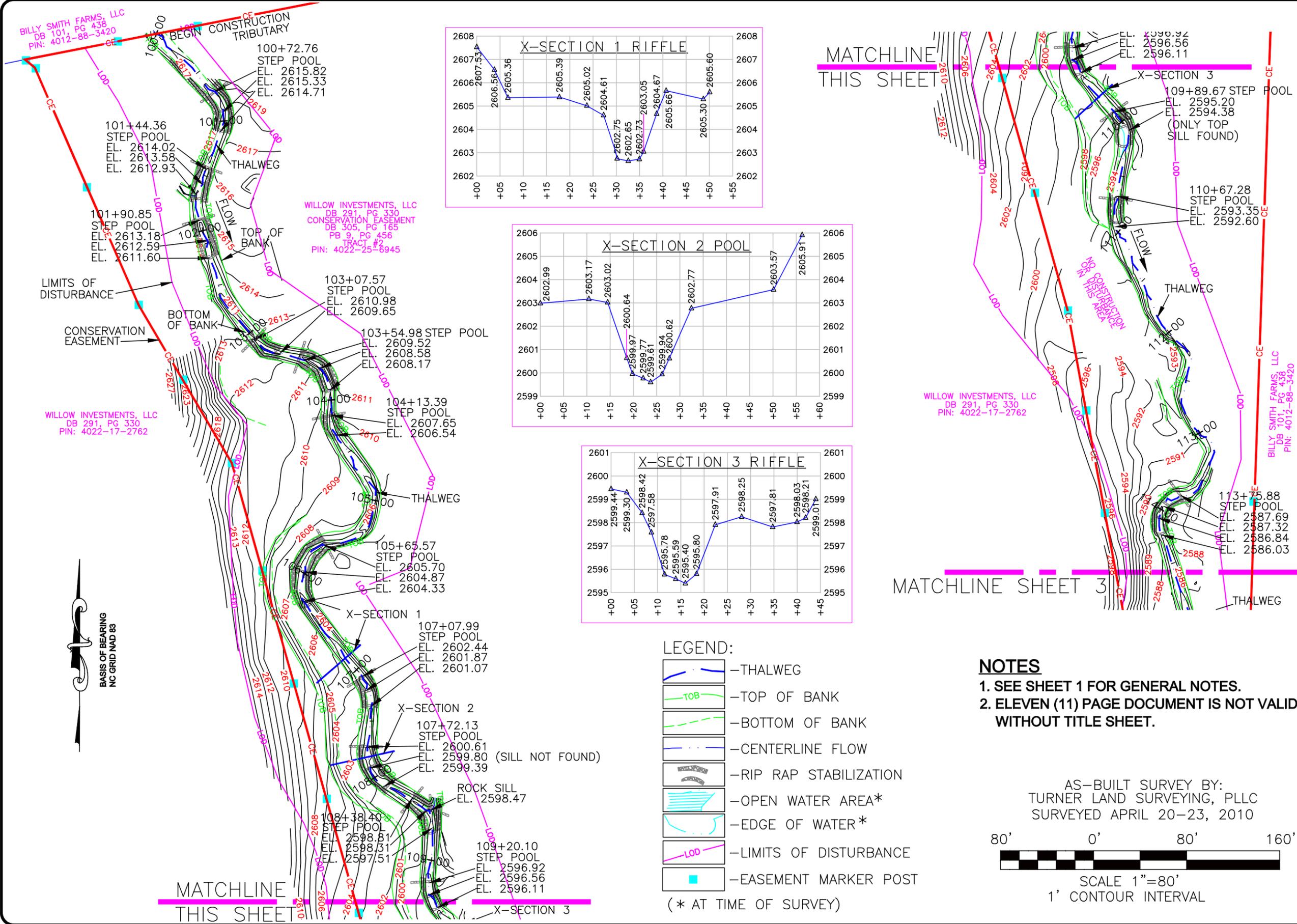
NORTH CAROLINA

ALLEGHANY COUNTY

ENNIDE

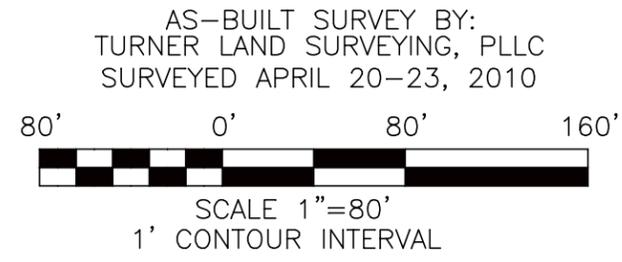
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DRAWN BY:	DST/EGT
REVIEWED BY:	DST
PROJECT:	TLS-09-004
FILE:	CRAB CREEK FINAL AS-BUILT.DWG
SCALE:	NOT TO SCALE

SHEET:
1 of 11



- LEGEND:**
- THALWEG
 - TOP OF BANK
 - BOTTOM OF BANK
 - CENTERLINE FLOW
 - RIP RAP STABILIZATION
 - OPEN WATER AREA*
 - EDGE OF WATER*
 - LIMITS OF DISTURBANCE
 - EASEMENT MARKER POST
- (* AT TIME OF SURVEY)

NOTES
 1. SEE SHEET 1 FOR GENERAL NOTES.
 2. ELEVEN (11) PAGE DOCUMENT IS NOT VALID WITHOUT TITLE SHEET.



REVISIONS, DATE AND INITIAL:

TURNER LAND SURVEYING, PLLC
 3201 Glenridge Drive, Raleigh, NC 27604 - (919)875-1378
 Lturner@tncs.com - Dturner119@tncs.com
 WWW.TURNERLANDSURVEYING.COM

PLAN VIEW

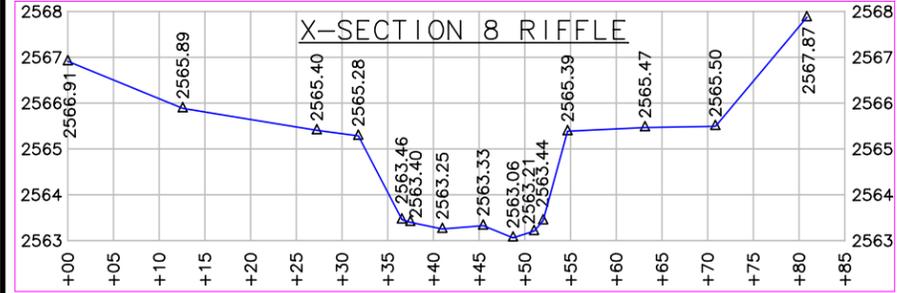
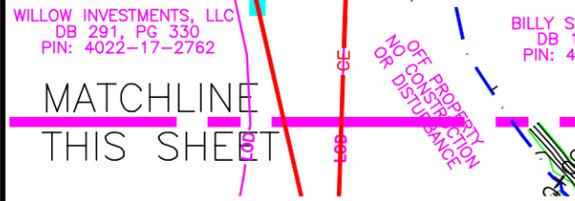
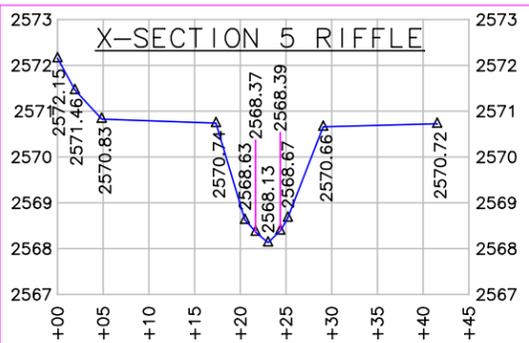
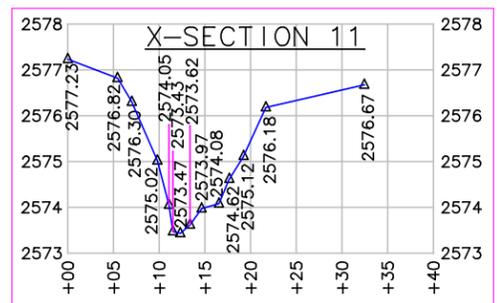
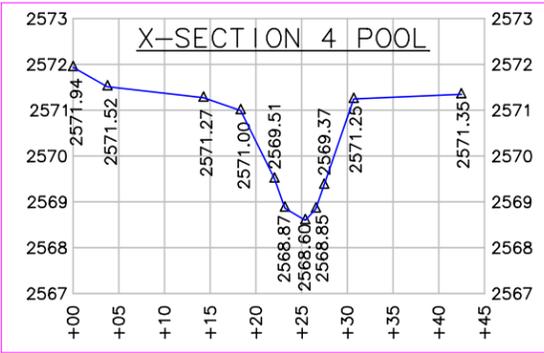
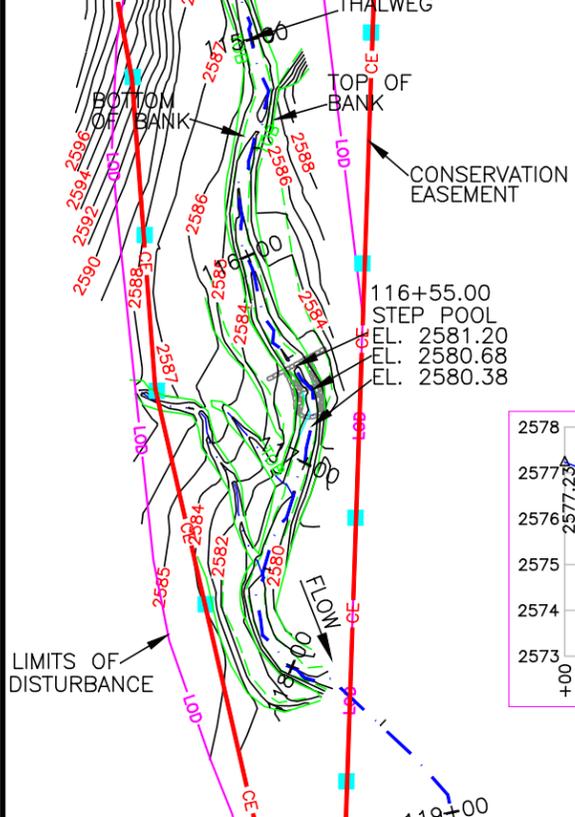
**AS-BUILT SURVEY OF
 UT TO CRAB CREEK STREAM & WETLAND RESTORATION**
 SCO# 06-06784-01A

NORTH CAROLINA
 ALLEGANY COUNTY

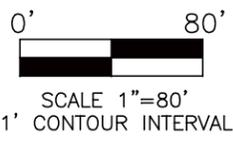
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 DRAWN BY: DST/EGT
 REVIEWED BY: DST
 PROJECT: TLS-09-004
 FILE: CRAB CREEK FINAL AS-BUILT.DWG
 SCALE: 1"=80'
 SHEET: 2 of 11

MATCHLINE SHEET 2

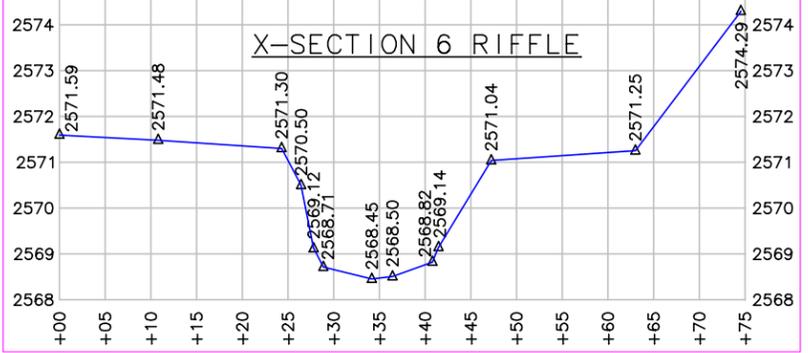
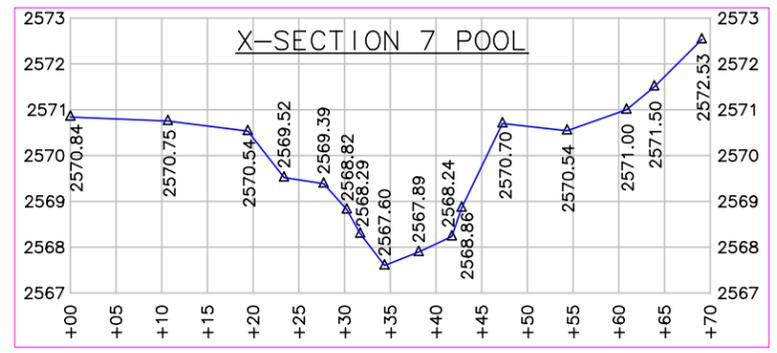
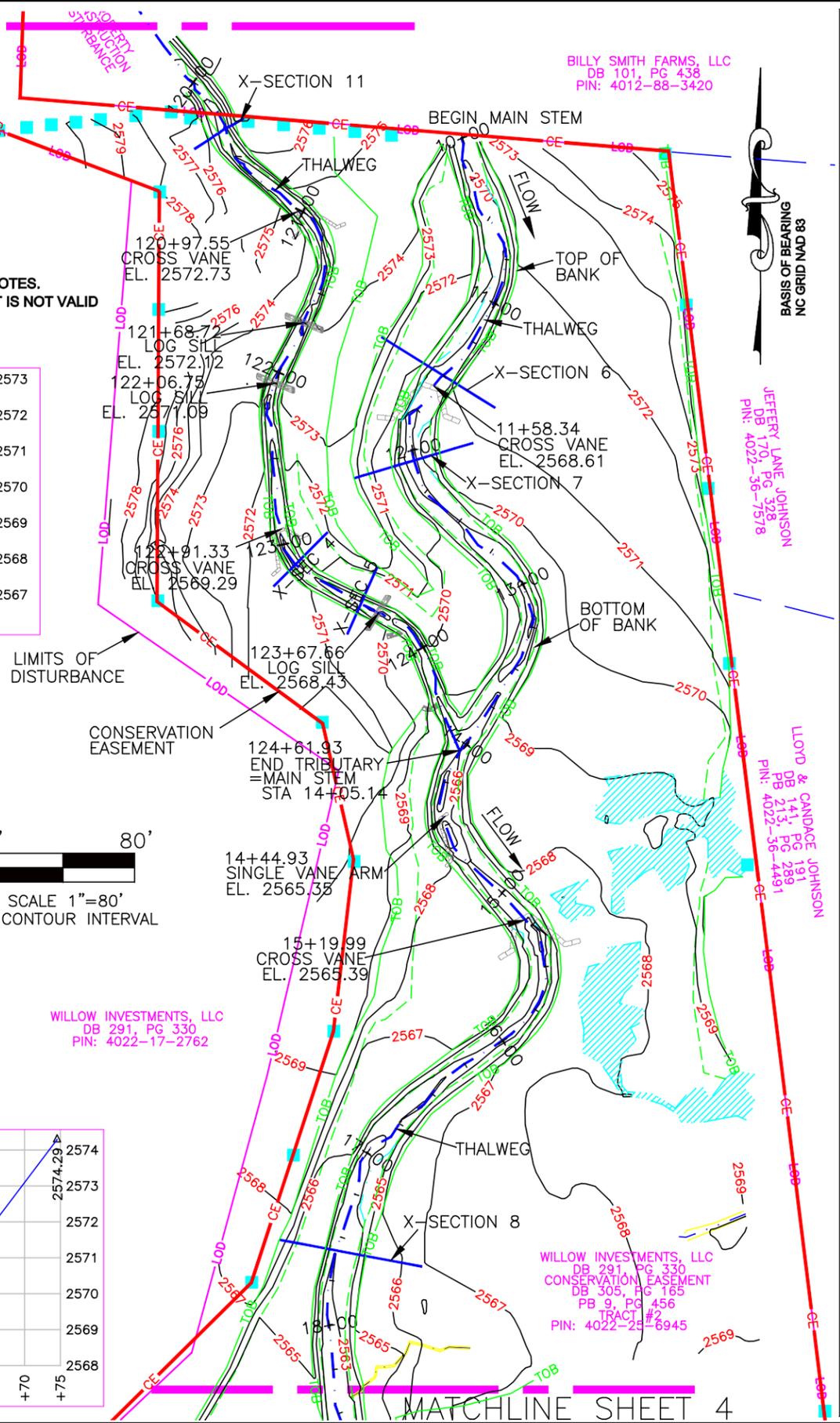


- LEGEND:**
- THALWEG
 - TOP OF BANK
 - BOTTOM OF BANK
 - CENTERLINE FLOW
 - RIP RAP STABILIZATION
 - OPEN WATER AREA*
 - EDGE OF WATER*
 - LIMITS OF DISTURBANCE
 - EASEMENT MARKER POST
- (* AT TIME OF SURVEY)



MATCHLINE THIS SHEET

NOTES
 1. SEE SHEET 1 FOR GENERAL NOTES.
 2. ELEVEN (11) PAGE DOCUMENT IS NOT VALID WITHOUT TITLE SHEET.



WILLOW INVESTMENTS, LLC
 DB 291, PG 330
 PIN: 4022-17-2762

BILLY SMITH FARMS, LLC
 DB 101, PG 438
 PIN: 4012-88-3420

WILLOW INVESTMENTS, LLC
 DB 291, PG 330
 PIN: 4022-17-2762

WILLOW INVESTMENTS, LLC
 DB 291, PG 330
 CONSERVATION EASEMENT
 DB 305, PG 165
 PB 9, PG 456
 TRACT # 2
 PIN: 4022-25-6945

BILLY SMITH FARMS, LLC
 DB 101, PG 438
 PIN: 4012-88-3420

JEFFERY LANE JOHNSON
 DB 170, PG 298
 PIN: 4022-36-7578

LLOYD & CANDACE JOHNSON
 DB 141, PG 191
 DB 141, PG 289
 PIN: 4022-36-4491

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NORTH CAROLINA

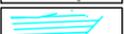
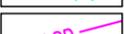
PLAN VIEW

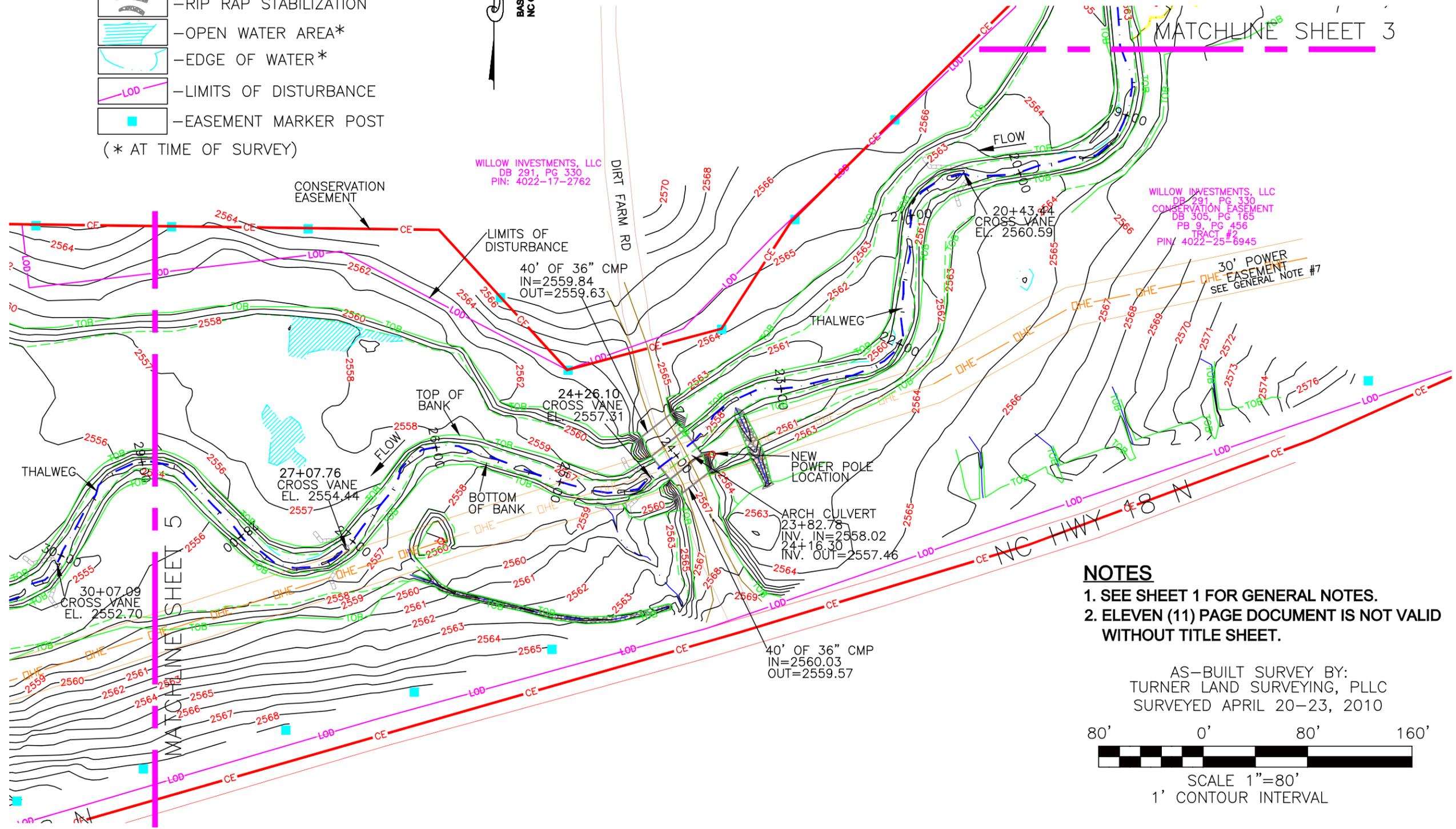
**AS-BUILT SURVEY OF
 UT TO CRAB CREEK STREAM & WETLAND RESTORATION**
 SCO# 06-06784-01A

ALLEGANY COUNTY

DATE:	06/10/2010
SURVEYED BY:	DST/EGT
DRAWN BY:	DST/EGT
REVIEWED BY:	DST
PROJECT:	TLS-09-004
FILE:	CRAB CREEK FINAL AS-BUILT.DWG
SCALE:	1" = 80'
SHEET:	3 of 11

LEGEND:

-  - THALWEG
 -  - TOP OF BANK
 -  - BOTTOM OF BANK
 -  - CENTERLINE FLOW
 -  - RIP RAP STABILIZATION
 -  - OPEN WATER AREA*
 -  - EDGE OF WATER*
 -  - LIMITS OF DISTURBANCE
 -  - EASEMENT MARKER POST
- (* AT TIME OF SURVEY)



NOTES

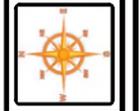
1. SEE SHEET 1 FOR GENERAL NOTES.
2. ELEVEN (11) PAGE DOCUMENT IS NOT VALID WITHOUT TITLE SHEET.

AS-BUILT SURVEY BY:
TURNER LAND SURVEYING, PLLC
SURVEYED APRIL 20-23, 2010



SCALE 1"=80'
1' CONTOUR INTERVAL

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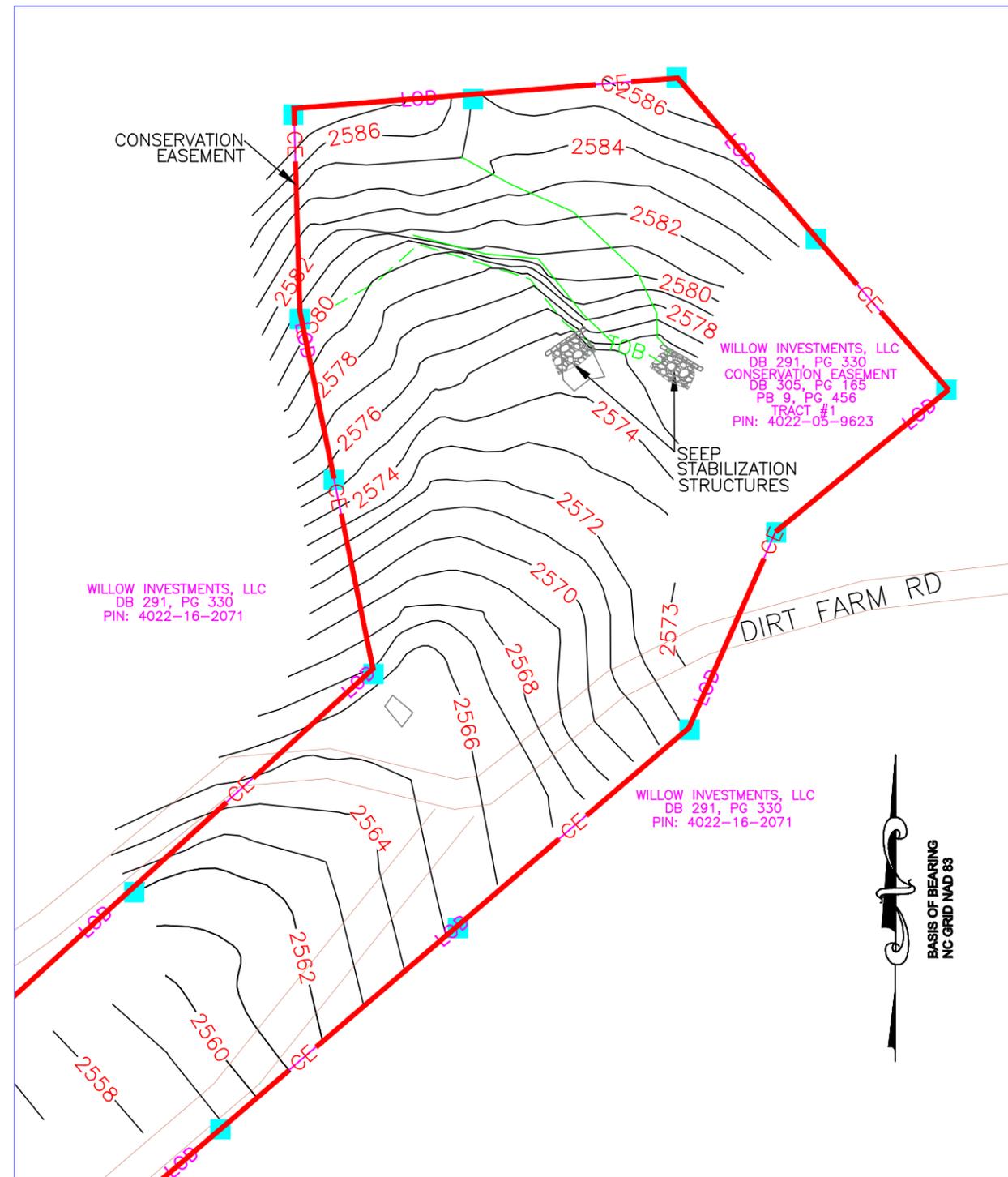
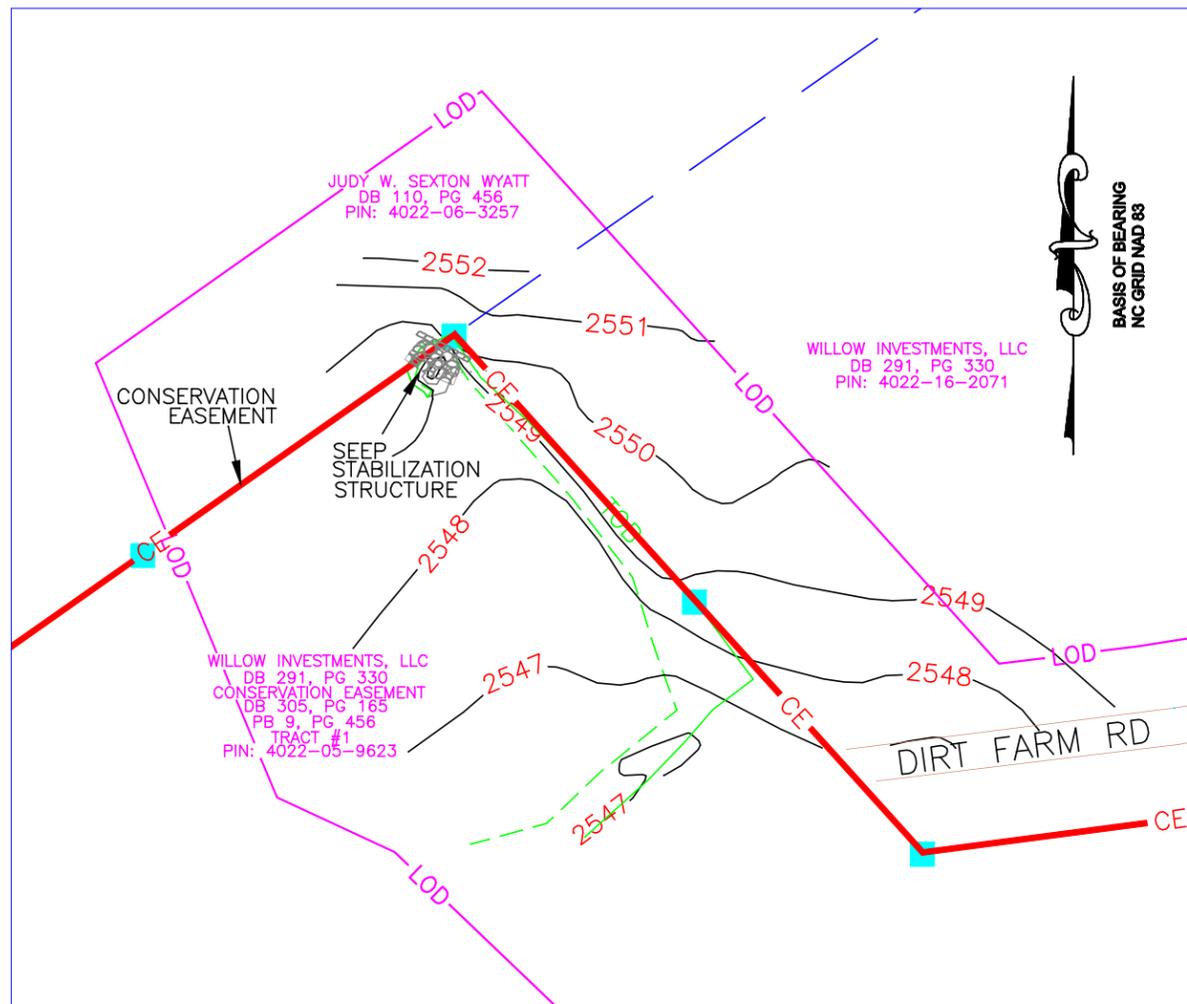


REVISIONS, DATE AND INITIAL:

PLAN VIEW
AS-BUILT SURVEY OF
UT TO CRAB CREEK STREAM & WETLAND RESTORATION
SCO# 06-06784-01A
NORTH CAROLINA
ALLEGANY COUNTY

DATE:	06/10/2010
SURVEYED BY:	DST/EGT
DRAWN BY:	DST/EGT
REVIEWED BY:	DST
PROJECT:	TLS-09-004
FILE:	CRAB CREEK FINAL AS-BUILT.DWG
SCALE:	1" = 80'
SHEET:	4 of 11

WETLAND AREAS 5 & 6



LEGEND:

- THALWEG
- TOP OF BANK
- BOTTOM OF BANK
- CENTERLINE FLOW
- RIP RAP STABILIZATION
- OPEN WATER AREA*
- EDGE OF WATER*
- LIMITS OF DISTURBANCE
- EASEMENT MARKER POST

(* AT TIME OF SURVEY)

NOTES

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SCALE 1"=50'
1' CONTOUR INTERVAL

REVISIONS, DATE AND INITIAL:

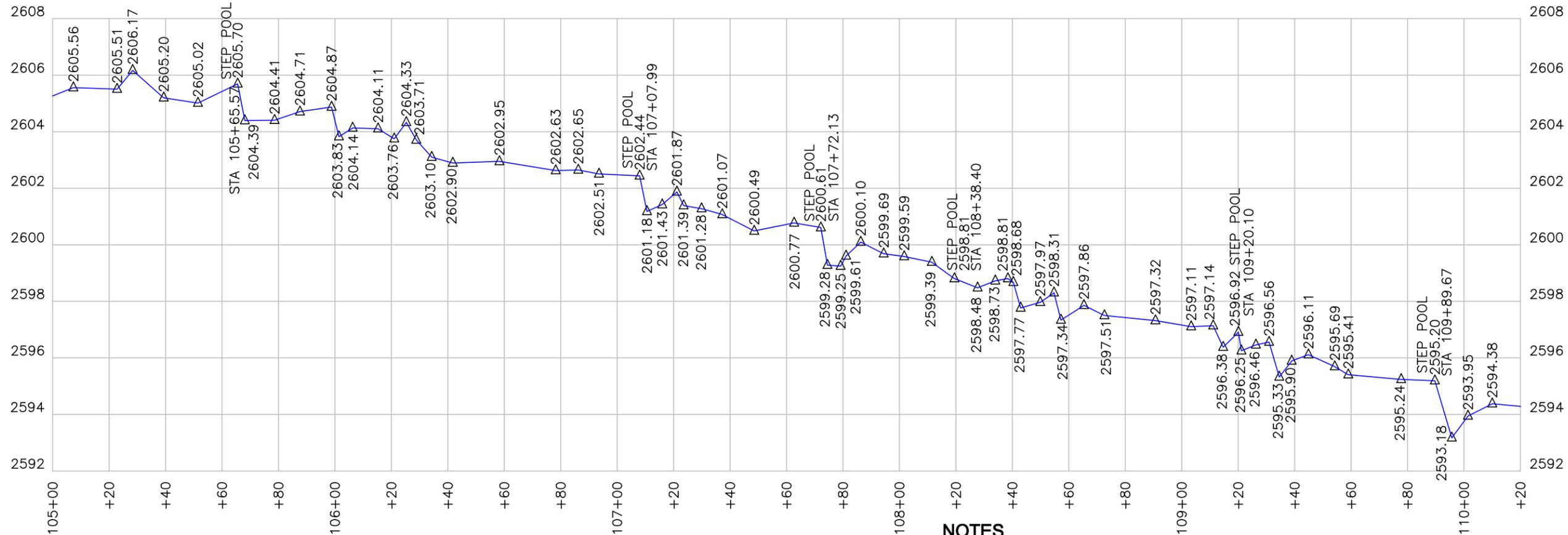
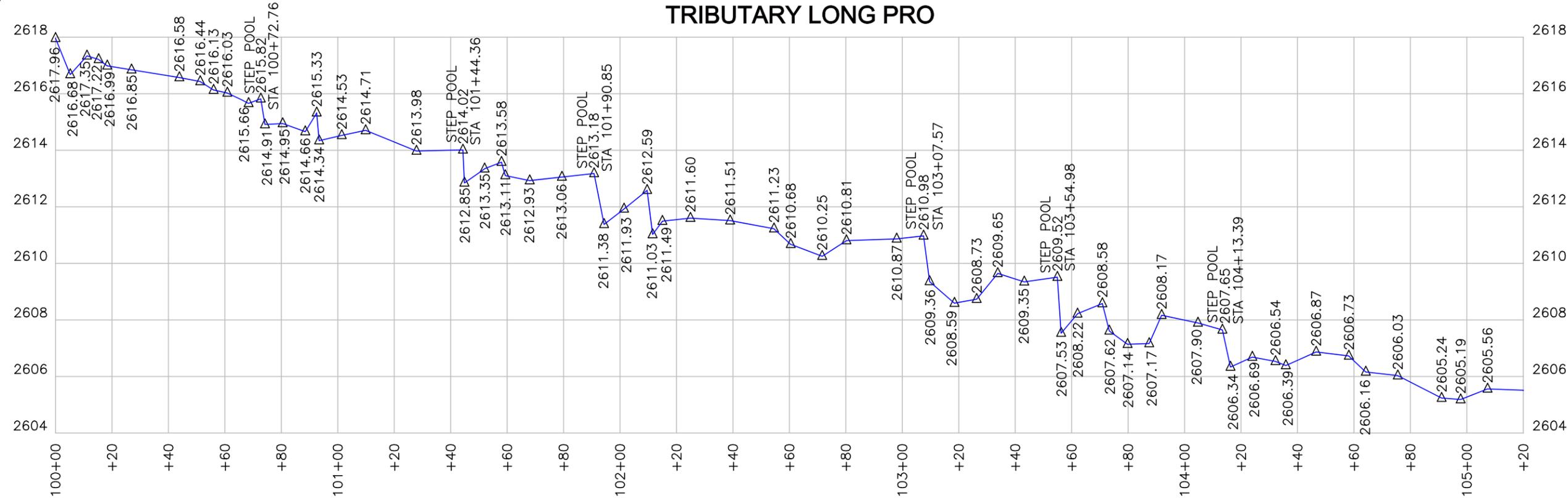
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PLAN VIEW
AS-BUILT SURVEY OF
UT TO CRAB CREEK STREAM & WETLAND RESTORATION
SCO# 06-06784-01A
NORTH CAROLINA
ALLEGANY COUNTY

DATE:	06/10/2010
SURVEYED BY:	DST/EGT
DRAWN BY:	DST/EGT
REVIEWED BY:	DST
PROJECT:	TLS-09-004
FILE:	CRAB CREEK FINAL AS-BUILT.DWG
SCALE:	1" = 50'
SHEET:	6 of 11

TRIBUTARY LONG PRO



NOTES

- SEE SHEET 1 FOR GENERAL NOTES.
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AS-BUILT SURVEY BY:
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SURVEYED APRIL 20-23, 2010

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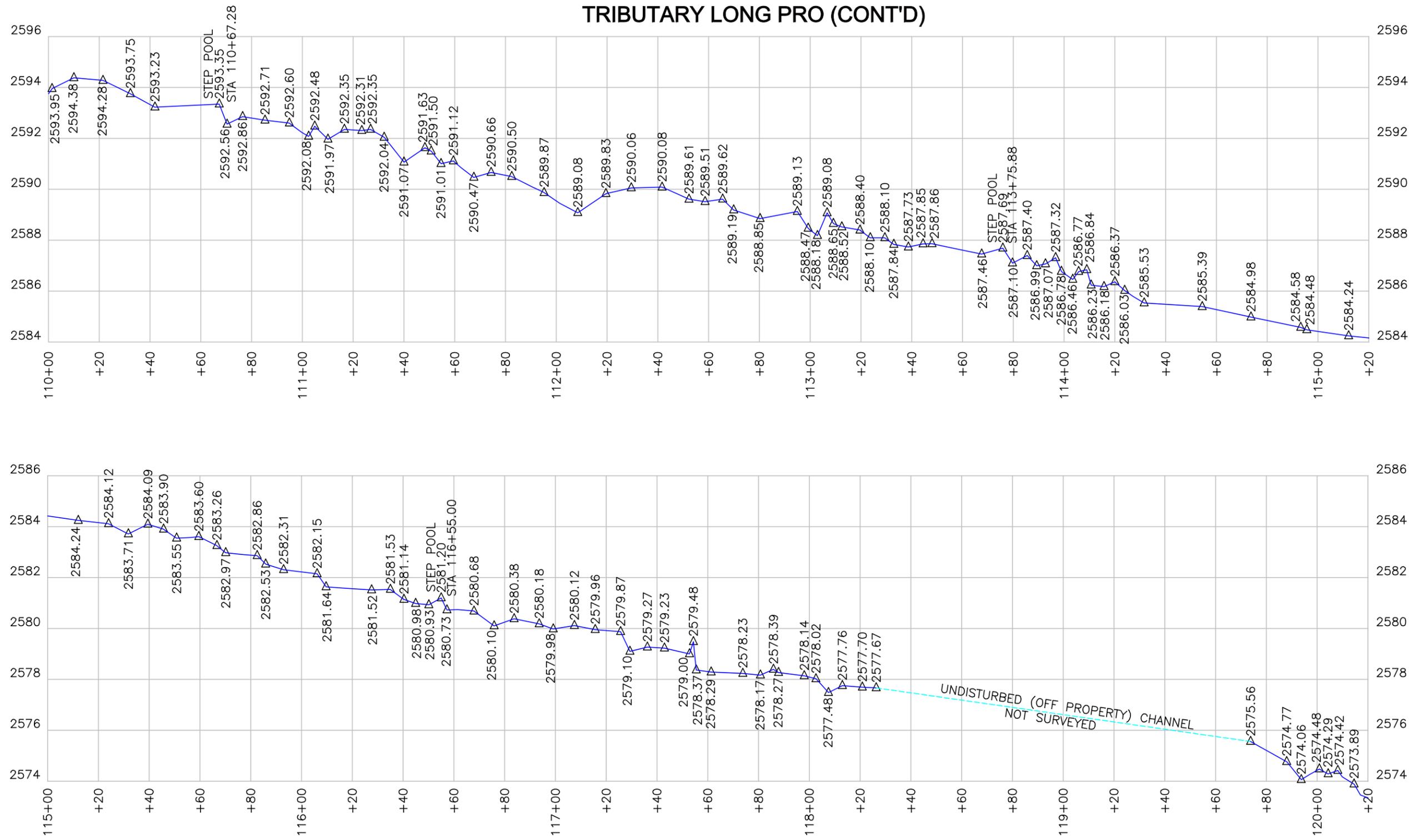
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TRIBUTARY - LONGITUDINAL PROFILE

**AS-BUILT SURVEY OF
UT TO CRAB CREEK STREAM & WETLAND RESTORATION
SCO# 06-06784-01A**

ENRICE
ALLEGANY COUNTY
NORTH CAROLINA

DATE:	06/10/2010
SURVEYED BY:	DST/EGT
DRAWN BY:	DST/EGT
REVIEWED BY:	DST
PROJECT:	TLS-09-004
FILE:	CRAB CREEK FINAL AS-BUILT.DWG
SCALE:	NOT TO SCALE

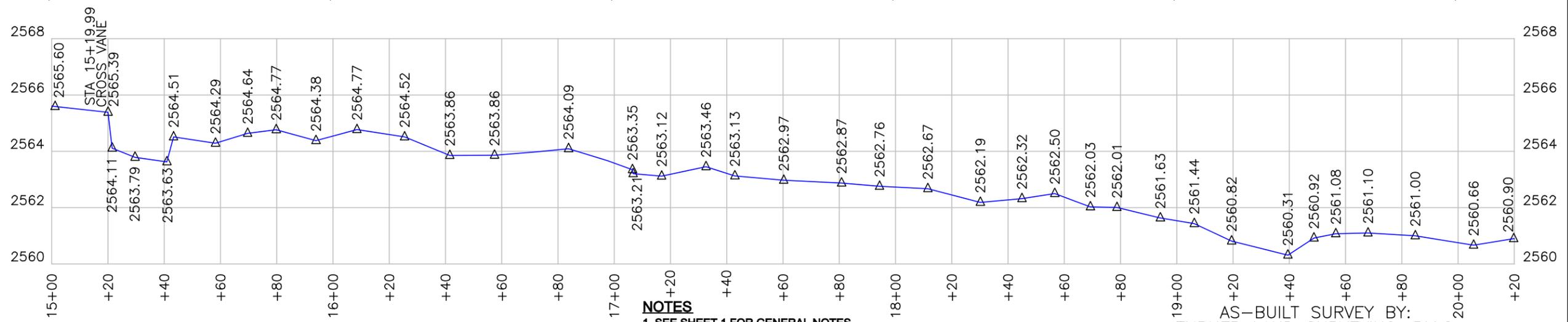


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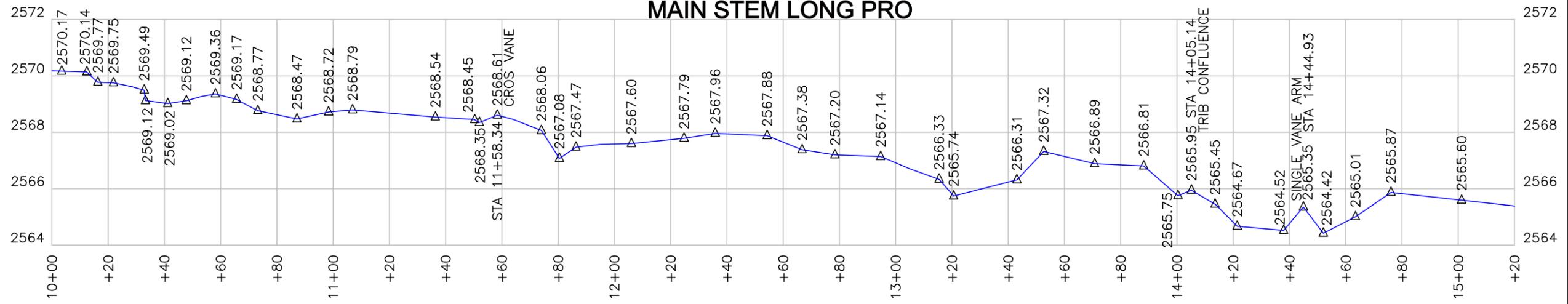
1. SEE SHEET 1 FOR GENERAL NOTES.
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TRIBUTARY - LONGITUDINAL PROFILE AS-BUILT SURVEY OF UT TO CRAB CREEK STREAM & WETLAND RESTORATION SCO# 06-06784-01A NORTH CAROLINA ALLEGANY COUNTY ENNICE	
DATE:	06/10/2010
SURVEYED BY:	DST/EGT
DRAWN BY:	DST/EGT
REVIEWED BY:	DST
PROJECT:	TLS-09-004
FILE:	CRAB CREEK FINAL AS-BUILT.DWG
SCALE:	NOT TO SCALE
SHEET: 8 of 11	

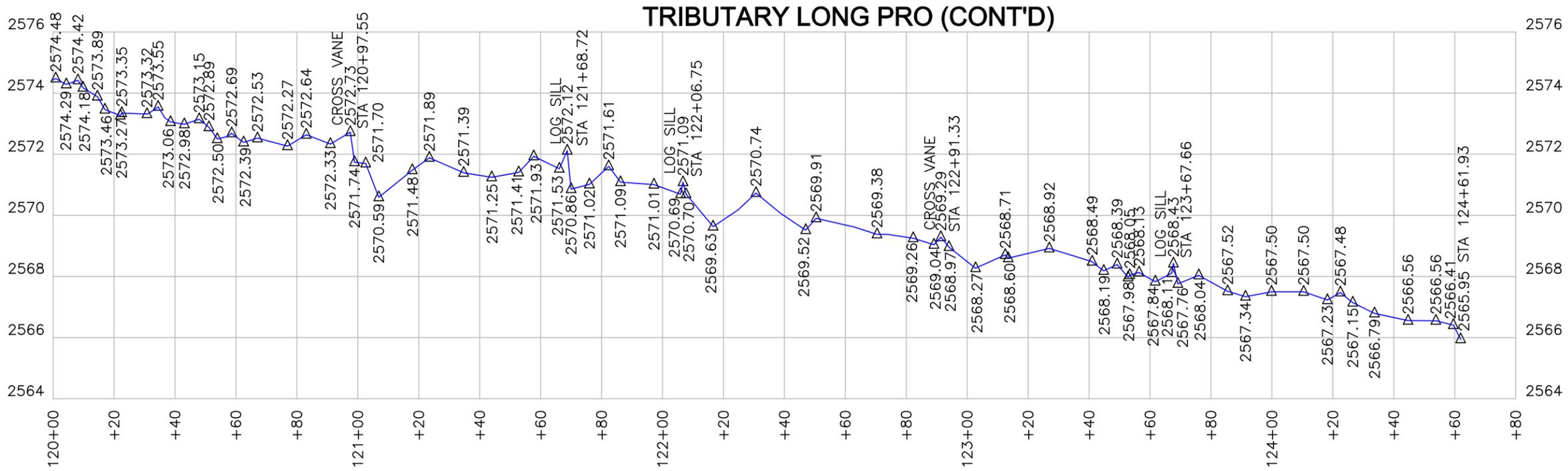


MAIN STEM LONG PRO



NOTES
 1. SEE SHEET 1 FOR GENERAL NOTES.
 2. ELEVEN (11) PAGE DOCUMENT IS NOT VALID WITHOUT TITLE SHEET.

AS-BUILT SURVEY BY:
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MAIN STEM - LONGITUDINAL PROFILE

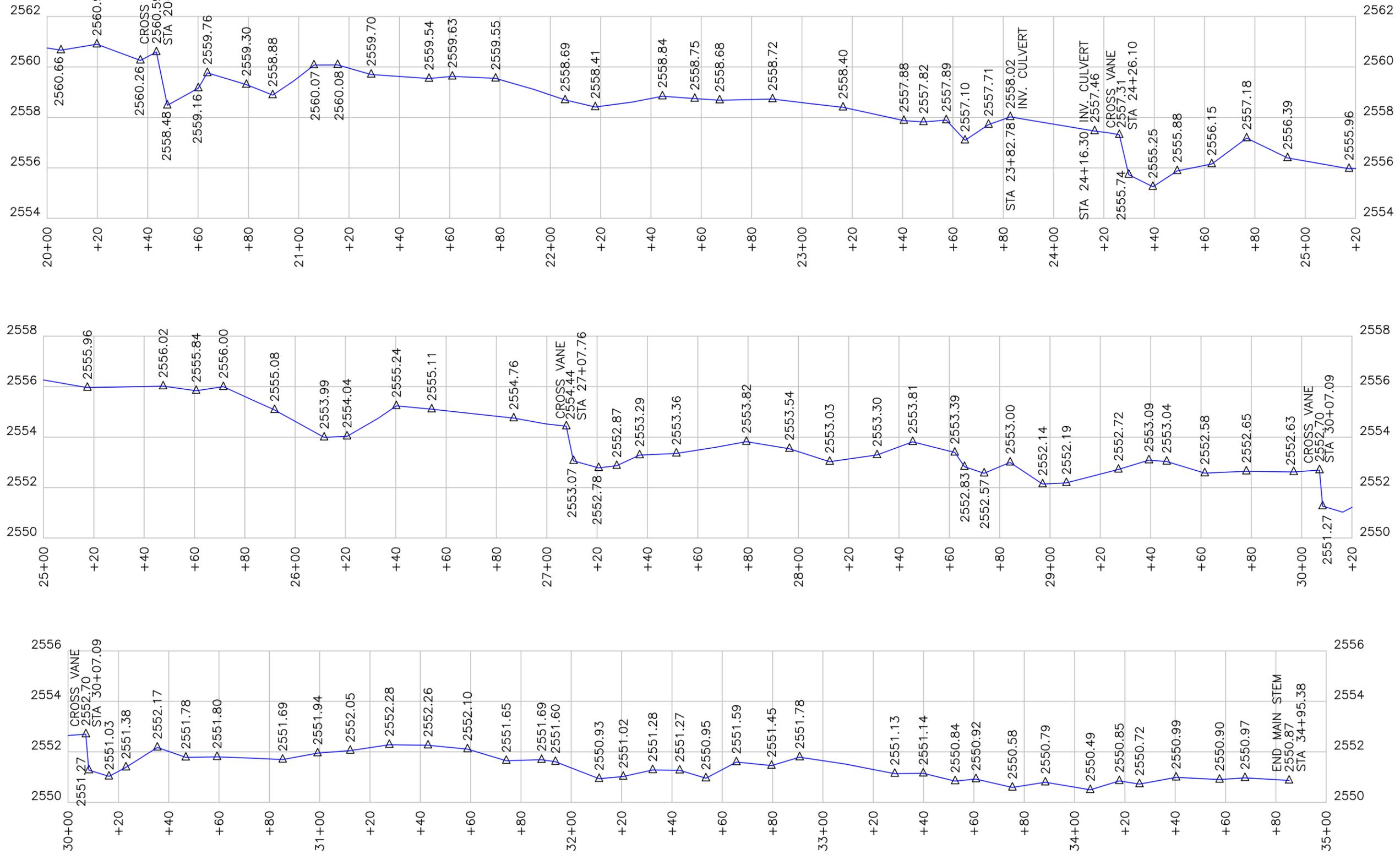
**AS-BUILT SURVEY OF
 UT TO CRAB CREEK STREAM & WETLAND RESTORATION
 SCO# 06-06784-01A**

ENNVIC ALLEGHANY COUNTY NORTH CAROLINA

DATE: 06/10/2010
 SURVEYED BY: DST/EGT
 DRAWN BY: DST/EGT
 REVIEWED BY: DST
 PROJECT: TLS-09-004
 FILE: CRAB CREEK FINAL AS-BUILT.DWG
 SCALE: NOT TO SCALE

SHEET: **9 of 11**

MAIN STEM LONG PRO (CONT'D)



NOTES

- SEE SHEET 1 FOR GENERAL NOTES.
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SURVEYED APRIL 20-23, 2010

REVISIONS, DATE AND INITIAL:



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MAIN STEM - LONGITUDINAL PROFILE

**AS-BUILT SURVEY OF
UT TO CRAB CREEK STREAM & WETLAND RESTORATION
SCO# 06-06784-01A**

NORTH CAROLINA

ALLEGANY COUNTY

ENRICE

DATE:	06/10/2010
SURVEYED BY:	DST/EGT
DRAWN BY:	DST/EGT
REVIEWED BY:	DST
PROJECT:	TLS-09-004
FILE:	CRAB CREEK FINAL AS-BUILT.DWG
SCALE:	NOT TO SCALE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION	STRUCTURE #
1216	1028624.9643	1422606.4586	2615.82	TW/RS	TRIBUTARY STEP POOL 1
1222	1028607.2108	1422613.5467	2615.33	TW/RS	
1227	1028590.4341	1422611.1613	2614.71	TW/RF	
1234	1028558.3151	1422598.6776	2614.02	TW/RS	TRIBUTARY STEP POOL 2
1238	1028545.1222	1422595.8207	2613.58	TW/RS	
1242	1028536.8258	1422590.2809	2612.93	TW/RF	
1252	1028514.5093	1422593.4060	2613.18	TW/RS	TRIBUTARY STEP POOL 3
1257	1028497.0886	1422599.9612	2612.59	TW/RS	
1262	1028482.4430	1422602.0187	2611.60	TW/RF	
1277	1028412.1411	1422641.2430	2610.98	TW/RS	TRIBUTARY STEP POOL 4
1285	1028400.4511	1422663.1176	2609.65	TW/RF	
1291	1028394.4046	1422683.3923	2609.52	TW/RS	TRIBUTARY STEP POOL 5
1294	1028387.5129	1422696.9876	2608.58	TW/RS	
1300	1028368.6639	1422705.6676	2608.17	TW/RF	
1304	1028347.2289	1422707.0195	2607.65	TW/RS	TRIBUTARY STEP POOL 6
1311	1028329.8882	1422710.9862	2606.54	TW/RF	
1341	1028235.6642	1422701.1710	2605.70	TW/RS	TRIBUTARY STEP POOL 7
1352	1028212.7652	1422684.1965	2604.87	TW/RS	
1372	1028187.7165	1422682.6270	2604.33	TW/RF	
1385	1028123.2797	1422733.5426	2602.44	TW/RS	TRIBUTARY STEP POOL 8
1390	1028111.5121	1422736.7255	2601.87	TW/RS	
1395	1028097.7849	1422741.0698	2601.07	TW/RF	
1400	1028063.1417	1422737.4171	2600.61	TW/RS	TRIBUTARY STEP POOL 9
1412	1028028.8625	1422751.7725	2599.39	TW/RF	
1418	1028018.7159	1422776.0444	2598.81	TW/RS	TRIBUTARY STEP POOL 10
1424	1028008.3493	1422788.2254	2598.31	TW/RS	
1431	1027993.1815	1422793.3759	2597.51	TW/RF	
1442	1027946.2561	1422791.0664	2596.92	TW/RS	TRIBUTARY STEP POOL 11
1445	1027935.8953	1422790.4839	2596.56	TW/RS	
1450	1027924.9648	1422797.6429	2596.11	TW/RF	
1460	1027891.4352	1422826.5366	2595.20	TW/RS	TRIBUTARY STEP POOL 12
1578	1027875.4955	1422839.1255	2594.38	TW/RF	
1595	1027819.6319	1422828.3030	2593.35	TW/RS	TRIBUTARY STEP POOL 13
1603	1027792.7390	1422827.2700	2592.60	TW/RF	
1797	1027562.9642	1422883.5788	2587.69	TW/RS	TRIBUTARY STEP POOL 14
1808	1027553.2702	1422868.9681	2587.32	TW/RS	
1816	1027543.1811	1422864.8108	2586.84	TW/RS	
1820	1027528.8698	1422867.6680	2586.03	TW/RF	
1877	1027313.8163	1422909.7218	2581.20	TW/RS	
1882	1027303.6419	1422917.3965	2580.68	TW	TRIBUTARY STEP POOL 15
1889	1027287.9387	1422916.8514	2580.38	TW	

NOTES

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SURVEYED APRIL 20-23, 2010

10466	1026949.4558	1423086.7771	2574.10	TBR/XV	TRIBUTARY CROSS VANE 16
10498	1026961.6449	1423083.9098	2572.73	TW/XV	
10501	1026958.5756	1423093.3163	2573.42	BBL/XV	
10642	1026952.2554	1423098.7527	2574.48	XV	TRIBUTARY LOG SILL 17
10517	1026898.4942	1423089.9632	2572.20	BBL/LS	
10518	1026901.7364	1423083.9346	2572.20	BBR/LS	
10520	1026899.7498	1423086.9648	2572.12	TW/LS	TRIBUTARY LOG SILL 18
10529	1026866.0962	1423070.6710	2571.09	TW/LS	
10530	1026869.0401	1423068.1258	2571.32	BBR/LS	
10531	1026866.0505	1423074.1754	2571.31	BBL/LS	TRIBUTARY CROSS VANE 19
10552	1026784.8851	1423075.0180	2569.29	TW/XV	
10553	1026770.1873	1423075.9480	2570.98	XV	
10554	1026776.9093	1423081.7558	2570.34	XV	TRIBUTARY LOG SILL 20
10559	1026772.5550	1423073.7487	2570.97	BBR/XV	
10577	1026738.2246	1423129.1468	2568.43	TW/LS	
10580	1026735.1722	1423126.1253	2568.62	BBR/LS	MAIN STEM CROSS VANE 1
10581	1026741.0481	1423130.0715	2568.58	BBL/LS	
10712	1026846.4718	1423139.2560	2570.85	TBR/XV	
10732	1026851.9957	1423163.8477	2570.59	TBL/XV	MAIN STEM CROSS VANE 2
10788	1026864.5720	1423159.6449	2568.61	TW/XV	
10795	1026846.2716	1423141.4279	2570.93	XV	
10799	1026845.9153	1423155.3036	2568.92	XV	MAIN STEM CROSS VANE 3
11394	1026624.7859	1423164.8085	2565.35	TW/SAV	
11457	1026600.4934	1423170.3925	2567.59	SAV	
12617	1026600.8118	1423169.4844	2567.52	SINGLE ARM VANE	MAIN STEM CROSS VANE 4
12618	1026606.1123	1423167.9438	2566.95	SINGLE ARM VANE	
12619	1026608.9788	1423166.8704	2566.49	SINGLE ARM VANE	
12620	1026613.3284	1423166.0287	2566.33	SINGLE ARM VANE	MAIN STEM CROSS VANE 5
11469	1026567.3698	1423210.9937	2565.39	TW/XV	
11471	1026554.7440	1423209.7874	2566.12	XV	
11475	1026559.0939	1423224.8397	2567.07	XV	MAIN STEM CROSS VANE 6
11299	1026202.3097	1422966.1934	2562.75	TBR/XV	
2523	1026180.8651	1422976.1330	2562.80	TBL/XV	
2607	1026199.1644	1422985.5227	2560.59	TW/XV	MAIN STEM CROSS VANE 7
12299	1025967.4056	1422745.1966	2557.31	TW/XV	
12301	1025966.3025	1422729.2784	2557.99	XV	
12307	1025952.3141	1422729.2290	2559.29	XV	MAIN STEM CROSS VANE 6
2287	1025912.8698	1422512.0160	2554.44	TW/XV	
2338	1025901.2519	1422290.5238	2552.70	TW/XV	MAIN STEM CROSS VANE 7

LEGEND:

- TW - THALWEG
- XV - CROSS VANE
- LS - LOG SILL
- RF - RIFFLE
- SAV - SINGLE ARM VANE
- TBR - TOP OF BANK RIGHT
- TBL - TOB OF BANK LEFT
- BBR - BOTTOM OF BANK RIGHT
- BBL - BOTTOM OF BANK LEFT

REVISIONS, DATE AND INITIAL:

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STRUCTURE POINT TABLE

AS-BUILT SURVEY OF
UT TO CRAB CREEK STREAM & WETLAND RESTORATION
SCO# 06-06784-01A
NORTH CAROLINA
ALLEGANY COUNTY

DATE: 06/10/2010

SURVEYED BY: DST/EGT

DRAWN BY: DST/EGT

REVIEWED BY: DST

PROJECT: TLS-09-004

FILE: CRAB CREEK
FINAL AS-BUILT.DWG

SCALE: NOT TO SCALE

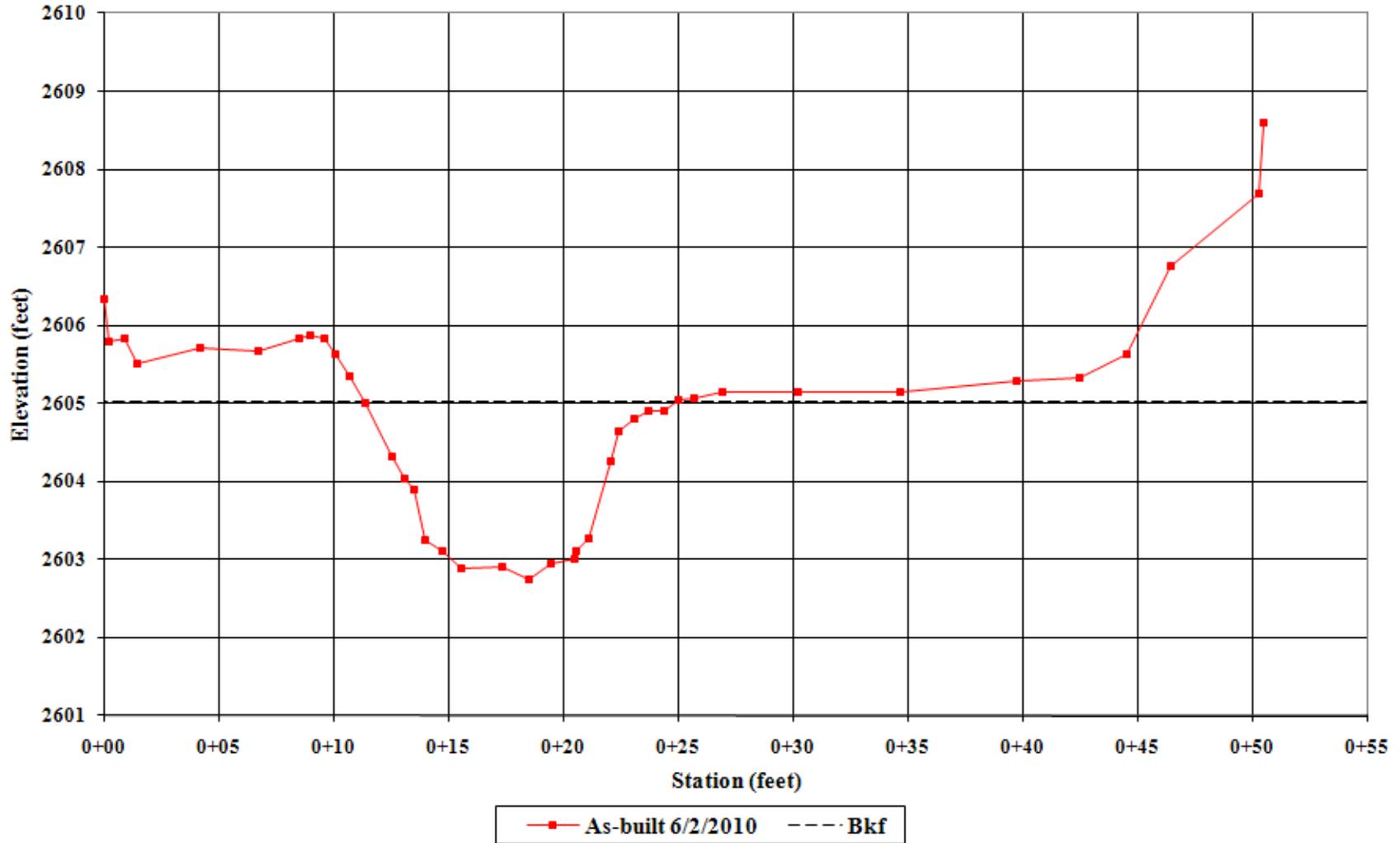
SHEET:

11 of 11

Appendix C

Cross-Section Plots and Photos

**Unnamed Tributary 1 - Upper
Cross-Section #1 - Riffle
Station 106 + 83.73**





Unnamed Tributary 1 Upper – Cross-Section #1 – Riffle
(Looking at Left Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary 1 Upper – Cross-Section #1 – Riffle
(Looking at Right Bank Descending)
Baseline – April 19, 2010

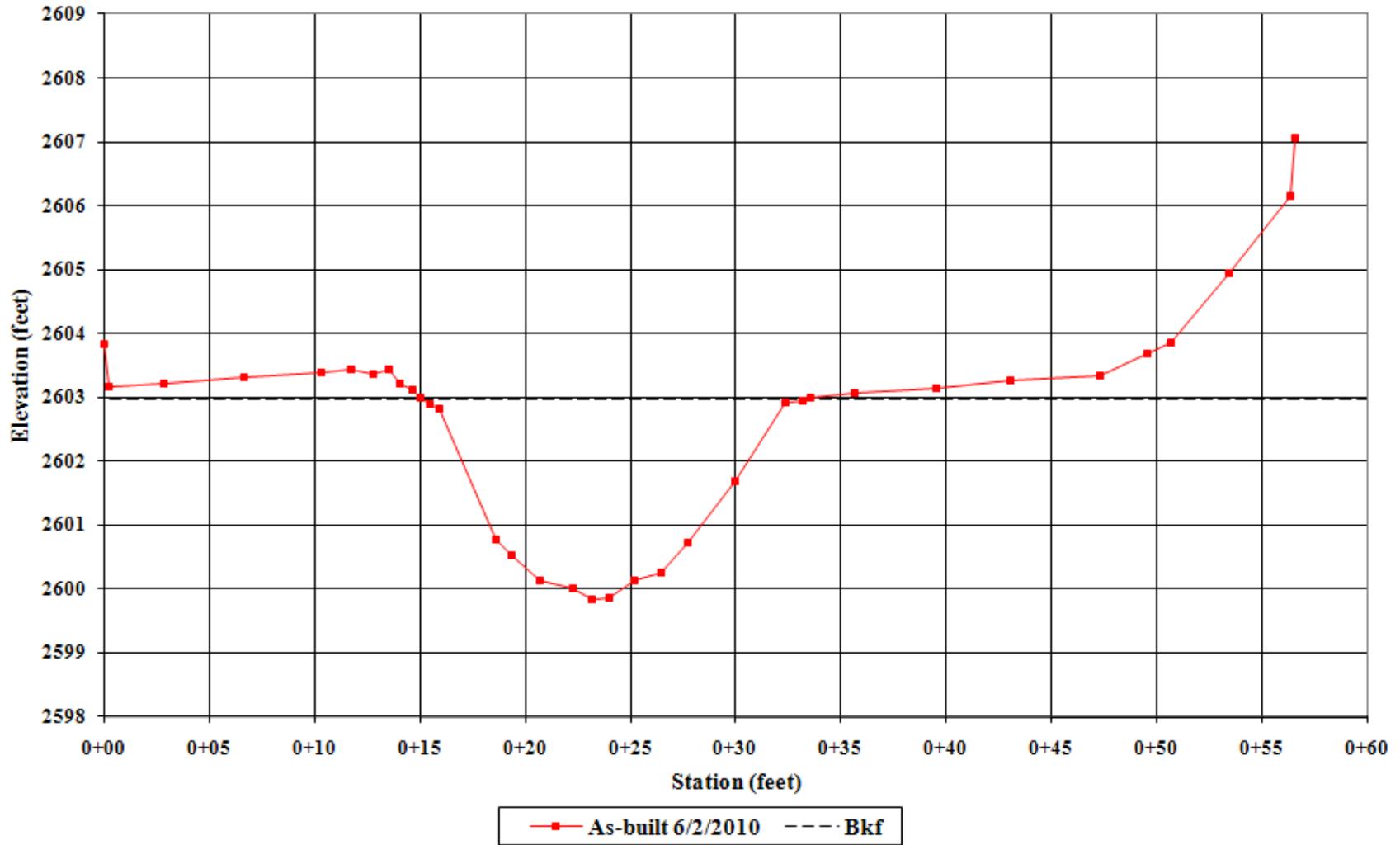


Unnamed Tributary 1 Upper – Cross-Section #1 – Riffle
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary 1 Upper – Cross-Section #1 – Riffle
(Looking Upstream)
Baseline – April 19, 2010

**Unnamed Tributary 1 - Upper
Cross-Section #2 - Pool
Station 107 + 77.18**





Unnamed Tributary 1 Upper – Cross-Section #2 – Pool
(Looking at Left Bank Descending)
Baseline – April 19, 2010



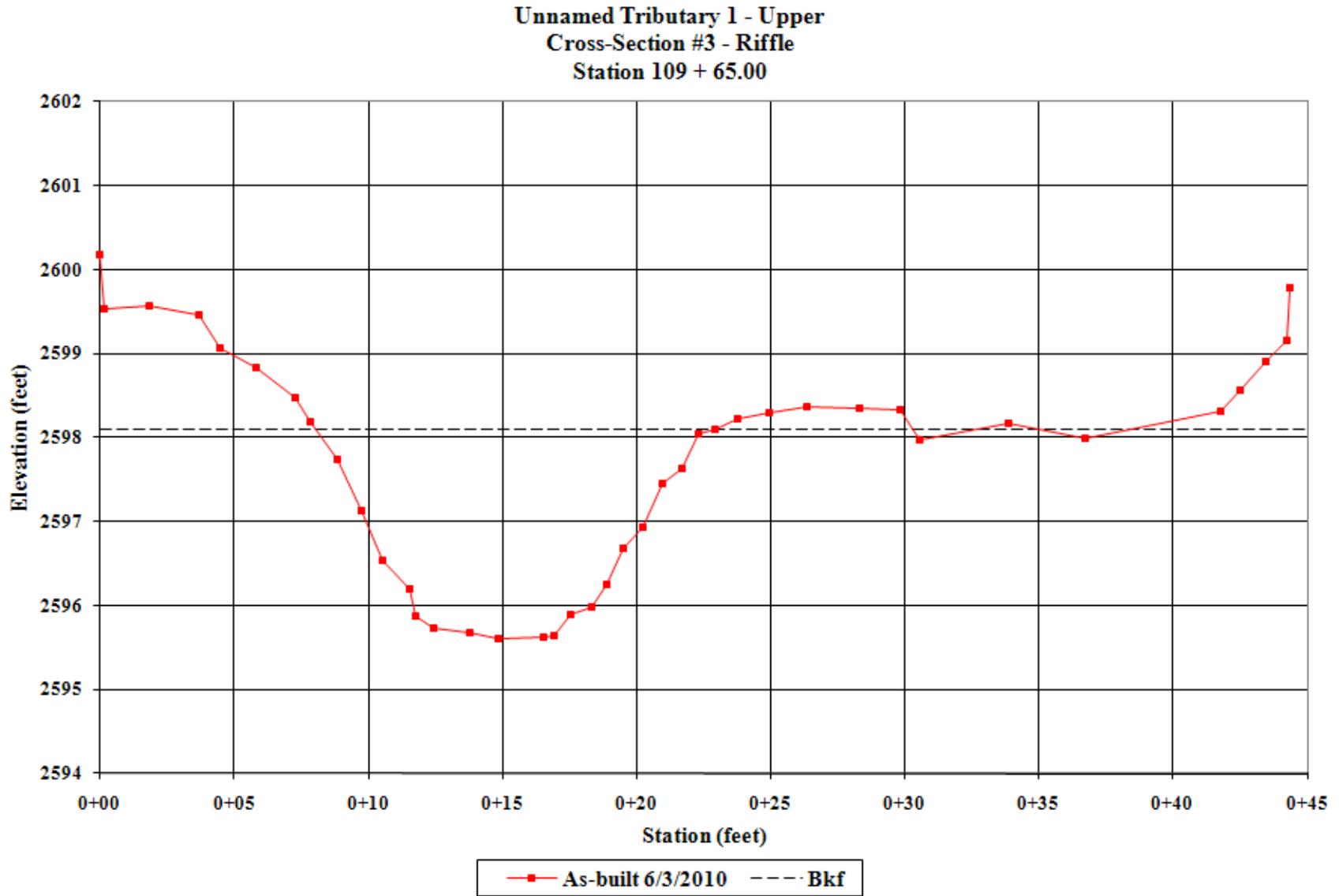
Unnamed Tributary 1 Upper – Cross-Section #2 – Pool
(Looking at Right Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary 1 Upper – Cross-Section #2 – Pool
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary 1 Upper – Cross-Section #2 – Pool
(Looking Upstream)
Baseline – April 19, 2010





Unnamed Tributary 1 Upper – Cross-Section #3 – Riffle
(Looking at Left Bank Descending)
Baseline – April 19, 2010



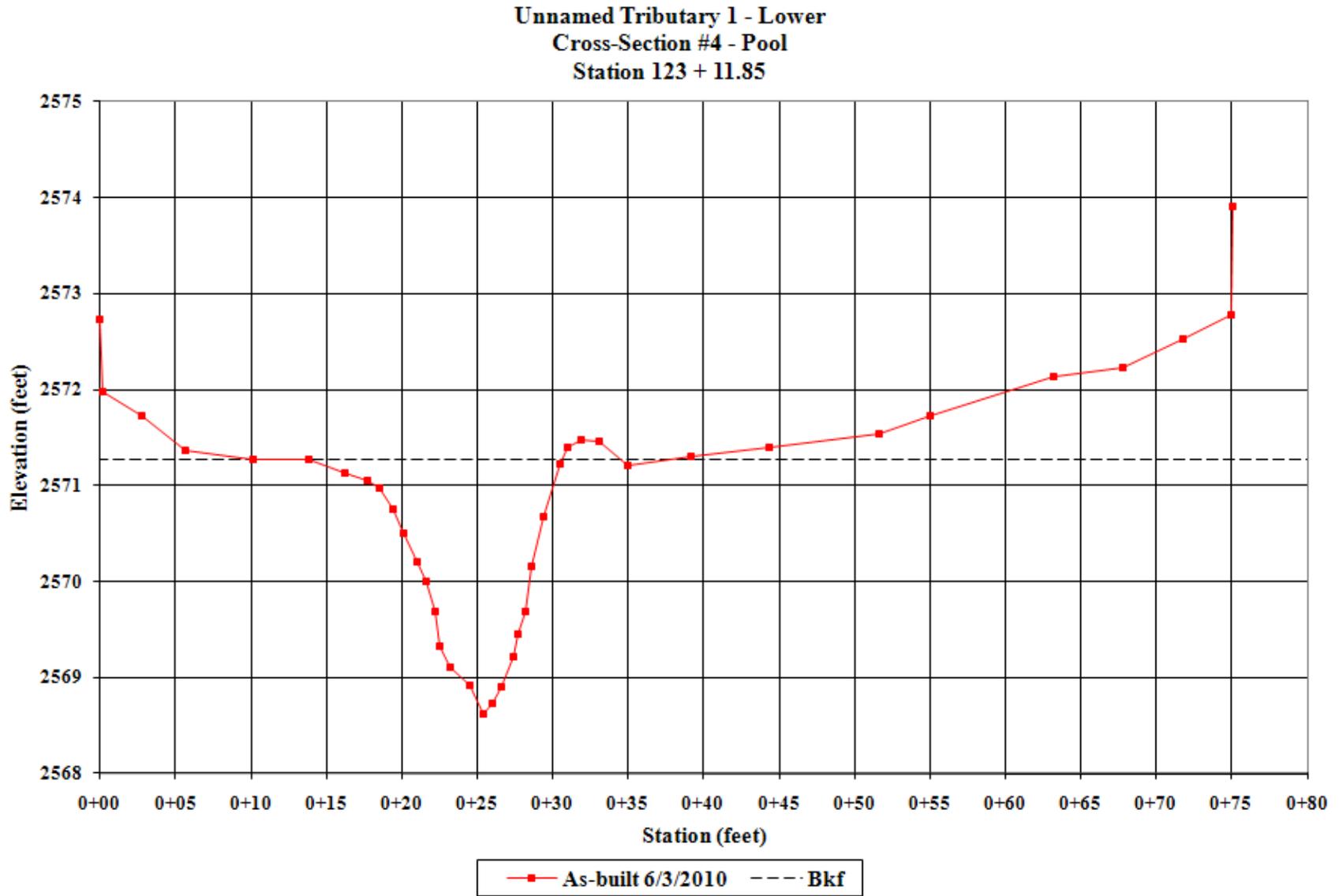
Unnamed Tributary 1 Upper – Cross-Section #3 – Riffle
(Looking at Right Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary 1 Upper – Cross-Section #3 – Riffle
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary 1 Upper – Cross-Section #3 – Riffle
(Looking Upstream)
Baseline – April 19, 2010





Unnamed Tributary 1 Lower – Cross-Section #4 – Pool
(Looking at Left Bank Descending)
Baseline – April 19, 2010



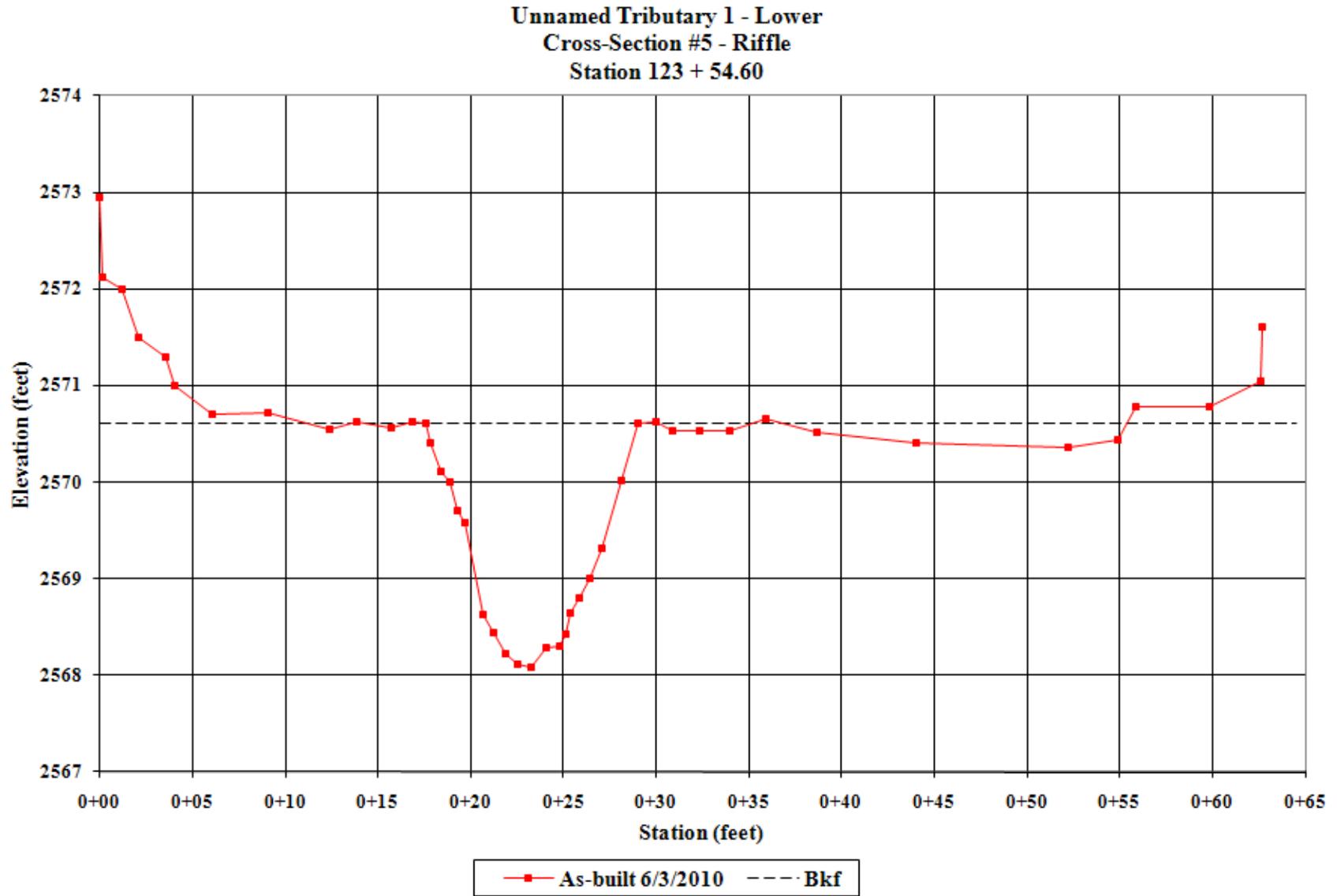
Unnamed Tributary 1 Lower – Cross-Section #4 – Pool
(Looking at Right Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary 1 Lower – Cross-Section #4 – Pool
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary 1 Lower – Cross-Section #4 – Pool
(Looking Upstream)
Baseline – April 19, 2010





Unnamed Tributary 1 Lower – Cross-Section #5 – Riffle
(Looking at Left Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary 1 Lower – Cross-Section #5 – Riffle
(Looking at Right Bank Descending)
Baseline – April 19, 2010

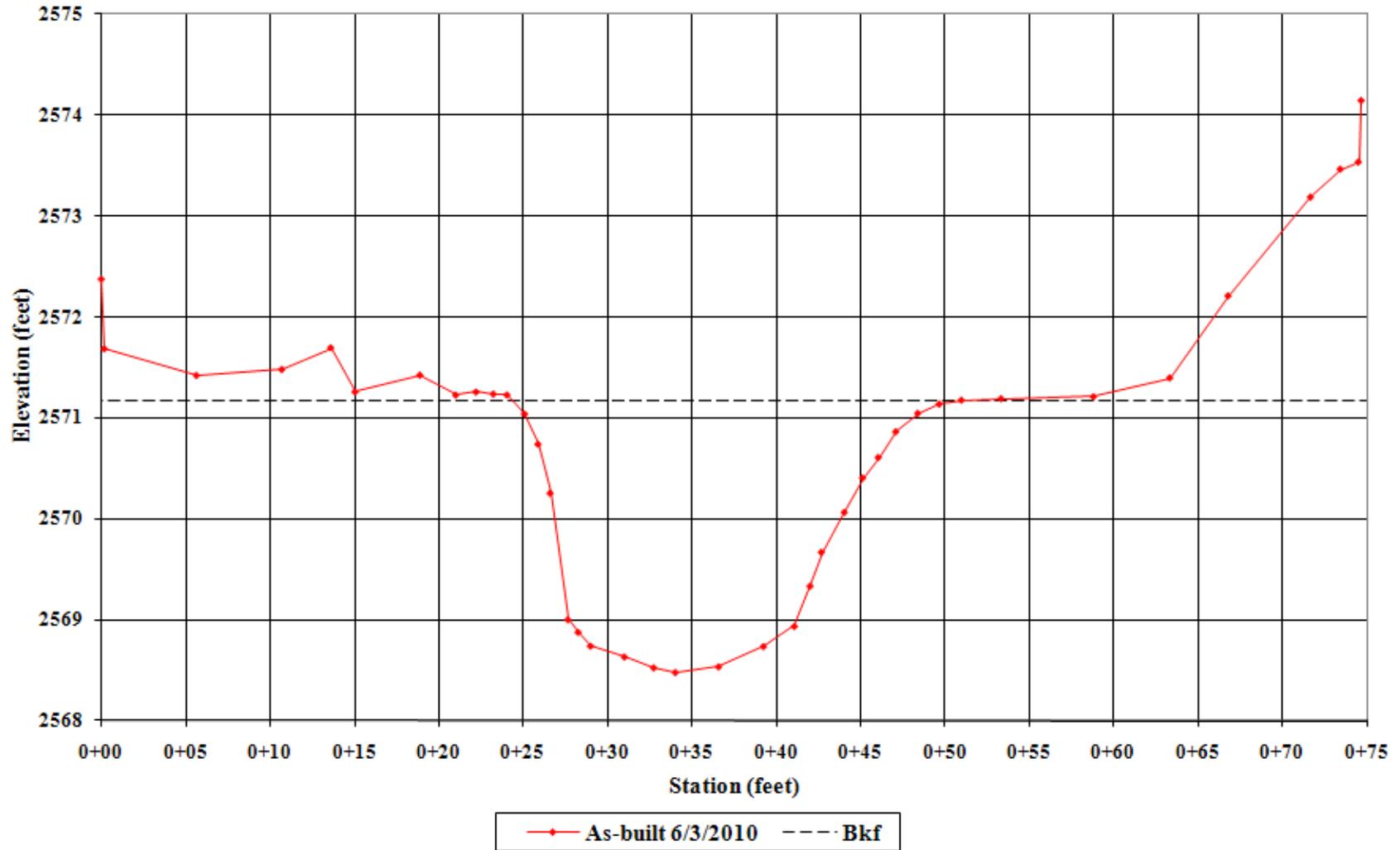


Unnamed Tributary 1 Lower – Cross-Section #5 – Riffle
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary 1 Lower – Cross-Section #5 – Riffle
(Looking Upstream)
Baseline – April 19, 2010

**UT Crab Creek - Upstream
Cross-Section #6 - Riffle
Station 11 + 47.00**





Unnamed Tributary Crab Creek Upstream – Cross-Section #6 – Riffle
(Looking at Left Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #6 – Riffle
(Looking at Right Bank Descending)
Baseline – April 19, 2010

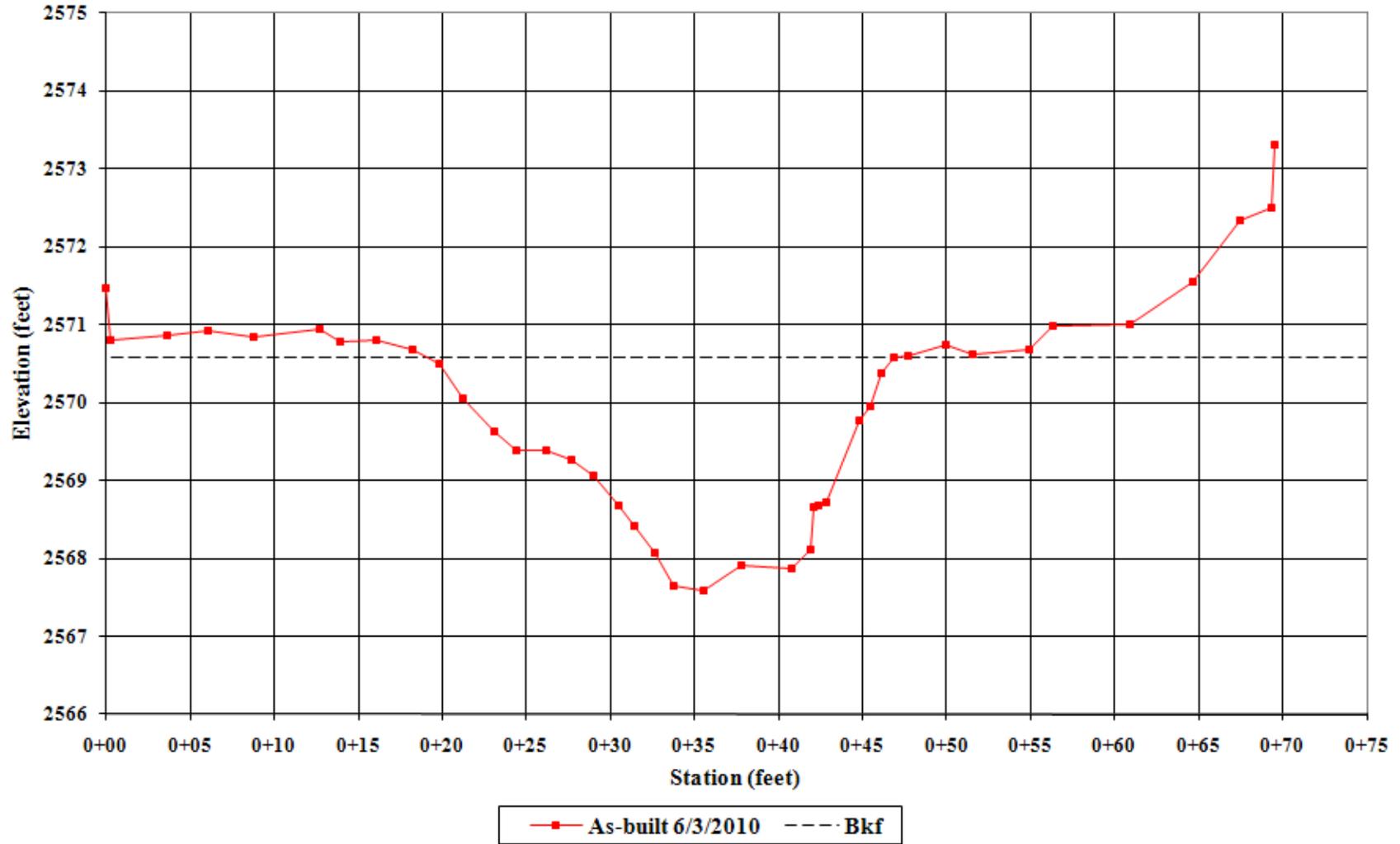


Unnamed Tributary Crab Creek Upstream – Cross-Section #6 – Riffle
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #6 – Riffle
(Looking Upstream)
Baseline – April 19, 2010

**UT Crab Creek - Upstream
Cross-Section #7 - Pool
Station 12 + 02.03**





Unnamed Tributary Crab Creek Upstream – Cross-Section #7 – Pool
(Looking at Left Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #7 – Pool
(Looking at Right Bank Descending)
Baseline – April 19, 2010

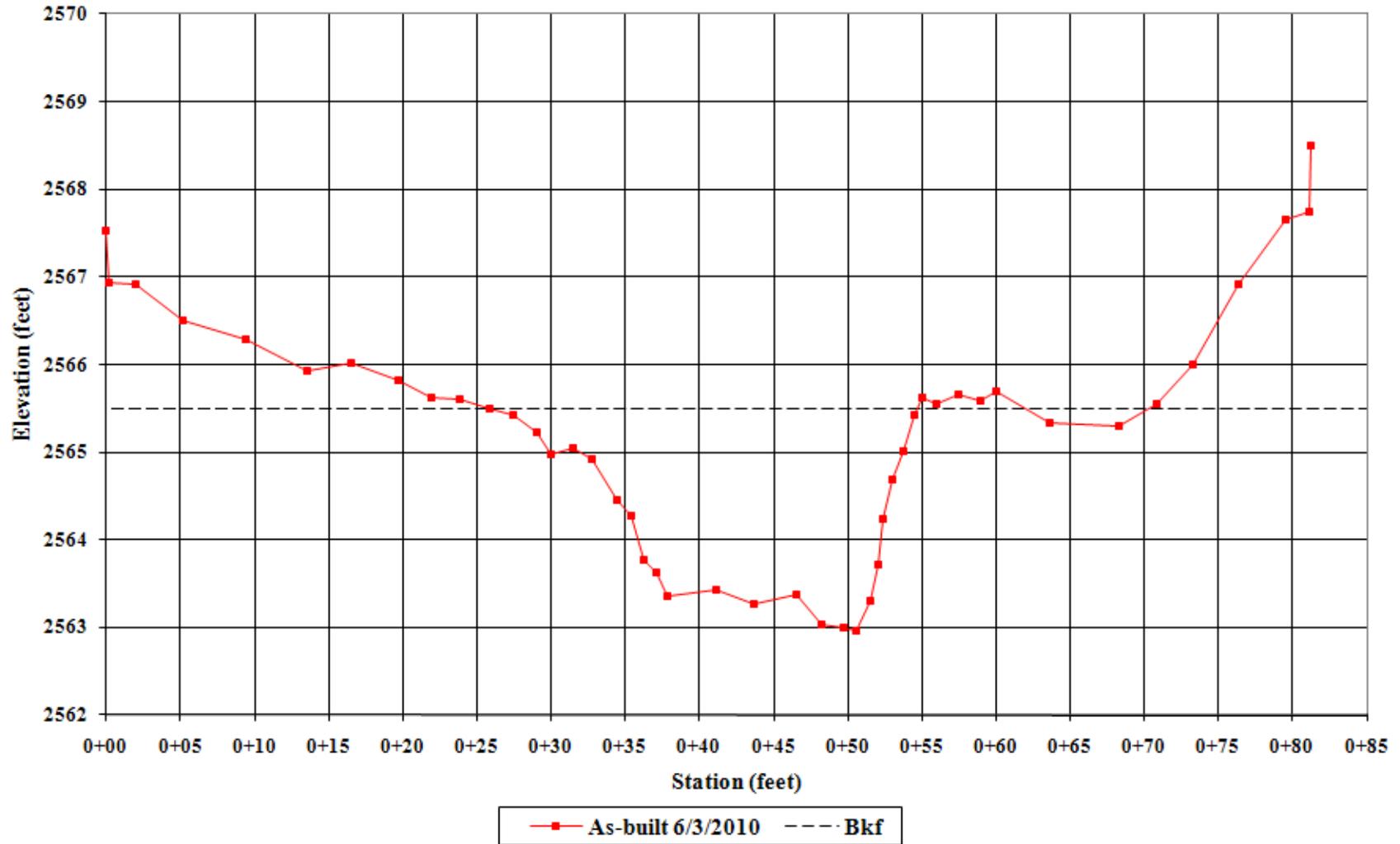


Unnamed Tributary Crab Creek Upstream – Cross-Section #7 – Pool
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #7 – Pool
(Looking Upstream)
Baseline – April 19, 2010

**UT Crab Creek - Upstream
Cross-Section #8 - Riffle
Station 17 + 49.02**





Unnamed Tributary Crab Creek Upstream – Cross-Section #8 – Riffle
(Looking at Left Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #8 – Riffle
(Looking at Right Bank Descending)
Baseline – April 19, 2010

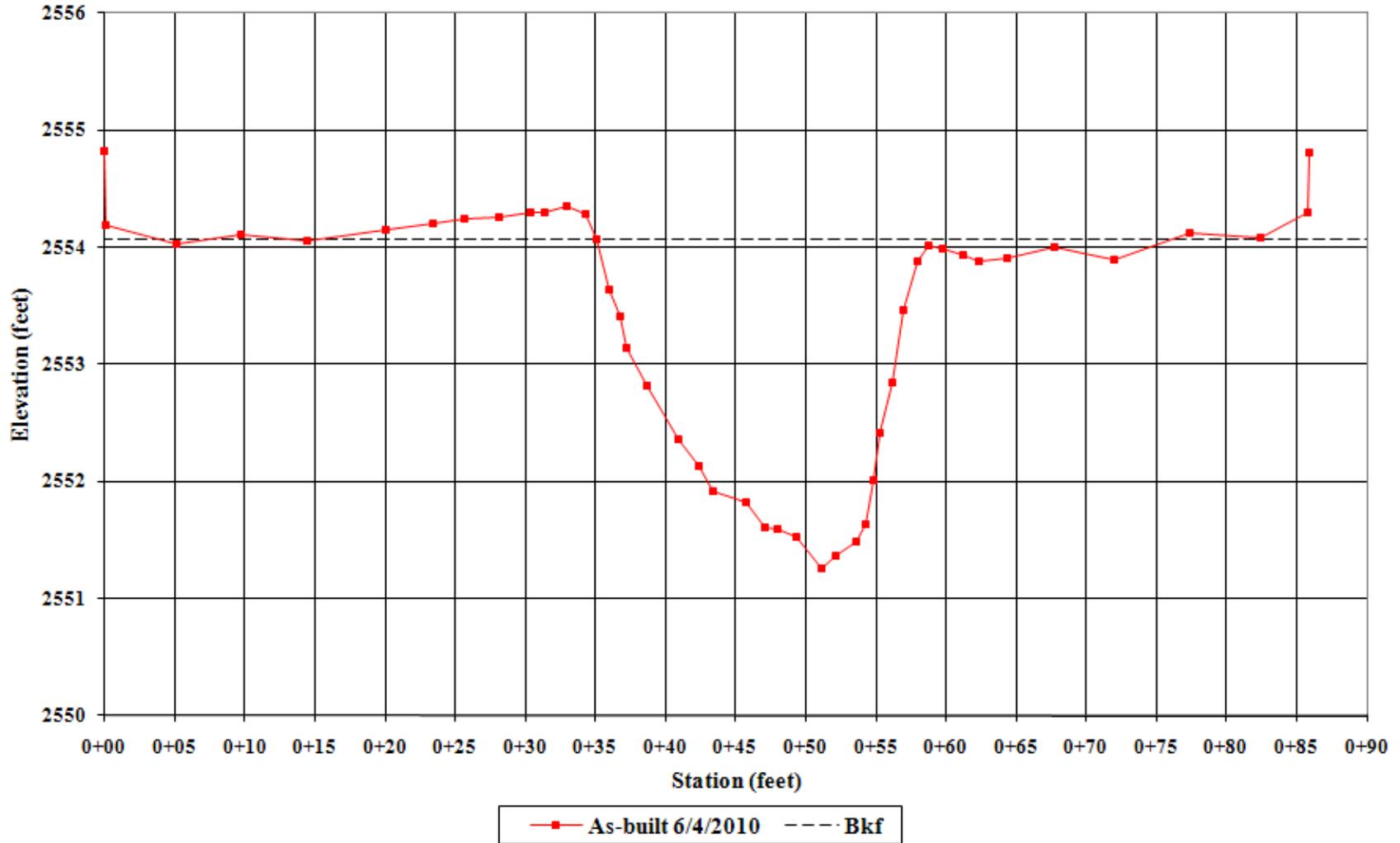


Unnamed Tributary Crab Creek Upstream – Cross-Section #8 – Riffle
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #8 – Riffle
(Looking Upstream)
Baseline – April 19, 2010

**UT Crab Creek - Upstream
Cross-Section #9 - Pool
Station 32 + 30.85**





Unnamed Tributary Crab Creek Upstream – Cross-Section #9 – Pool
(Looking at Left Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #9 – Pool
(Looking at Right Bank Descending)
Baseline – April 19, 2010

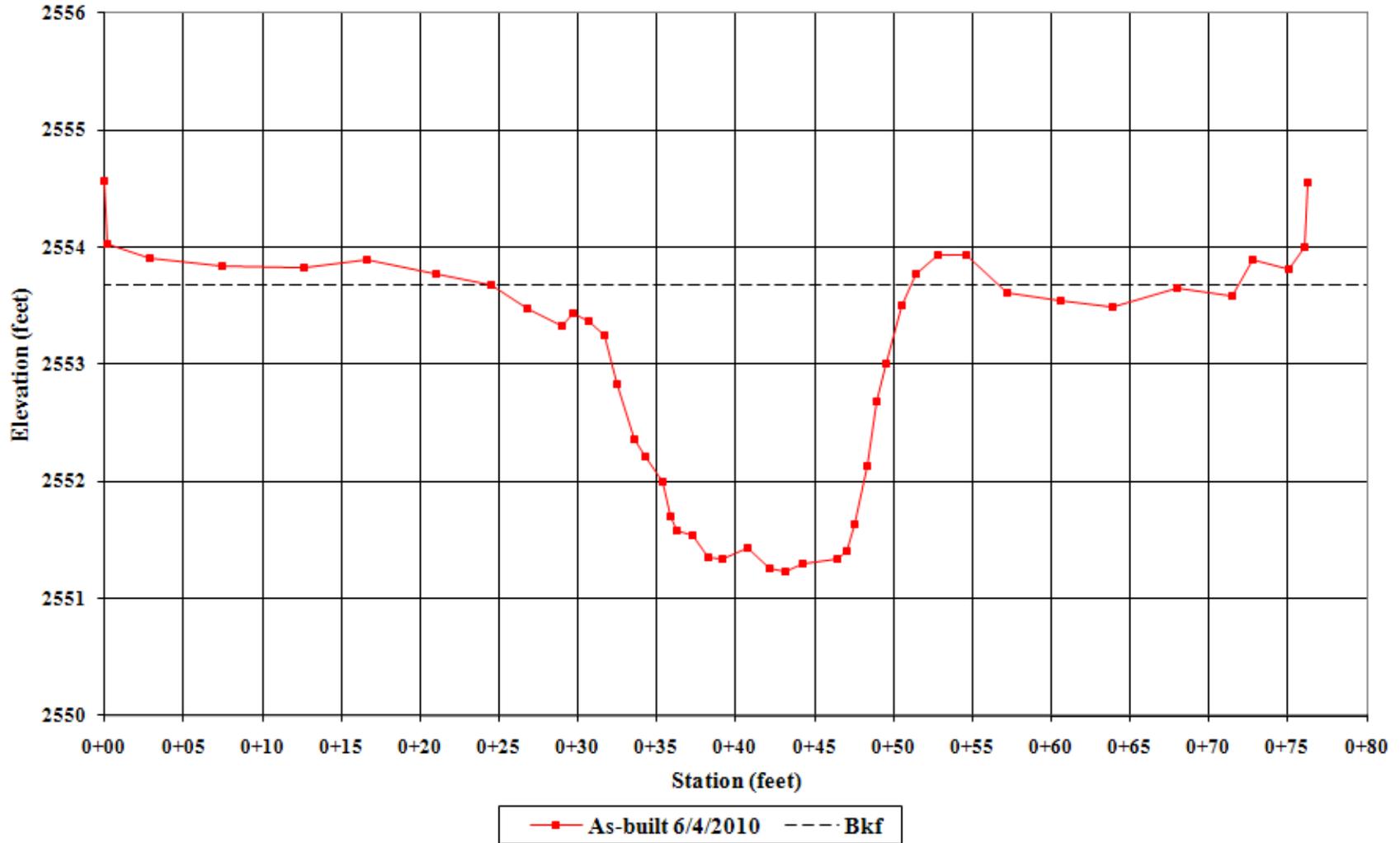


Unnamed Tributary Crab Creek Upstream – Cross-Section #9 – Pool
(Looking Downstream)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #9 – Pool
(Looking Upstream)
Baseline – April 19, 2010

**UT Crab Creek - Upstream
Cross-Section #10 - Riffle
Station 33 + 08.78**





Unnamed Tributary Crab Creek Upstream – Cross-Section #10 – Riffle
(Looking at Left Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #10 – Riffle
(Looking at Right Bank Descending)
Baseline – April 19, 2010



Unnamed Tributary Crab Creek Upstream – Cross-Section #10 – Riffle
(Looking Downstream)
Baseline – April 19, 2010

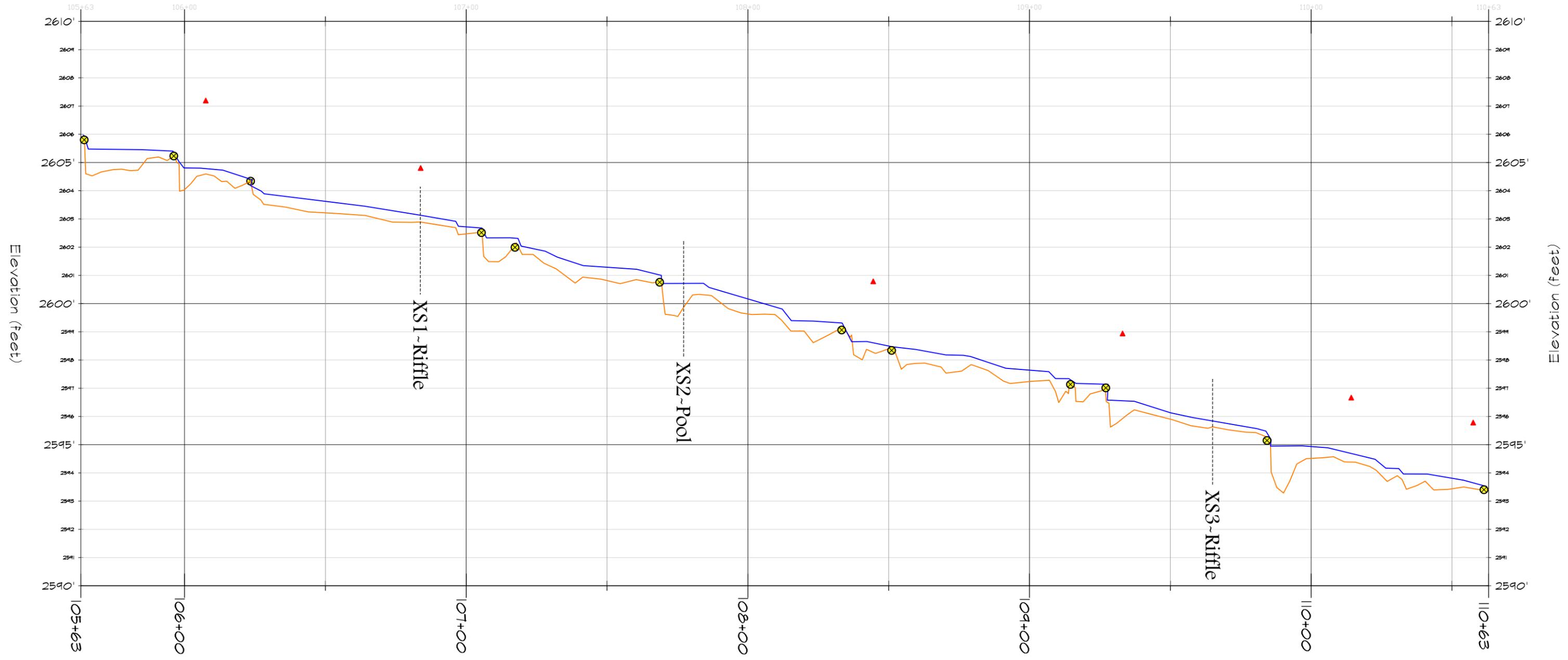


Unnamed Tributary Crab Creek Upstream – Cross-Section #10 – Riffle
(Looking Upstream)
Baseline – April 19, 2010

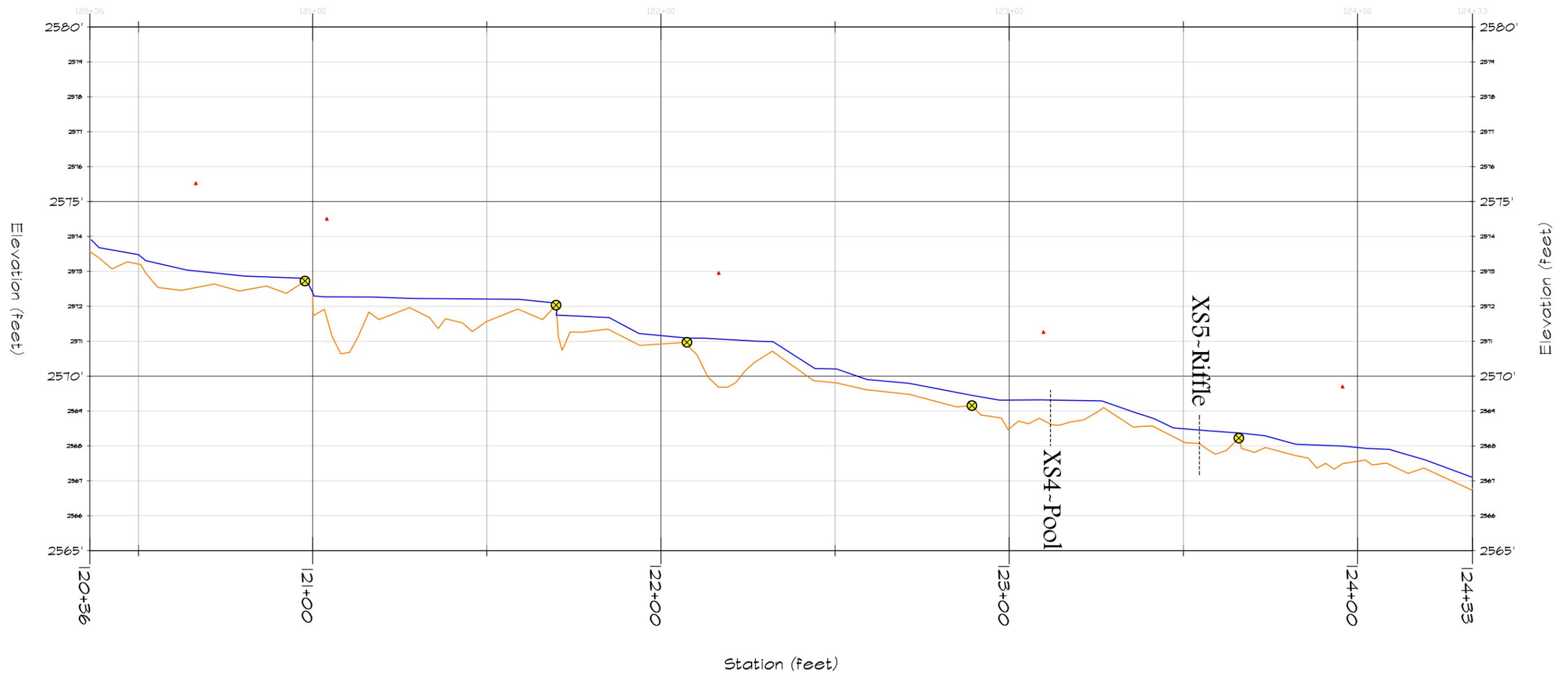
Appendix D

Longitudinal Profile Plots

UNNAMED TRIBUTARY 1/UPPER LONGITUDINAL PROFILE AS-BUILT STATIONING 105+63 ~ 110+63



UNNAMED TRIBUTARY 1/LOWER LONGITUDINAL PROFILE AS-BUILT STATIONING 120+36 ~ 124+33

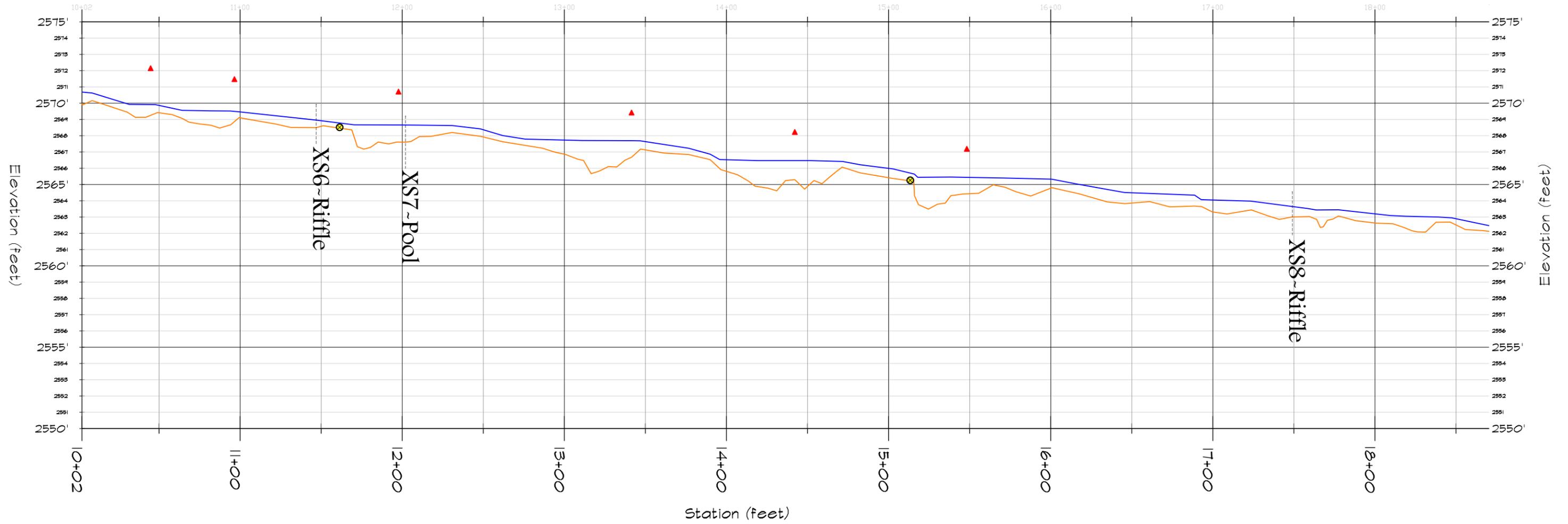


— TW AS-BUILT 6/4/2010 — WS-MYO ▲ BKF-MYO ⊗ Vane/Structure-MYO

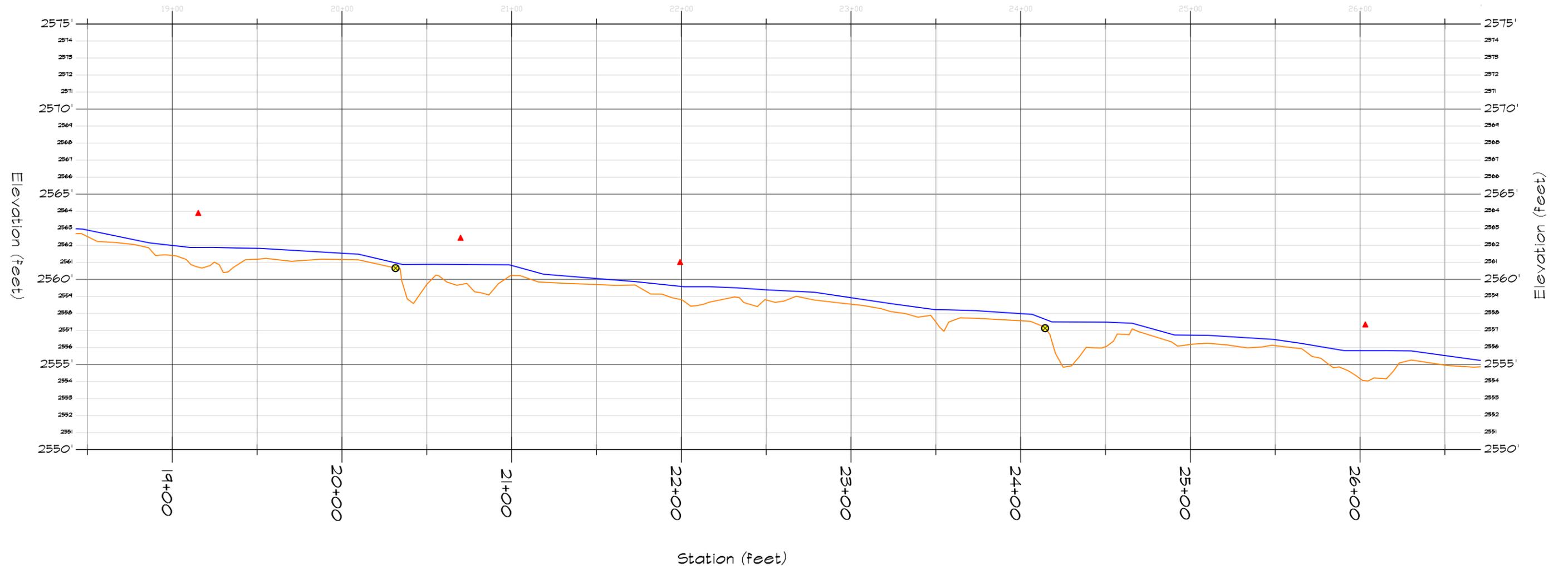
UNNAMED TRIBUTARY CRAB CREEK UPSTREAM

LONGITUDINAL PROFILE (SHEET 1 OF 3)

AS-BUILT STATIONING 10+02 ~ 34+57

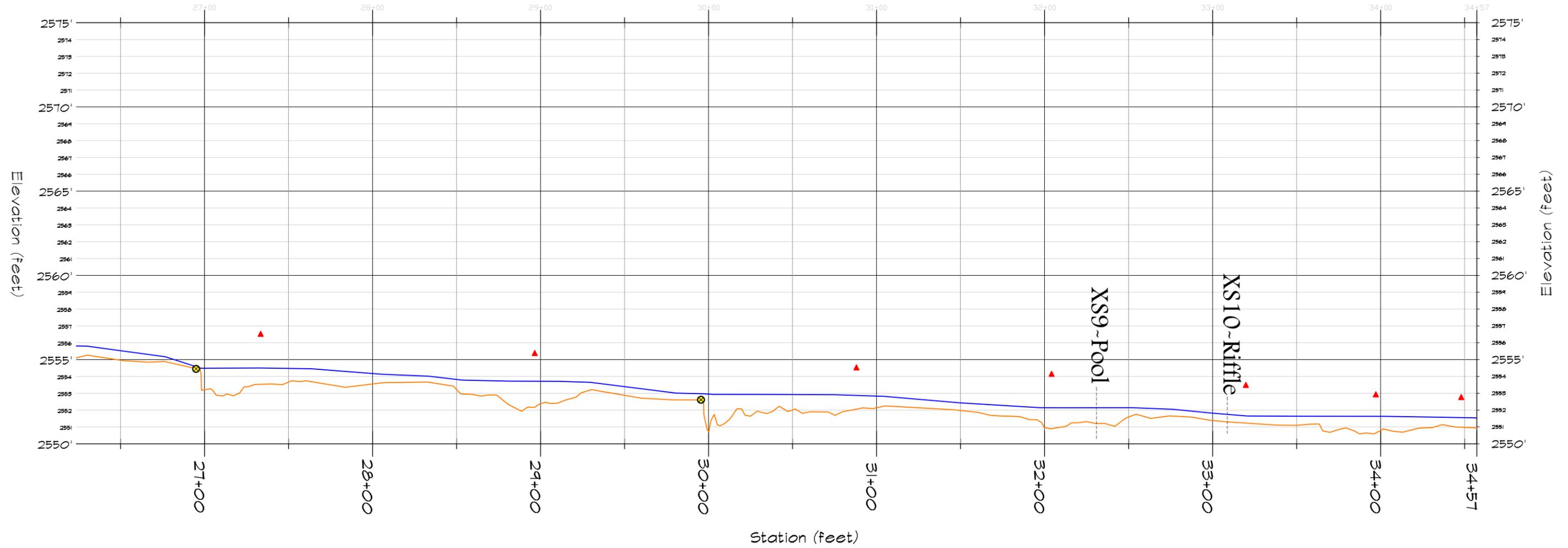


UNNAMED TRIBUTARY CRAB CREEK UPSTREAM LONGITUDINAL PROFILE (SHEET 2 OF 3)



— TW AS-BUILT 6/4/2010
 — WS-MYO
 ▲ BKF-MYO
 ⊗ Vane/Structure-MYO

UNNAMED TRIBUTARY CRAB CREEK UPSTREAM LONGITUDINAL PROFILE (SHEET 3 OF 3)



Appendix E

Vegetation Plot Photos



Vegetation Monitoring Plot #1
Baseline – April 13, 2010



Vegetation Monitoring Plot #2
Baseline – April 13, 2010



Vegetation Monitoring Plot #3
Baseline – April 13, 2010



Vegetation Monitoring Plot #4
Baseline – April 13, 2010



Vegetation Monitoring Plot #5
Baseline – April 13, 2010



Vegetation Monitoring Plot #6
Baseline – April 13, 2010



Vegetation Monitoring Plot #7
Baseline – April 13, 2010



Vegetation Monitoring Plot #8
Baseline – April 13, 2010



Vegetation Monitoring Plot #9
Baseline – April 13, 2010

Appendix F

Permanent Photo Station Photos



Unnamed Tributary 1 – Permanent Photo Station #1
Looking Upstream



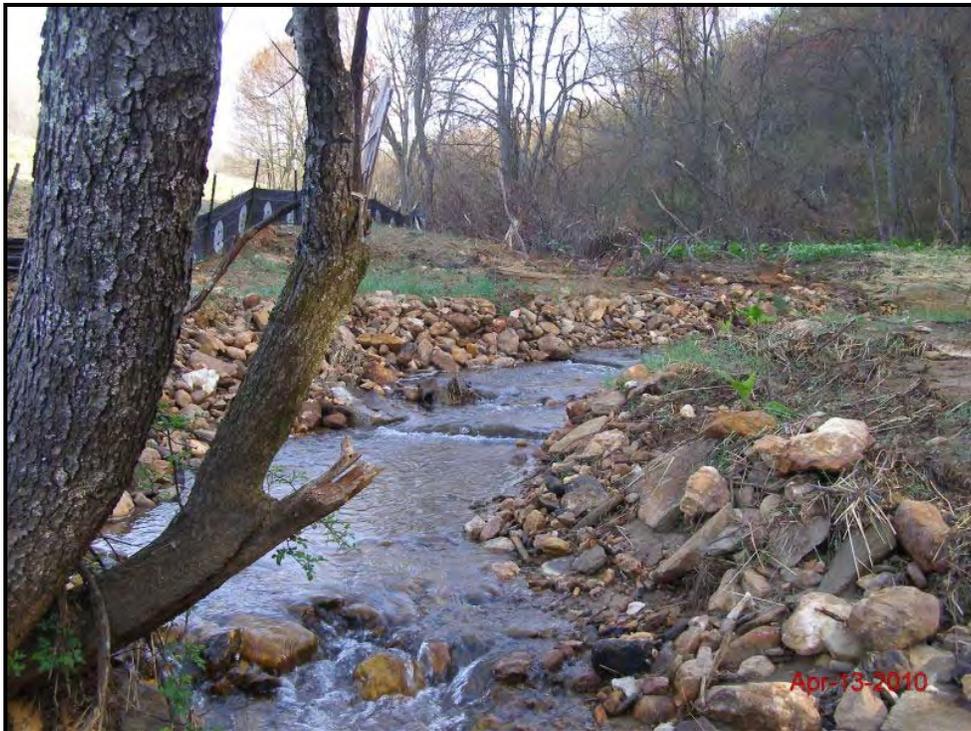
Unnamed Tributary 1
Pre-construction conditions in proximity to Photo Station #2



Unnamed Tributary 1 – Permanent Photo Station #2
Looking Upstream



Unnamed Tributary 1
Pre-construction conditions in proximity to Photo Station #3



Unnamed Tributary 1 – Permanent Photo Station #3
Looking Upstream



Unnamed Tributary 1
Pre-construction conditions in proximity to Photo Station #3



Unnamed Tributary 1 – Permanent Photo Station #3
Looking Downstream



Unnamed Tributary 1
Pre-construction conditions in proximity to Photo Station #4



Unnamed Tributary 1 – Permanent Photo Station #4
Looking Upstream



Unnamed Tributary 1 – Permanent Photo Station #5
Looking Upstream



Unnamed Tributary 1 – Permanent Photo Station #6
Looking Upstream



Unnamed Tributary 1
Pre-construction conditions in proximity to Photo Station #7



Unnamed Tributary 1 – Permanent Photo Station #7
Looking Upstream



Unnamed Tributary Crab Creek Upper – Permanent Photo Station #7
Looking Upstream



Unnamed Tributary Crab Creek Upper – Permanent Photo Station #7
Looking Downstream



Wetland Area 3 – Permanent Photo Station #8
Looking North



Wetland Area 3 – Permanent Photo Station #8
Looking Southwest



Wetland Area 3
Pre-construction conditions in proximity to Photo Station #9



Wetland Area 3 – Permanent Photo Station #9
Looking North



Wetland Area 3
Pre-construction conditions looking east towards Photo Station #9



Wetland Area 3 – Permanent Photo Station #9
Looking West



Unnamed Tributary Crab Creek Upper
Pre-construction conditions in proximity to Photo Station #10



Unnamed Tributary Crab Creek Upper – Permanent Photo Station #10
Looking Upstream



Unnamed Tributary Crab Creek Upper
Pre-construction conditions looking upstream from Photo Station #11



Unnamed Tributary Crab Creek Upper – Permanent Photo Station #11
Looking Upstream



Unnamed Tributary Crab Creek Upper
Pre-construction conditions looking downstream from Photo Station #11



Unnamed Tributary Crab Creek Upper – Permanent Photo Station #11
Looking Downstream



Unnamed Tributary Crab Creek Upper
Pre-construction conditions in proximity to Photo Station #12



Unnamed Tributary Crab Creek Upper – Permanent Photo Station #12
Looking Upstream



Unnamed Tributary Crab Creek Upper
Pre-construction conditions looking downstream towards Photo Station #13



Unnamed Tributary Crab Creek Upper – Permanent Photo Station #13
Looking Upstream



Wetland Area 7 – Permanent Photo Station #14
Looking West



Wetland Area 7 – Permanent Photo Station #15
Looking Southwest



Wetland Area 8
Pre-construction conditions in proximity to Photo Station #16



Wetland Area 8 – Permanent Photo Station #16
Looking South