

YEAR 3 MONITORING REPORT

UT ROCKY RIVER – HARRIS ROAD MIDDLE

Cabarrus County, North Carolina

EEP IMS No. 92383, Contract No. 004346



Submitted to:



NCDENR-Ecosystem Enhancement Program

217 West Jones Street, Suite 3000A

Raleigh, North Carolina 27603

Construction Completed: August 2010

Morphology Data Collected: March 21, 2013

Vegetation Data Collected: September 24, 2013

Submitted: January 2015

Prepared by:



ICA Engineering, Inc.
5121 Kingdom Way, Suite 100
Raleigh, North Carolina 27607
919.851.6066
919.851.6846 (fax)

I HEREBY CERTIFY THAT THE DOCUMENTS CONTAINED HEREIN, UT ROCKY RIVER-HARRIS ROAD MIDDLE YEAR 3 MONITORING REPORT WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED SEALED, AND DATED THIS 8TH DAY OF JANUARY 2015.

A handwritten signature in blue ink, appearing to read "Chris L. Smith", is written over a horizontal line.

Chris L. Smith, PE



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1.0 EXECUTIVE SUMMARY

The following report summarizes the vegetation establishment and stream stability for Year 3 monitoring for the UT Rocky River–Harris Road Middle Site (hereafter referred to as the “Site”) in Cabarrus County, North Carolina.

1.1 Goals and Objectives

The primary goals of the UT Rocky River stream restoration project focus on:

- Improving water quality
- Enhancing aquatic and terrestrial habitat within the Site watershed
- Establishing wildlife corridors within the Site boundaries
- Enhancing riparian wetlands adjacent to UT Rocky River
- Providing educational opportunities for students at grade schools adjacent to the Site

These goals will be achieved through the following objectives:

- Stabilizing UT Rocky River by restoring a more natural pattern, profile, and dimension that transports its sediment and flow without aggrading (as seen in areas affected by beavers and erosion control devices), or degrading (as seen in gully reaches on-site).
- Establishing a natural vegetative buffer adjacent to the UT Rocky River that filters runoff from adjacent development.
- Enhancing semi-aquatic habitat by enhancing existing wetlands with native tree and shrub plantings.
- Enhancing stream bed variability, providing shading/cover areas within the stream channel, and introducing woody debris in the form of rootwads, log vanes, and log sills.
- Removing existing invasive vegetative species and planting the buffer (floodplain) with native trees, shrubs, herbs and grasses.
- Create a wildlife corridor through the Site that connects habitat areas along the Rocky River with habitat areas at the upstream end of the Site. The corridors provide connectivity to a diversity of habitats including mature forest, early successional forest, stream-side forest, riparian wetlands, and uplands.
- Providing an educational benefit to children who can utilize the planned pedestrian footpath crossing the floodplain, and can view the stream channel from adjacent terraces where schools are located.

1.2 Background Summary

The North Carolina Ecosystem Enhancement Program (EEP) has completed restoration of 2,715 linear feet of stream and enhanced 8.7 acres of riparian wetland at the Site to assist in fulfilling stream and wetland mitigation goals in the area. The Site is located in northwest Cabarrus County approximately 6 miles southwest of the town of Kannapolis (Figure 1). The Site has a latitude and longitude of 035° 25' 34.52" N and 080° 44' 25.53" W. The Site is situated in the

northeast quadrant of the intersection of Harris Road and the Rocky River, between Harris Middle School and Odell Elementary School, approximately 1.5 miles south of Highway 73. The Site is located within United States Geological Survey (USGS) Hydrologic Unit (HU) and Targeted Local Watershed 03040105010010 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-07-11) of the Yadkin-Pee Dee River Basin, and will service the USGS 8-digit Cataloging Unit (CU) 03040105. The Site is currently owned by Cabarrus County and the State of North Carolina holds the conservation easement on the property.

1.3 Vegetation

Bare root plantings are surviving well across the site. Vegetation plots are averaging 373 stems per acre, exceeding Year 3 monitoring success criteria of 320 stems per acre or greater. Individually, 9 of the 14 plots are exceeding the Year 3 target. Five plots (plot 2, 4, 7, 8 and 10) are not meeting success criteria. When including natural recruits plots 2, 7, 8, and 10 exceed Year 3 target criteria. Plot 7 was affected by a beaver dam that was located immediately adjacent to the plot during Year 1 monitoring; however, the dam has been removed and the plot seems to be recovering.

Blackberry (*Rubus argutus*) is very dense throughout the site and in specific areas is beginning to choke out planted species. Plot 12 is overrun with blackberry growing up to 8 feet tall. Additionally, Plot 10 has dense blackberry that is contributing to the planted species not meeting success criteria. The plot has an average stem density of 283 stems per acre and several planted stems have gone missing since the first year of monitoring. While blackberry is affecting the growth of planted species, natural recruits are surviving well in these plots as both plots have greater than ten natural stems.

In previous monitoring years Plots 8 and 10 were noted as being drier than other plots, potentially leading to their lack of success. The plots remain drier than the rest of the site, and continue to fall short of success criteria when counting planted stems alone. However, as expected, both plots exceed 360 stems per acre when including natural recruits. Additional planting is not recommended due to continued development of natural recruit tree species. Previous encroachment occurring within Plot 10 appears to have ceased.

The cluster of serica lespedeza (*Lespedeza cuneata*) observed in Monitoring Year 2 is still present and has expanded in coverage. The cluster is in the vicinity of Plot 9, which is located near Moss Farm Street. A sewer line easement makes the area susceptible to invasive plant species encroachment. While the invasive plant species remain, Plot 9 has improved over the previous monitoring year. The plot is now exceeding success criteria with an average stem density of 364 stems per acre without natural recruits. Invasive plant species should be watched closely in the coming years; however, no action is necessary at this time as affected plots have improved.

In winter 2014 EEP installed live stakes to a portion of the stream affected by the beaver dam removed in 2012. EEP planted silky dogwood (*Cornus amomum*) and black willow (*Salix nigra*) using on-site material. The live stakes appear to be growing and functioning as intended.

1.4 Stream Stability

UT Rocky River appears to be stable and functioning as designed. The area affected by the beaver dam removed in 2012 is recovering and does not show significant changes from Year 2 Monitoring. However, it appears that the beaver were attempting to rebuild the dam at this location during vegetation surveys in September 2014. Another beaver dam was observed at station 26+46 and is reflected in the longitudinal profile (Figure 5.3). The beaver dam was removed in summer 2014.

Deposition observed in Year 2 has washed out and the profile is aligning closely with baseline. The beaver dam located at station 26+40 caused deposition to occur between station 23+03 – 23+61 and 24+21 – 25+28. With the beaver dam now removed, this deposition is expected to wash out in the coming year.

Cross section data represents the channel has experienced changes in dimension. Cross Section 3 shows the channel filling in at the thalweg, which aligns with the deposition shown in the profile, as a result of the beaver dam. Cross Section 5 shows minor scouring at the left toe and Cross Section 6 shows minor scouring at the right toe. A beaver dam was removed about 50 feet up stream of Cross Section 6 in 2012. Removing the dam lowered water surface slope to desired levels, placing less stress on Cross Section 6 and slowing scouring seen in Year 2 Monitoring. The cross section is currently functioning as a pool and will continue to do so moving forward. Fluctuation in Cross Section geometry is expected in a sand bed system, however, if scouring and deposition continues repairs may be necessary.

The stream continues to fluctuate in its riffle to pool ratio. The percentage of riffle is now 45 percent (compared to 28, 38, and 43 percent for Year 2, 1, and baseline respectively) and the percentage of pools is now 55 percent (compared to 72, 62, and 57 percent for Year 2, 1, and baseline respectively). The riffle/pool ratio is a sign that the stream is stabilizing from the backwater effect caused by the beaver dam removed in 2012.

Table 5, Visual Stream Morphology Stability Assessment, details 99 percent of the stream bed as stable, performing as intended for Year 3 Monitoring. The minor headcut observed in Year 2 Monitoring is still present (Figure 5.1). Additionally, six segments of stream bank are scoured/eroding. These segments account for two percent of total stream bank. All of the segments experiencing minor/moderate erosion have woody vegetation along the areas of concern which should prevent erosion from accelerating. Two segments are experiencing mass wasting totaling 34 feet or 0.6 percent of stream bank. Neither segment has woody vegetation growing along the mass wasting bank, and because of this erosion will likely remain active without vegetative stabilization in the winter months.

The log cross vane below STA 35+00 failed before Year 2 Monitoring. The structure was not able to be surveyed during Year 3 surveys due to back water from Rocky River. If damages are not contained in the upcoming monitoring year repairs may be necessary.

Areas of concern can be seen in the Current Conditions Plan View (CCPV) located in Appendix B. Photos of each problem area are also included in Appendix B.

The site has experienced several bankfull flows throughout the first three monitoring years. Crest gauges installed on-site were inspected on April 16, 2014 and September 23, 2014. The crest gauges revealed that a bankfull event occurred at least twice during Year 3 monitoring (Table 13). Additional overbank evidence includes debris lines and vegetation bent in the downstream direction. Evidence of bankfull events can be found in Appendix E.

1.5 Wetlands

Existing wetlands at the Site were enhanced by removing exotic vegetation and plating native species. All vegetation plots located within wetland areas are exceeding success criteria. Plot 7 and 9 did not meet success criteria in Year 2; however, it appears the plots are improving in Year 3 as Plot 7 exceeds success criteria when including natural recruits and Plot 9 exceeds criteria with only planted stems. Section 1.3 provides more details concerning vegetation at the site.

1.6 Note

A wooden pedestrian bridge has been constructed at the sewer crossing.

Summary information/data related to the occurrence of items and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 METHODOLOGY

Year 1, 2 and 3 monitoring surveys were completed using a Total Station. Each cross section was marked with two rebar monuments at their beginning and ending points. The rebar has been located vertically and horizontally in NAD 83-State Plane. Surveying these monuments throughout the Site ensured proper orientation. The survey data was imported into MicroStation for verification. The longitudinal stationing was developed from total station data and compared with previous years' data to ensure consistent beginning and ending points. RIVERMorph and the Ohio Department of Natural Resources' "The Reference Reach Spreadsheet Version 4.3L" were used to analyze the profile and cross section data (Mecklenburg 2006). Tables and figures were created using Microsoft Excel.

The channel is entirely a sand bed system; therefore, a pebble count was not conducted.

Vegetation monitoring was completed using CVS level II methods, for 14, 100 square meter vegetation plots (Lee et al. 2006). The taxonomic standard for vegetation used for this document was Flora of the Southern and Mid-Atlantic States (Weakley 2011).

3.0 REFERENCES

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (<http://cvs.bio.unc.edu/methods.htm>).

Mecklenburg, Dan. 2006. The Reference Reach Spreadsheet Version 4.3L. 2006. Ohio Department of Natural Resources. Division of Soil and Water. (<http://www.dnr.state.oh.us/tabid/9188/default.aspx>)

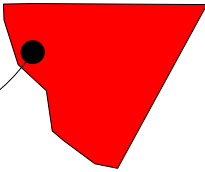
Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States (online). Available: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf [May 15, 2011]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

APPENDICES

Appendix A. Project Vicinity Map and Background Tables

**Cabarrus County
North Carolina**

**PROJECT
AREA**



Vicinity Map

**UT Rocky River –Harris Road Middle
Baseline Monitoring Document
Cabarrus County, North Carolina**



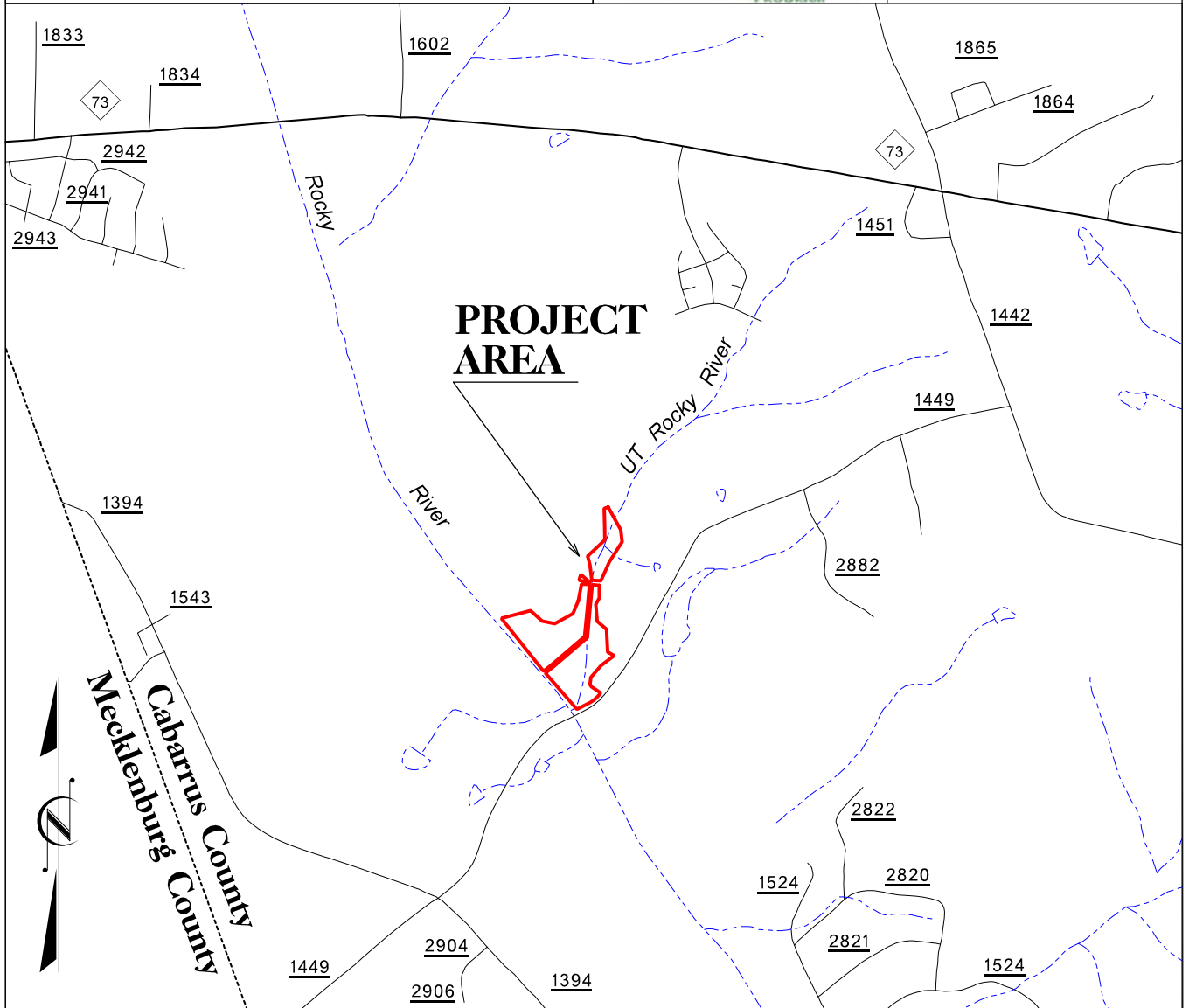
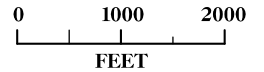
5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: F-0258

f/k/a Florence & Hutcheson, Inc.



Date: 10/03/13

Figure: 1



**PROJECT
AREA**



**Mecklenburg County
Cabarrus County**

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

Table 1. Project Components and Mitigation Credits

UT Rocky River – Harris Road Middle (EEP IMS No. 92383)

Mitigation Credits		
	Stream*	Riparian Wetland**
Type	R	R
Total	2,615	4.1

Project Components						
Restoration Segment/ Reach ID	Station Range	Existing LF/AC	Approach	Restoration or Restoration Equivalent	Restored LF/AC	Mitigation Ratio
UT to Rocky River	10+00 – 34+50	2,020	PI	R	2,450	1:1
UT to Rocky River	34+50 – 37+15	330	PII	R	265	1:1
Wetland	-	8.7	Invasive Removal & Planting	R	8.2	2:1

Component Summation		
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)
		Riverine
Restoration	2,715	
Enhancement		8.2

*Stream credits are less than the linear feet restored because 100 feet of the restored stream flows through sewer line easements and was not included as part of the stream credit calculations.

**Wetlands located within the sewer line easements were not planted during the construction phase of this project and are not included as part of the enhanced wetland acreage or Wetland Mitigation Credits

Table 2. Project Activity and Reporting History

UT Rocky River – Harris Road Middle (EEP IMS No. 92383)

Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	April 2008	September 2008
Final Design – Construction Plans	September 2008	October 2008
Construction	June 11, 2010	March 23, 2011
Temporary S&E Mix Applied to Entire Project Area	August 30, 2010	March 23, 2011
Permanent Seed Mix Applied to Entire Project Area	August 30, 2010	March 23, 2011
Bare Root, Containerized, and B&B plantings for Entire Project Area	February 14, 2011	February 15, 2011
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	April 11, 2012	June 27, 2012
Year 1 Monitoring	October 4, 2012	January 3, 2013
Beaver removal	January/February 2013	January/February 2013
Year 2 Monitoring	September 24, 2013	November 6, 2013
Live Stake Supplemental Planting		January/February 2014
Year 3 Monitoring	September 23, 2014	January 2015
Supplemental planting of containerized material		
Year 4 Monitoring		

Table 3. Project Contacts Table

UT Rocky River – Harris Road Middle (EEP IMS No. 92383)

Designer Primary project design POC	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Kevin Williams (919) 851-6066
Construction Contractor Construction Contractor POC	Vaughn Contracting, Inc. Tommy Vaughn P.O. Box 796 Wadesboro, NC 28170 (704) 694-6450
Planting Contractor Planting Contractor POC	Bruton Natural Systems Charlie Bruton PO Box 1197 Fremont, NC 27830 (919) 242-6555
Seeding Contractor Seeding Contractor POC	Vaughn Contracting, Inc. Tommy Vaughn P.O. Box 796 Wadesboro, NC 28170 (704) 694-6450
Seed Mix Sources	Green Resources – Triad Office
Nursery Stock Suppliers	1) ArborGen - South Carolina SuperTree Nursery 2) Dykes & Son Nursery 3) NC Division of Forest Resources 4) Carolina Wetland Services
Monitoring Performers	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Stream Monitoring POC	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Vegetation Monitoring POC	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066

Table 4. Project Information

UT Rocky River – Harris Road Middle (EEP IMS No. 92383)

Project Information	
Project Name	UT Rocky River – Harris Road Middle
Project County	Cabarrus
Project Area (acres)	20
Project Coordinates	35° 25' 34.52" N, 80° 44' 25.53" W
Project Watershed Summary Information	
Physiographic Region	Southern Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Yadkin-Pee Dee
USGS 8-digit HUC	03040105
USGS 14-digit HUC	03040105010010
NCDWQ Subbasin	03-07-11
Project Drainage Area	0.77 sq. mi (at end of restoration reach)
Watershed Land Use	Forested = 15% Residential/Commerical = 85%
Reach Summary Information	
Parameters	UT Rocky River
Restored length	2,715
Drainage Area	0.77 sq. mi.
NCDWQ Index Number	14-(7)
NCDWQ Classification	C
Valley Type/Morphological Description	VIII/C5
Dominant Soil Series	Chewacla
Drainage Class	Somewhat poorly drained
Soil Hydric Status	Hydric
Slope	0.0060
FEMA Classification	AE & X
Native Vegetation Community	Piedmont Alluvial Forest
Percent Composition of Exotic Invasives	0.1%
Wetland Summary Information	
Parameters	Wetland 1
Size of Wetland (acres)	8.2
Wetland Type	Riparian Riverine
Mapped Soil Series	Chewacla
Drainage Class	Somewhat poorly drained
Soil Hydric Status	Hydric
Source of Hydrology	Groundwater and Floodwater
Hydrologic Impairment	No
Native Vegetation Community	Piedmont Alluvial Forest
Percent Composition of Exotic Invasive Veg.	0%

Table 4. Project Information (continued)

Regulatory Considerations			
Regulation	Applicable	Resolved	Supporting Documentation
Waters of the U.S. –Sections 404 and 401	Yes	Yes	Restoration Plan
Endangered Species Act	Yes	Yes	Restoration Plan
Historic Preservation Act	Yes	Yes	Restoration Plan
CZMA/CAMA	No	--	--
FEMA Floodplain Compliance	Yes	Yes	Restoration Plan
Essential Fisheries Habitat	No	--	--

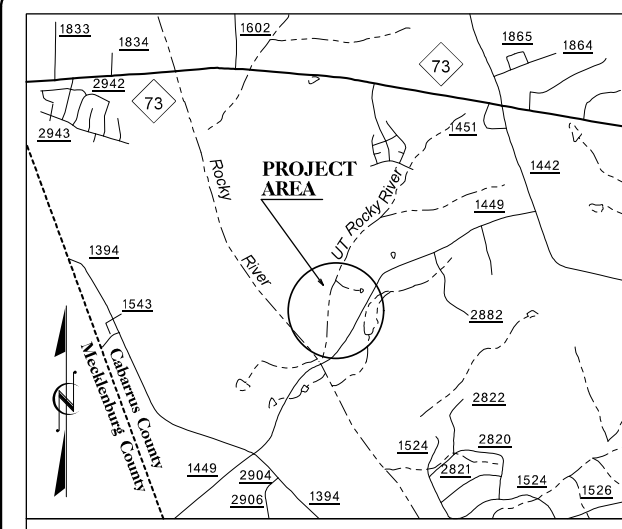
Appendix B. Visual Assessment Data

Figures 2.0 - 2.4. Current Condition Plan View

09/08/19

11/25/2014
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ICA Engineering

CONTRACT: UT ROCKY RIVER - HARRIS ROAD MIDDLE SCO# 070708001



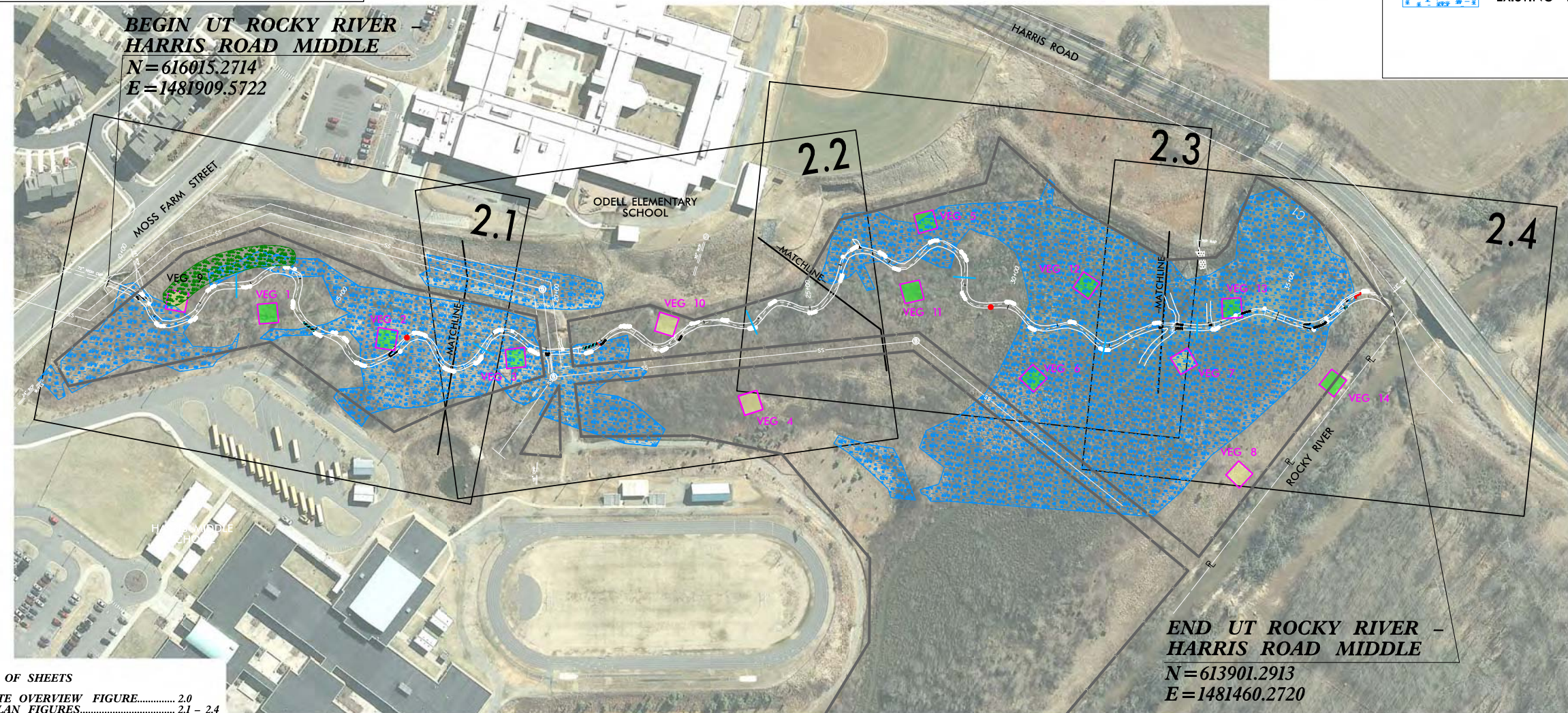
VICINITY MAP

CURRENT CONDITIONS PLAN VIEW (CCPV) UT ROCKY RIVER - HARRIS ROAD MIDDLE

LOCATION: CABARRUS COUNTY, NORTH CAROLINA
 LAT: 35°25'34.52" N LONG: 80°44'25.53" W
 TYPE OF WORK: CURRENT CONDITIONS PLAN VIEW

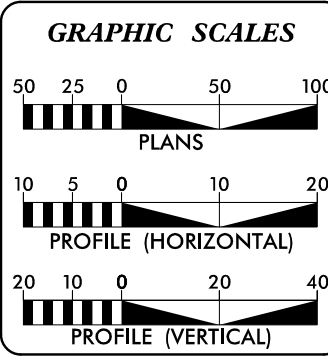


LEGEND			
	MONITORING CROSS SECTION		OLD BRIDGE MAT
	CREST GAUGE		ROCK L-VANE
	EXISTING PROPERTY LINE		ROCK CROSS VANE
	EASEMENT BOUNDARY		LOG VANE W/SILL
	BANKFULL		LOG CROSS VANE
	THALWEG		DOUBLE STEP LOG CROSS VANE
	TOE OF SLOPE		LOG SILL
	FPI - FLOODPLAIN INTERCEPTOR		TRANSPLANTS
	EXISTING WETLANDS		



YEAR 3 CONDITIONS	
BANKBED CONDITION	
	MAJOR EROSION
	MODERATE EROSION
	MINOR EROSION
	BEAVER DAM
IN-STREAM STRUCTURE CONDITION	
	FAILED
VEGETATION PROBLEM AREAS	
	INVASIVE POPULATION
VEGETATION PLOT CONDITIONS	
	CRITERIA MET
	CRITERIA UNMET

INDEX OF SHEETS	
TITLE SITE OVERVIEW FIGURE.....	2.0
CCPV PLAN FIGURES.....	2.1 - 2.4



DESIGN DATA	
DESIGN STREAM TYPE	= C5/E5
BANKFULL AREA (FT ²)	= 9.0
CROSS-SECTIONED	
BANKFULL WIDTH (FT)	= 9.5
MAX DEPTH (FT)	= 1.4
WIDTH /DEPTH RATIO	= 10
DRAINAGE AREA (MI ²)	= 0.8
BANKFULL SLOPE (FT/FT)	= 0.002

PROJECT LENGTH	
EXISTING STREAM LENGTH	= 2,350 FT
PROPOSED DESIGN STREAM LENGTH	= 2,715 FT
WETLAND ENHANCEMENT AREA	= 8.20 AC.
OWNER CONTACT:	
PAUL WIESNER EEP PROJECT MANAGER	
LIN XU REVIEW COORDINATOR	

Prepared In the Office of:

5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: F-0258

R. KEVIN WILLIAMS
PROJECT ENGINEER

RYAN V. SMITH
PROJECT DESIGNER

CURRENT CONDITIONS PLAN VIEW (CCPV)

LEGEND

MONITORING CROSS SECTION	TOE OF SLOPE	LOG CROSS VANE
CREST GAUGE	EXISTING WETLANDS	DOUBLE STEP LOG CROSS VANE
EXISTING PROPERTY LINE	ROCK L-VANE	TRANSPLANTS
EASEMENT BOUNDARY	ROCK CROSS VANE	LOG SILL
BANKFULL	LOG VANE W/SILL	FPI - FLOODPLAIN INTERCEPTOR
THALWEG		

UT ROCKY RIVER - HARRIS ROAD MIDDLE
 N = 616015.2714
 E = 1481909.5722

CP-3
 N = 616053.1140
 E = 1481902.6200
 ELEV = 633.910

SMALL HEADCUT
 STA 14+20

CREST GAUGE 1

MOSS FARM STREET
 72" HIGH CMP

HARRIS MIDDLE SCHOOL

-MATCHLINE- SEE FIGURE 2.2

YEAR 3 CONDITIONS

BANKBED CONDITION	VEGETATION PLOT CONDITIONS
MINOR EROSION	CRITERIA UNMET
VEGETATION PROBLEM AREAS	
INVASIVE POPULATION	

CP-4
 N = 615583.8840
 E = 1481538.7100
 ELEV = 636.439

FOR SITE OVERVIEW SEE FIGURE 2.0
 FOR CCPV PLANS SEE FIGURES 2.1 THRU 2.4

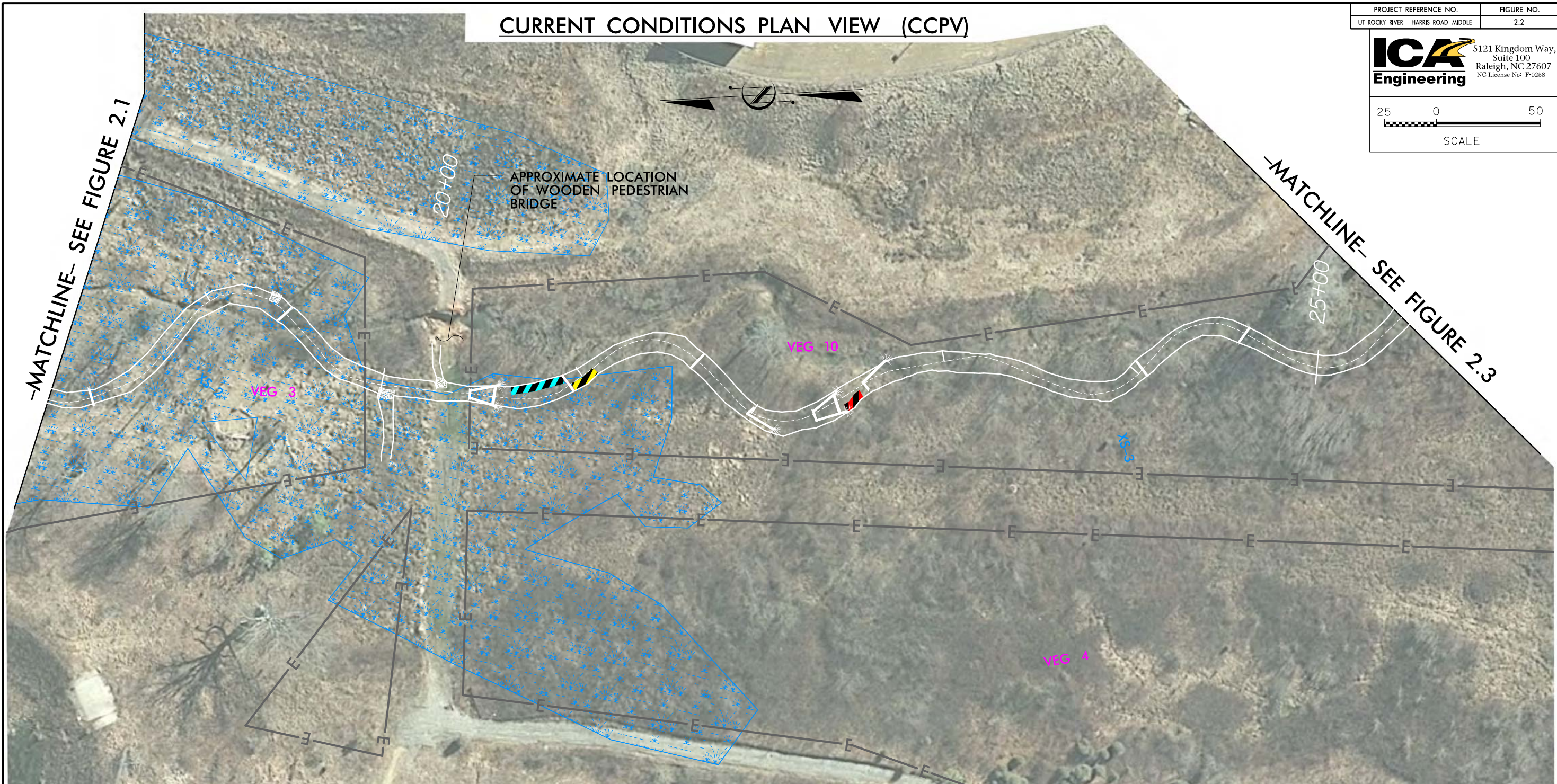
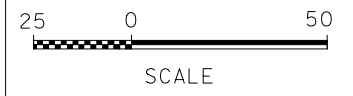
CCPV UT ROCKY RIVER - HARRIS ROAD MIDDLE	
SCOP: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 1/14

11/25/2014
 P:\Stream\Proj\CCPV_Plans\CCPV_YR3\RockyRiver-CCPV_YR3_psh_2.1.dgn
 ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)

PROJECT REFERENCE NO. UT ROCKY RIVER - HARRIS ROAD MIDDLE
 FIGURE NO. 2.2

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LEGEND		YEAR 3 CONDITIONS	
	MONITORING CROSS SECTION		MAJOR EROSION
	CREST GAUGE		MODERATE EROSION
	EXISTING PROPERTY LINE		MINOR EROSION
	EASEMENT BOUNDARY		FAILED
	BANKFULL		CRITERIA MET
	THALWEG		CRITERIA UNMET
	TOE OF SLOPE		
	FPI - FLOODPLAIN INTERCEPTOR	IN-STREAM STRUCTURE CONDITION	
	EXISTING WETLANDS		MAJOR EROSION
	OLD BRIDGE MAT		MODERATE EROSION
	ROCK L-VANE		MINOR EROSION
	ROCK CROSS VANE		FAILED
	LOG VANE W/SILL		CRITERIA MET
	LOG CROSS VANE		CRITERIA UNMET
	DOUBLE STEP LOG CROSS VANE		
	TRANSPLANTS		
	LOG SILL		

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 ICA Engineering

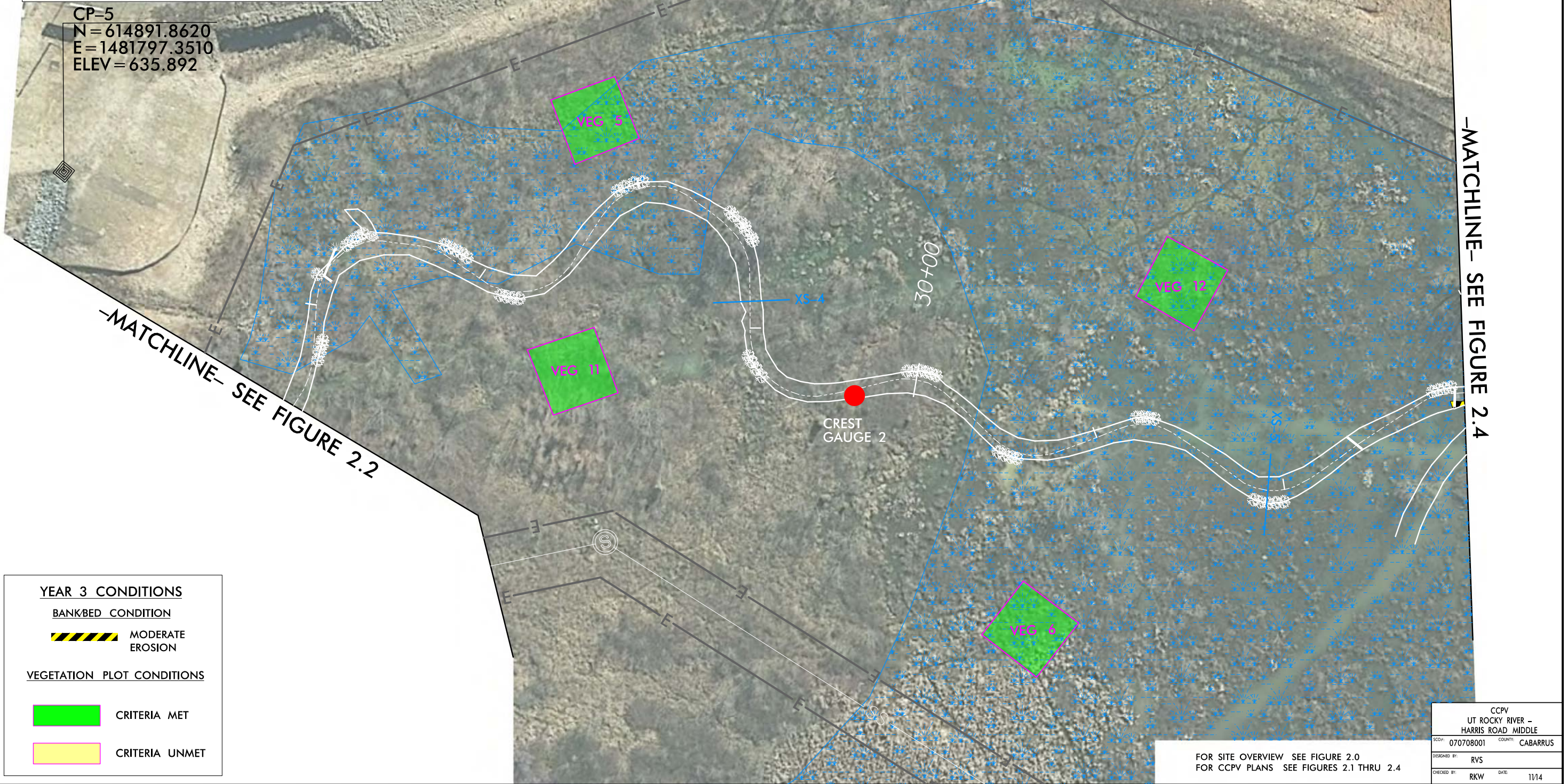
CCPV UT ROCKY RIVER - HARRIS ROAD MIDDLE	
SCDP: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 11/4

FOR SITE OVERVIEW SEE FIGURE 2.0
 FOR CCPV PLANS SEE FIGURES 2.1 THRU 2.4



CURRENT CONDITIONS PLAN VIEW (CCPV)

LEGEND			
	MONITORING CROSS SECTION		ROCK L-VANE
	CREST GAUGE		ROCK CROSS VANE
	EXISTING PROPERTY LINE		LOG VANE W/SILL
	EASEMENT BOUNDARY		LOG CROSS VANE
	BANKFULL		DOUBLE STEP LOG CROSS VANE
	THALWEG		TRANSPLANTS
	TOE OF SLOPE		LOG SILL
	FPI - FLOODPLAIN INTERCEPTOR		
	EXISTING WETLANDS		



YEAR 3 CONDITIONS	
BANK/BED CONDITION	
	MODERATE EROSION
VEGETATION PLOT CONDITIONS	
	CRITERIA MET
	CRITERIA UNMET

FOR SITE OVERVIEW SEE FIGURE 2.0
 FOR CCPV PLANS SEE FIGURES 2.1 THRU 2.4

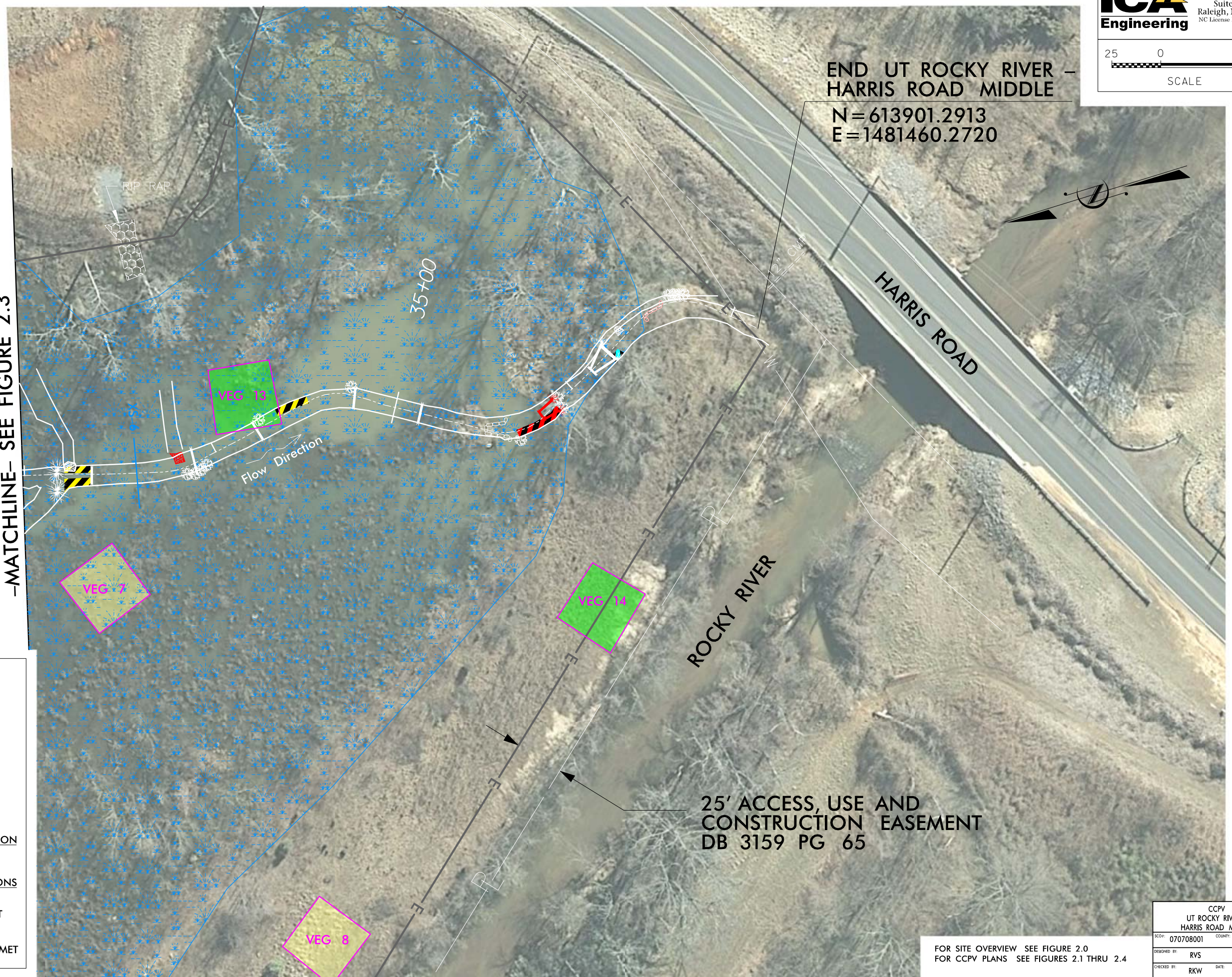
CCPV UT ROCKY RIVER - HARRIS ROAD MIDDLE	
SCOP: 070708001	COUNTY: CABARRUS
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 11/14

I:\25\2014\Stream\Pro\CCPV_Plans\CCPV_YR3\RockyRiver-CCPV_YR3_psh_2.3.dgn
 ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)

- LEGEND**
- MONITORING CROSS SECTION
 - CREST GAUGE
 - EXISTING PROPERTY LINE
 - EASEMENT BOUNDARY
 - BANKFULL
 - - - THALWEG
 - - - TOE OF SLOPE
 - EXISTING WETLANDS
 - FPI - FLOODPLAIN INTERCEPTOR
 - ROCK L-VANE
 - ROCK CROSS VANE
 - LOG VANE W/SILL
 - LOG CROSS VANE
 - DOUBLE STEP LOG CROSS VANE
 - TRANSPLANTS
 - LOG SILL

-MATCHLINE- SEE FIGURE 2.3



END UT ROCKY RIVER -
HARRIS ROAD MIDDLE
N = 613901.2913
E = 1481460.2720

- YEAR 3 CONDITIONS**
- BANK/BED CONDITION**
- MAJOR EROSION
 - MODERATE EROSION
 - MINOR EROSION
 - BEAVER DAM
- IN-STREAM STRUCTURE CONDITION**
- FAILED
- VEGETATION PLOT CONDITIONS**
- CRITERIA MET
 - CRITERIA UNMET

25' ACCESS, USE AND
CONSTRUCTION EASEMENT
DB 3159 PG 65

Table 5 Visual Stream Morphology Stability Assessment
UT Rocky River - Harris Road Middle Stream Restoration Project, 92383
UT Rocky River - 2,715 feet assessed

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			1	27	99%			
	2. Riffle Condition*	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	N/A	N/A			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient	36	36			100%			
		2. <u>Length</u> appropriate	36	36			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	32	32			100%			
2. Thalweg centering at downstream of meander (Glide)		32	32			100%				
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			6	112.37	98%	6	112.37	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapses			2	34.02	99.4%	0	N/A	99.4%
Totals					8	146.39	97%	N/A	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	27	27			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	27	27			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	26	27			96%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	26	27			96%			
	4. Habitat	Pool forming structures maintaing - Max Pool Depth : Mean Bankfull Depth ratio > 1.6 Rootwads/logs providing some cover at base-flow.	27	27			100%			

*Stream is a sand bed system, riffles are not expected to coarsen

Table 6. Vegetation Condition Assessment
UT Rocky River-Harris Road Middle, 92383
UT Rocky River: 2,715 feet

Planted Acreage = 15.0						
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited ground cover (grass).	All populations were mapped	Thin grass	0	0	0.00%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	Vegetation Plots	VEG 2,4,7,8,10	5.00	0.12	0.82%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	None	N/A	N/A	N/A	N/A
Easement Acreage = 67.85						
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	All populations were mapped	See legend on CCPV	1	0.20	1.33%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	Noted on map	See note on CCPV	0	0	0.00%

Figures 3.1 - 3.20. Vegetation Plot Photos and Problem Areas



3.1 Vegetation Plot 1



3.2 Vegetation Plot 2



3.3 Vegetation Plot 3



3.4 Vegetation Plot 4



3.5 Vegetation Plot 5



3.6 Vegetation Plot 6



3.8 Vegetation Plot 8

Photo Not Available for Plot 7



3.9 Vegetation Plot 9



3.10 Vegetation Plot 10



3.11 Vegetation Plot 11



3.12 Vegetation Plot 12



3.13 Vegetation Plot 13



3.14 Vegetation Plot 14



3.16 Lespedeza cluster near Plot 9



3.17 Major erosion near 22+50



3.18 Major erosion below 35+00



3.19 Moderate erosion above 35+00



3.20 Minor erosion at 15+00

Appendix C. Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary

UT Rocky River – Harris Road Middle (EEP IMS No. 92383)					
Plot ID	Community Type	CVS Level	Planted Stems	Stems Per Acre	Survival Threshold Met?
1	Piedmont Alluvial Forest (non-wetland area)	II	10	404	Yes
2	Piedmont Alluvial Forest (supplemental planting)	II	7	283	No
3	Piedmont Alluvial Forest (riverine wetland area)	II	10	404	Yes
4	Piedmont Alluvial Forest (non-wetland area)	II	6	242	No
5	Piedmont Alluvial Forest (riverine wetland area)	II	9	364	Yes
6	Piedmont Alluvial Forest (riverine wetland area)	II	12	485	Yes
7	Piedmont Alluvial Forest (riverine wetland area)	II	6	242	No
8	Piedmont Alluvial Forest (non-wetland area)	II	7	283	No
9	Piedmont Alluvial Forest (riverine wetland area & non-wetland area)	II	9	364	Yes
10	Piedmont Alluvial Forest (non-wetland area)	II	7	283	No
11	Piedmont Alluvial Forest (non-wetland area)	II	12	485	Yes
12	Piedmont Alluvial Forest (riverine wetland area)	II	9	364	Yes
13	Piedmont Alluvial Forest (riverine wetland area)	II	13	526	Yes
14	Piedmont Alluvial Forest (non-wetland area)	II	12	485	Yes
Average Stems Per Acre				373	

Table 8. CVS Vegetation Metadata

Report Prepared By	Ben Furr
Date Prepared	10/7/2013 15:27
database name	cvs-eep-entrytool-v2.2.7.mdb
database location	S:\ UT_Rocky_River\Docs\Monitoring\CVS Data
computer name	NC10465
file size	49401856
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	RR
project Name	UT Rocky River
Description	Stream and Wetland Restoration Project
River Basin	Yadkin-Pee Dee
length(ft)	2715
stream-to-edge width (ft)	50
area (sq m)	25220.62
Required Plots (calculated)	14
Sampled Plots	14

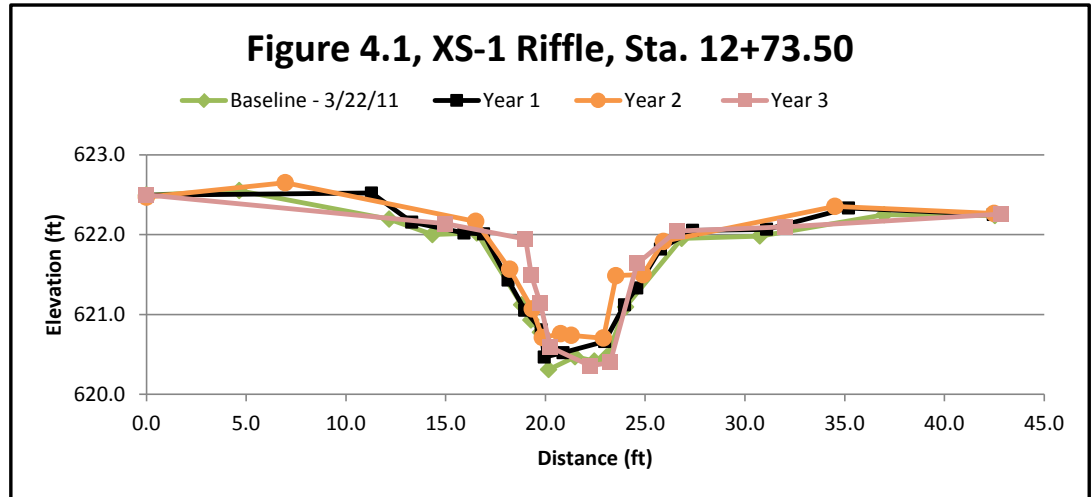
Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means)
 UT Rocky River – Harris Road Middle (EEP IMS No. 92383) (Year 2 Monitoring 2013)

Scientific Name	Common Name	Type	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12	
			P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
<i>Acer negundo</i>	Boxelder	Tree																								
<i>Acer rubrum</i>	Red maple	Tree		11		1		11												1		1				
<i>Alnus serrulata</i>	Tag alder	Shrub																			1	1				
<i>Asimina triloba</i>	Paw-paw	Shrub							1	1											2	1				
<i>Baccharis halimifolia</i>	Eastern baccharis	Shrub		1		3		4				1														
<i>Betula nigra</i>	River birch	Tree											1	2												
<i>Carya sp.</i>	Hickory	Tree																1								
<i>Carya ovata</i>	Shagbark hickory	Tree							1	1							2	2								
<i>Celtis laevigata</i>	Hackberry	Tree																								
<i>Cinnamomum</i>	Cinnamomum	Tree																								
<i>Cornus amomum</i>	Silky dogwood	Shrub					4	4							2	2							2		8	
<i>Cornus florida</i>	Flowering dogwood	Tree	2	6		2		4				13			1					2						
<i>Diospyros virginiana</i>	Common persimmon	Tree		4				3														1				
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	4	5	3	3		1	4	5	7	8			1	2			1	1			5	5	1	10
<i>Liquidambar styraciflua</i>	Sweetgum	Tree		19		6		19				1					1	5						1		
<i>Liriodendron tulipifera</i>	Yellow poplar	Tree						1									1					3				
<i>Morella cerifera</i>	Wax Myrtle	Shrub																				7				
<i>Platanus occidentalis</i>	Sycamore	Tree		1			5	5			1	1					5			6	3		6	6		
<i>Quercus sp.</i>	Oak	Tree	1	2	1	1																				
<i>Quercus falcata</i>	Southern red oak	Tree	3	3									3						3	5	1	3	1			
<i>Quercus michauxii</i>	Swamp chesnut oak	Tree									1	1		5								1		1	3	4
<i>Quercus phellos</i>	Willow oak	Tree			2	3							4	5	3	3									5	5
<i>Rosa multiflora</i>	Multiflora rose	Shrub																				1				
<i>Salix nigra</i>	Black willow	Tree										1								1						
<i>Sambucus canadensis</i>	Common elderberry	Shrub				2																				
<i>Ulmus sp.</i>	Elm	Tree						1																		
<i>Ulmus alata</i>	Winged elm	Tree																								
<i>Ulmus americana</i>	American elm	Tree			1	1	1						4	4												
<i>Ulmus rubra</i>	Slippery elm	Tree																								
Plot Area (acres)			0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247	
Species Count			4	9	4	9	3	10	3	3	3	7	4	4	3	4	2	4	3	6	4	9	3	5	3	4
Stem Count			10	52	7	22	10	53	6	7	9	26	12	16	6	8	7	5	9	16	7	19	12	15	9	27
Stems per Acre			404.86	2105.26	283.40	890.69	404.86	2145.75	242.91	283.40	364.37	1052.63	485.83	647.77	242.91	323.89	283.40	202.43	364.37	647.77	283.40	769.23	485.83	607.29	364.37	1093.12

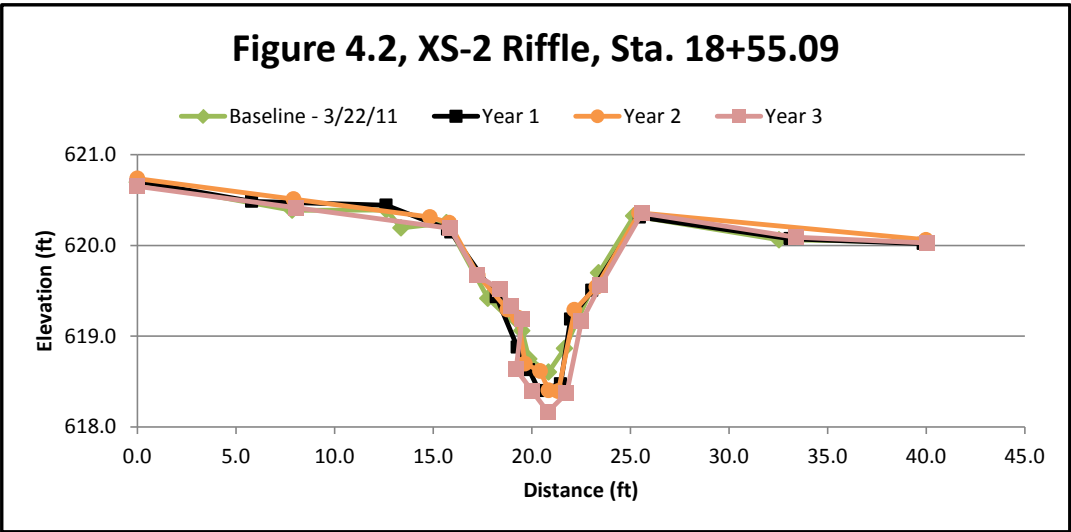
Annual Means														
Scientific Name	Common Name	Type	Plot 13		Plot 14		YR3 (2014)		YR2 (2013)		YR1 (2012)		AB (2011/2012)	
			P	T	P	T	P	T	P	T	P	T	P	T
Acer negundo	Boxelder	Tree					0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Acer rubrum	Red maple	Tree					0.0	5.0	0.0	3.5	0.0	11.0	0.0	21.9
Alnus serrulata	Tag alder	Shrub					1.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0
Asimina triloba	Paw-paw	Shrub					1.5	1.0	1.0	1.0	1.7	1.7	2.0	2.0
Baccharis halimifolia	Eastern baccharis	Shrub					0.0	2.3	0.0	2.0	0.0	4.0	0.0	3.5
Betula nigra	River birch	Tree	2	2			1.5	2.0	1.5	1.5	1.5	1.5	1.5	1.5
Carya sp.	Hickory	Tree					0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
Carya ovata	Shagbark hickory	Tree					1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5
Celtis laevigata	Hackberry	Tree	2	2			2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0
Cinnamomum	Cinnamomum	Tree					0.0	0.0	0.0	9.0	0.0	0.0	0.0	0.0
Cornus amomum	Silky dogwood	Shrub					3.0	4.0	3.0	3.8	2.7	4.7	2.3	2.8
Cornus florida	Flowering dogwood	Tree		1			2.0	4.1	1.0	1.0	2.0	2.0	2.0	2.0
Diospyros virginiana	Common persimmon	Tree					0.0	2.7	0.0	3.3	0.0	3.3	0.0	1.0
Fraxinus pennsylvanica	Green ash	Tree	5	5	1	2	3.2	4.3	3.6	3.6	3.5	3.3	3.6	4.5
Liquidambar styraciflua	Sweetgum	Tree		10		1	5.0	7.3	0.0	9.3	0.0	9.8	0.0	10.0
Liriodendron tulipifera	Yellow poplar	Tree					0.0	1.7	1.0	1.0	1.0	1.0	1.0	1.0
Morella cerifera	Wax Myrtle	Shrub					0.0	7.0	0.0	1.0	0.0	0.0	0.0	0.0
Platanus occidentalis	Sycamore	Tree	1	1	1	1	3.1	3.0	3.4	3.3	3.4	3.4	4.3	4.1
Quercus sp.	Oak	Tree					1.0	1.5	1.0	1.0	1.5	1.5	1.5	1.5
Quercus falcata	Southern red oak	Tree			7	7	3.0	4.5	2.6	2.6	3.4	3.4	3.5	3.5
Quercus michauxii	Swamp chesnut oak	Tree	3	3			2.3	2.5	2.5	2.3	2.8	2.8	3.0	3.0
Quercus phellos	Willow oak	Tree					3.5	4.0	3.8	3.8	3.8	3.8	3.8	3.8
Rosa multiflora	Multiflora rose	Shrub					0.0	1.0	0.0	1.8	0.0	1.5	0.0	0.0
Salix nigra	Black willow	Tree					0.0	1.0	0.0	1.0	0.0	3.5	0.0	3.0
Sambucus canadensis	Common elderberry	Shrub					0.0	2.0	0.0	4.5	0.0	5.7	0.0	0.0
Ulmus sp.	Elm	Tree			3	3	3.0	2.0	3.0	3.0	3.0	3.0	2.5	5.3
Ulmus alata	Winged elm	Tree					0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
Ulmus americana	American elm	Tree					2.0	2.5	2.0	3.0	2.0	5.5	2.0	2.0
Ulmus rubra	Slippery elm	Tree					0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
Plot Area (acres)			0.0247		0.0247									
Species Count			5	7	4	5	3.4	6.1	3.4	6.0	3.6	6.2	4.1	6.1
Stem Count			13	24	12	14	9.2	21.7	9.1	19.0	10.1	24.6	11.4	30.5
Stems per Acre			526.3	971.7	485.8	566.8	373.0	879.1	367.0	769.0	410.6	994.8	463.0	1235.0

Appendix D. Stream Survey Data

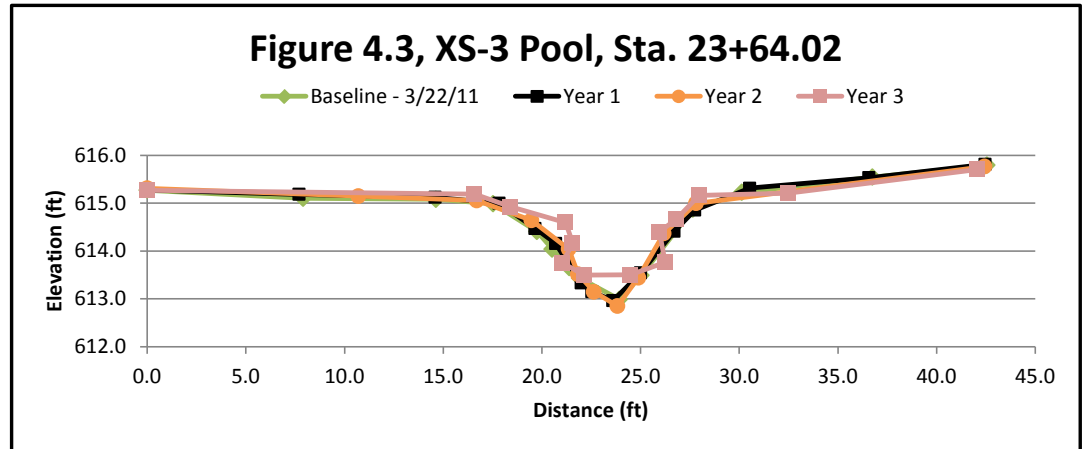
XS-1 Riffle, Sta. 12+73.50	Baseline		MY1		MY2		MY3	
	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
	0.00	622.50	0.00	622.49	0.00	622.47	0.00	622.50
	4.66	622.55	11.29	622.52	6.96	622.65	15.00	622.14
	12.17	622.19	13.30	622.16	16.51	622.17	19.00	621.95
	14.34	622.00	15.92	622.02	18.21	621.57	19.30	621.49
	16.56	622.02	16.91	622.01	19.34	621.07	19.75	621.14
	18.81	621.12	18.13	621.43	19.85	620.71	20.25	620.59
	19.28	620.93	18.97	621.05	20.76	620.76	22.25	620.36
	19.76	620.78	19.79	620.81	21.29	620.74	23.25	620.40
	20.16	620.31	19.94	620.47	22.90	620.70	24.58	621.64
	21.49	620.47	20.89	620.52	23.54	621.49	26.58	622.05
	22.46	620.41	22.97	620.66	24.90	621.50	32.00	622.10
	23.07	620.47	23.97	621.12	25.92	621.92	42.83	622.26
	24.02	621.09	24.58	621.33	34.51	622.35		
	26.83	621.95	25.77	621.82	42.49	622.26		
	30.75	621.98	27.38	622.05				
	36.99	622.25	31.09	622.07				
	42.53	622.24	35.19	622.34				
			42.46	622.25				



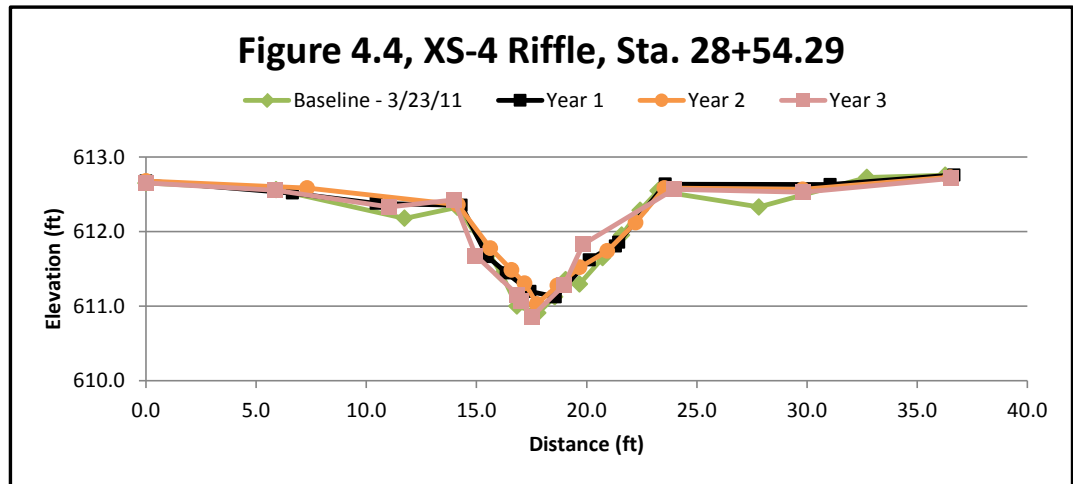
XS-2 Riffle, Sta. 18+55.09	Baseline		MY1		MY2		MY3	
	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
	0.00	620.70	0.00	620.71	0.00	620.74	0.00	620.65
	7.86	620.39	5.80	620.49	7.92	620.51	8.06	620.41
	12.63	620.39	12.62	620.45	14.84	620.31	15.84	620.19
	13.37	620.19	15.74	620.18	15.82	620.25	17.21	619.68
	15.68	620.25	15.90	620.15	17.27	619.67	18.40	619.51
	17.78	619.42	18.20	619.43	18.77	619.29	18.96	619.33
	19.50	619.06	19.27	618.88	19.31	619.20	19.49	619.19
	19.86	618.75	19.85	618.63	19.66	618.70	19.21	618.64
	20.85	618.60	20.36	618.40	20.43	618.62	20.01	618.40
	21.67	618.87	21.46	618.47	20.86	618.40	20.82	618.17
	23.40	619.70	21.97	619.19	21.34	618.40	21.77	618.37
	25.18	620.33	23.05	619.51	22.17	619.29	22.51	619.17
	32.54	620.06	25.46	620.31	23.28	619.54	23.48	619.56
	39.94	620.04	33.11	620.07	25.45	620.36	25.59	620.36
			39.86	620.02	40.00	620.06	33.38	620.09
							40.06	620.03



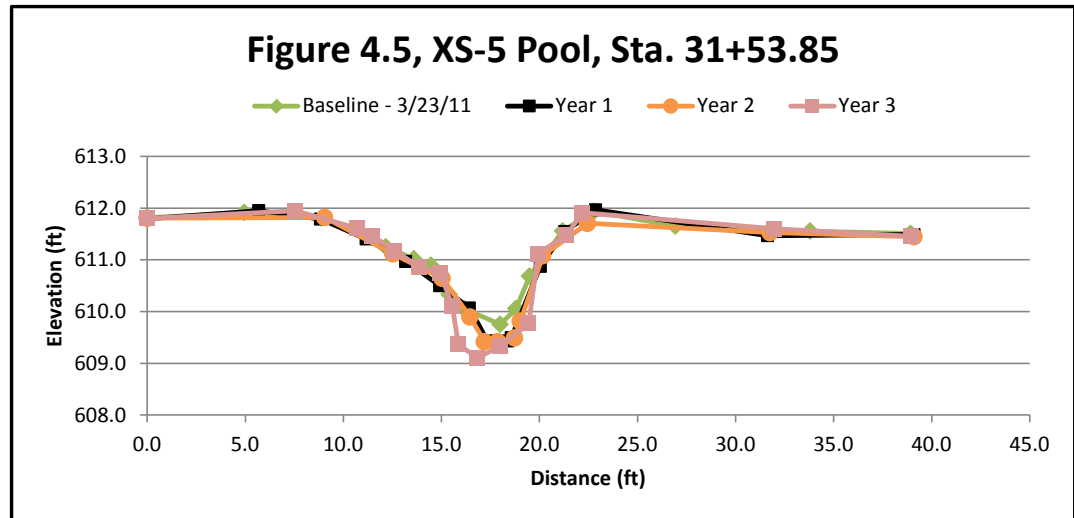
XS-3 Pool, Sta. 23+64.02	Baseline		MY1		MY2		MY3	
	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
	0.00	615.27	0.0	615.28	0.0	615.31	0.0	615.27
	7.90	615.10	7.7	615.18	10.7	615.15	16.6	615.19
	14.63	615.08	14.6	615.12	16.7	615.05	18.4	614.93
	17.53	614.99	17.8	615.00	19.5	614.64	21.2	614.59
	19.75	614.41	19.7	614.47	21.4	614.04	21.6	614.17
	20.53	614.04	20.7	614.16	21.8	613.52	21.1	613.75
	21.39	613.65	21.3	613.76	22.6	613.15	22.1	613.49
	21.92	613.43	22.0	613.33	23.8	612.85	24.5	613.50
	23.93	612.99	22.5	613.15	24.9	613.44	26.2	613.76
	25.03	613.49	23.6	612.96	26.2	614.37	26.0	614.40
	27.66	614.87	25.0	613.54	27.8	615.00	26.8	614.68
	30.14	615.22	26.7	614.41	42.4	615.77	28.0	615.16
	36.75	615.54	27.8	614.86			32.5	615.21
	42.56	615.79	30.5	615.31			42.1	615.70
			36.6	615.53				
			42.5	615.81				



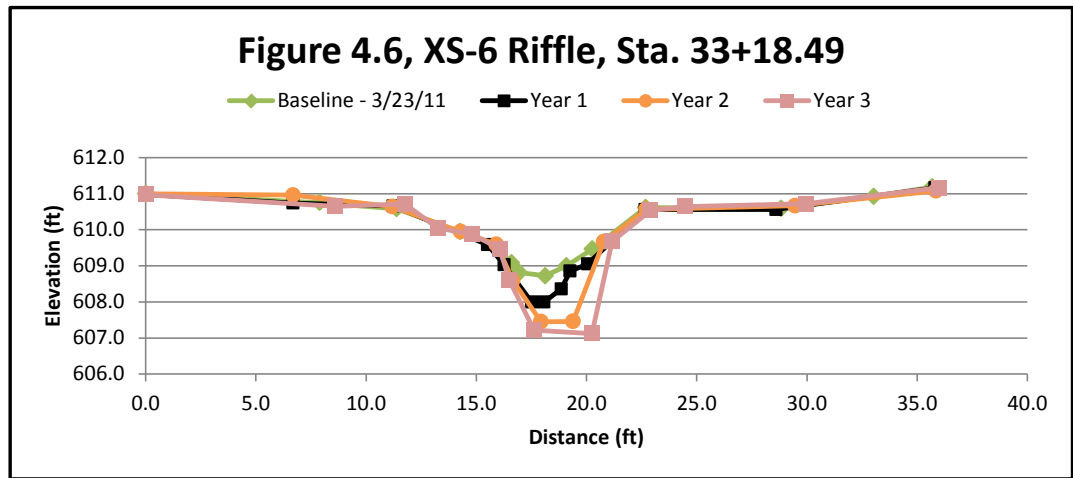
XS-4 Riffle, Sta. 28+54.29	Baseline		MY1		MY2		MY3	
	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
	0.00	612.65	0.00	612.68	0.00	612.68	0.00	612.65
	5.91	612.56	6.65	612.52	7.32	612.59	5.87	612.55
	11.74	612.18	10.45	612.38	14.15	612.36	11.04	612.33
	14.13	612.33	14.31	612.35	15.63	611.78	13.98	612.42
	15.57	611.70	15.49	611.66	16.59	611.49	14.96	611.68
	16.14	611.43	16.36	611.45	17.18	611.31	16.85	611.16
	16.84	611.00	17.43	611.20	17.74	611.03	17.02	611.07
	17.79	610.91	18.58	611.12	18.68	611.28	17.51	610.86
	18.55	611.13	20.12	611.62	19.68	611.52	18.97	611.28
	19.04	611.36	21.46	611.86	20.93	611.74	19.83	611.83
	19.67	611.30	21.31	611.81	22.22	612.12	23.95	612.57
	20.73	611.65	23.56	612.64	23.53	612.58	29.81	612.53
	21.59	611.95	31.05	612.63	29.80	612.57	36.54	612.71
	22.43	612.29	36.67	612.76	36.49	612.73		
	23.24	612.55						
	27.82	612.33						
	32.72	612.73						
	36.27	612.75						



XS-5 Pool, Sta. 31+53.85	Baseline		MY1		MY2		MY3	
	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
	0.00	611.81	0.00	611.79	0.00	611.81	0.00	611.80
	4.96	611.92	5.69	611.95	9.05	611.82	7.57	611.95
	8.92	611.81	8.84	611.79	12.54	611.11	10.72	611.61
	12.17	611.25	11.17	611.40	15.05	610.64	11.49	611.46
	13.60	611.02	13.18	610.97	16.46	609.90	12.62	611.18
	14.48	610.90	14.92	610.50	17.20	609.42	13.90	610.86
	15.40	610.33	16.43	610.07	17.87	609.42	14.95	610.74
	16.19	610.05	17.35	609.43	18.74	609.49	15.56	610.11
	18.00	609.75	18.40	609.43	19.03	609.82	15.86	609.36
	18.81	610.06	18.57	609.50	20.17	611.08	16.84	609.10
	19.50	610.68	20.05	610.88	22.46	611.71	18.01	609.34
	21.19	611.56	21.30	611.54	31.76	611.53	19.45	609.77
	22.79	611.94	22.87	611.97	39.10	611.45	19.93	611.12
	26.94	611.65	31.64	611.47			21.37	611.48
	33.80	611.56	39.11	611.49			22.20	611.91
	38.93	611.51					31.95	611.6
							38.96	611.5



XS-6 Riffle, Sta. 33+18.49	Baseline		MY1		MY2		MY3	
	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
	0.00	611.00	0.00	610.98	0.00	611.00	0.00	610.97
	7.89	610.75	6.68	610.74	6.68	610.96	8.60	610.65
	11.38	610.58	11.23	610.66	11.19	610.64	11.76	610.71
	14.26	609.95	15.51	609.59	14.29	609.95	13.25	610.05
	16.03	609.43	16.26	609.03	15.91	609.59	14.81	609.88
	16.60	609.08	17.51	607.99	16.65	608.59	16.06	609.47
	16.95	608.81	18.07	607.99	17.93	607.45	16.49	608.60
	18.13	608.72	18.85	608.36	19.38	607.46	17.62	607.22
	19.09	609.00	19.25	608.85	20.78	609.67	20.24	607.13
	20.26	609.47	20.05	609.05	22.71	610.56	21.16	609.68
	22.68	610.61	22.66	610.56	29.46	610.67	22.90	610.54
	28.83	610.59	28.59	610.56	35.85	611.08	24.47	610.65
	33.03	610.92	35.81	611.16			29.94	610.72
	35.68	611.18					35.98	611.16



Figures 5.1 – 5.3. Longitudinal Profile Plots

Figure 5.1 UT Rocky River - Longitudinal Profile

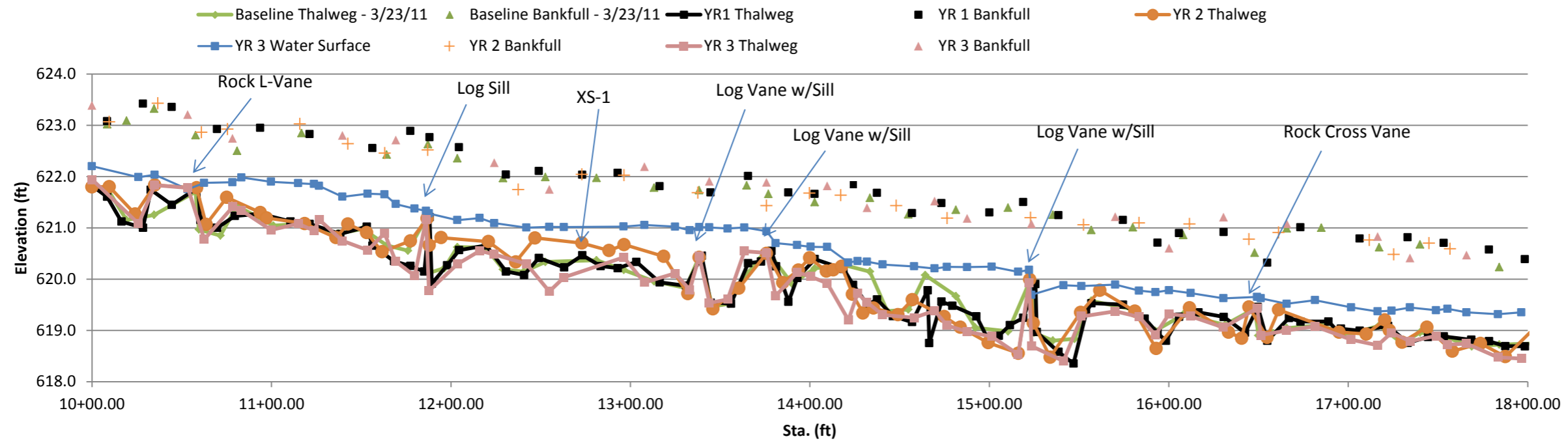


Figure 5.2 UT Rocky River - Longitudinal Profile

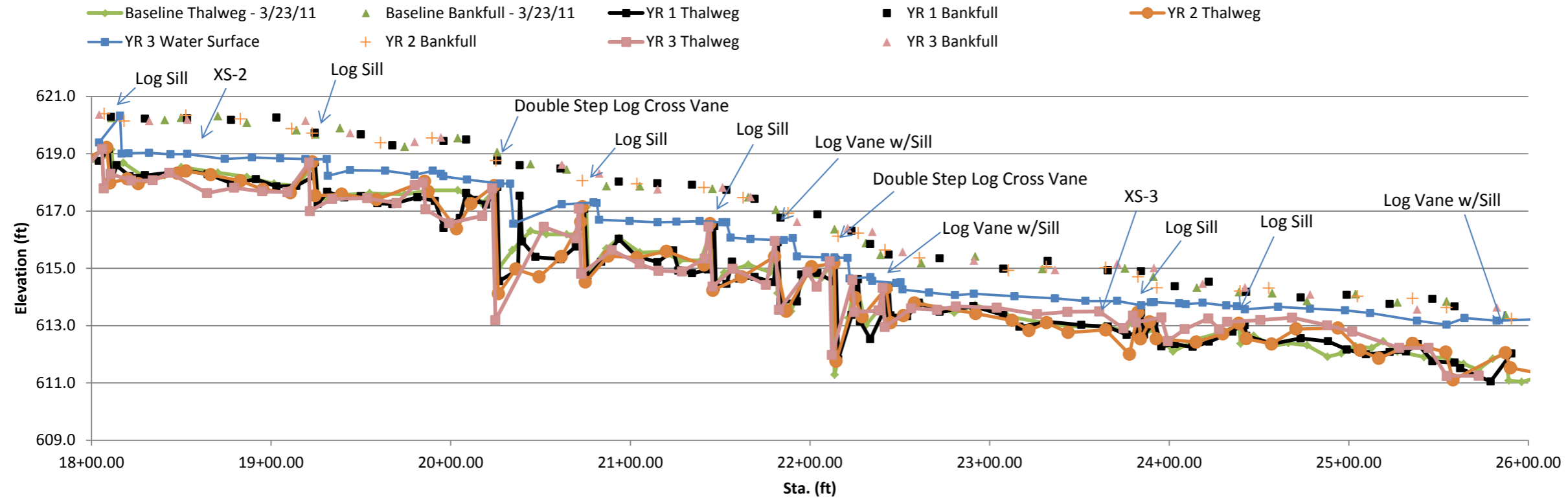


Figure 5.3 UT Rocky River - Longitudinal Profile

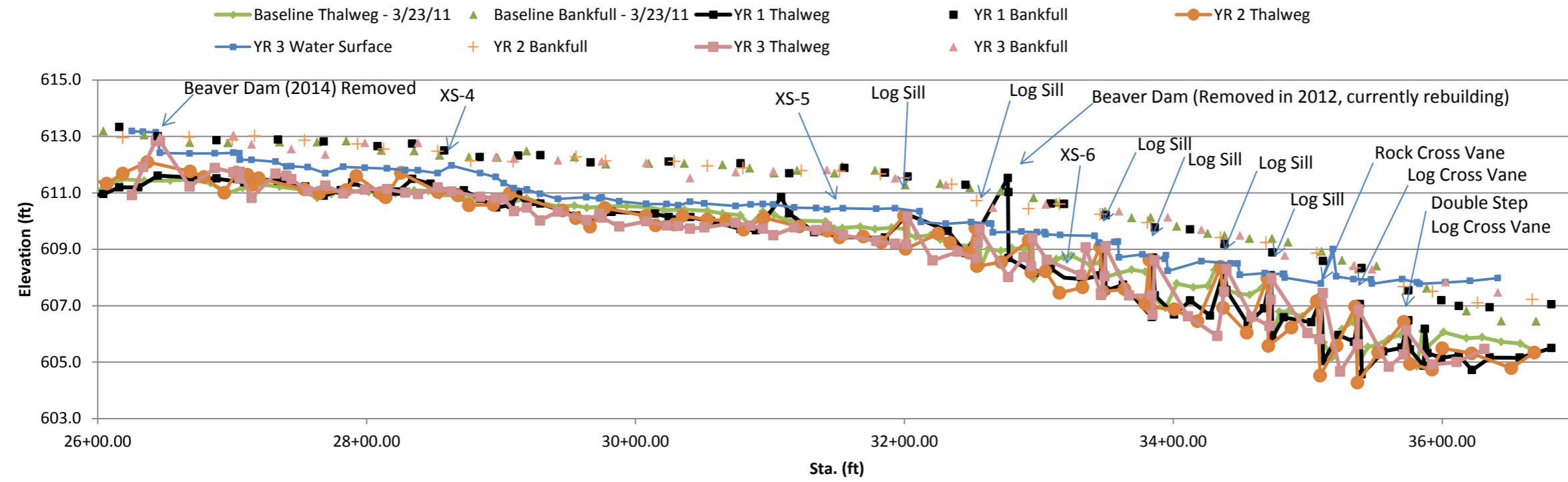


Table 10. Baseline Stream Data Summary
UT Rocky River - Harris Road Middle, EEP IMS No. 92383
UT Rocky River: 2,715 lf

Parameter	Regional Curve	Pre-Existing Condition (Beaver Influence Reach)	Pre-Existing Condition (Gully Reach)	Reference - UT Ledge Creek	Reference Reach - UT Wildcat Branch	Reference Reach - Mill Creek	Design	As-built/Baseline					
								Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle	Eq.	Mean	Mean	Mean	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	9.10	5.10	4.70	14.70	8.20	11.3	9.50	8.50	9.88	9.70	11.60	1.32	4
Floodprone Width (ft)		270.00	9.70	63.00	130.00	300	300.00	175.00	225.50	217.50	292.00	55.42	4
Bankfull Mean Depth (ft)	1.16	0.20	0.89	1.25	1.03	1.85	0.95	0.80	0.88	0.90	0.90	0.05	4
Bankfull Max Depth (ft)		0.40	1.06	1.75	1.57	2.58	1.43	1.40	1.64	1.63	1.90	0.21	4
Bankfull Cross Sectional Area (ft ²)	10.68	0.90	4.20	18.30	8.50	21	9.00	6.70	8.65	8.60	10.70	1.71	4
Width/Depth Ratio		29.80	5.30	11.70	8.00	6.1	10.00	10.70	11.30	10.95	12.60	0.88	4
Entrenchment Ratio		53.30	2.00	4.30	15.90	26.5	31.60	18.30	23.25	20.20	34.30	7.51	4
Bank Height Ratio		1.00	2.12	1.54	1.09	1.09	1.00	1.00	1.00	1.00	1.00	0.00	4
d50 (mm)		sand	sand	sand	sand	sand	sand						
Profile													
Riffle Length (ft)								9.05	45.88	46.41	88.46	24.23	32
Riffle Slope (ft/ft)		0.0184	0.0553	0.0010	0.0022	0.0037	0.0033	0.0006	0.0038	0.0033	0.0126	0.0023	32
Pool Length (ft)								3.94	15.98	14.75	32.84	7.40	46
Pool Max depth (ft)		1.38	2.32	2.67	1.75	3.12	1.90	1.48	2.23	2.07	4.85	0.56	46
Pool Spacing (ft)		7.16-42.49	11.43-54.09	12.0-72.0	14.0-16.6	11.4-61.0	9.5-57.0	13.31	45.43	37.86	98.34	24.40	45
Pool Cross Sectional Area (ft ²)								10.68	11.49	11.49	12.30	1.15	2
Pattern													
Channel Beltwidth (ft)		41.00	41.00	48.0-55.0	13.8-19.4	15.1-27.0	19.0-57.0						
Radius of Curvature (ft)		6.0-15.0	6.0-15.0	14.9-22.2	10.9-15.3	9.7-29.8	28.5-38.0						
Rc: Bankfull Width (ft/ft)		1.2-2.9	1.3-3.1	1.0-1.5	1.3-1.9	0.9-2.6	3.0-4.0						
Meander Wavelength (ft)		83.00	83.00	134-140	22.5-29.0	37.7-72.6	57.0-133.0						
Meander Width Ratio		8.09	8.70	3.3-3.8	1.7-2.4	1.3-2.4	2.0-6.0						
Substrate, bed and transport parameters													
Ri% / Ru% / P% / G% / S%													
SC% / Sa% / G% / C% / B% / Be%													
d16 / d35 / d50 / d84 / d95/ d1 ^p / d1 ⁵⁰ (mm)													
Reach Shear Stress (competency) lb/ft ²		0.164	2.499	0.033	0.122	0.230	0.126						
Max part size (mm) mobilized at bankfull													
Stream Power (transport capacity) W/m ²			21.416	0.700	1.300	5.000	2.450						
Additional Reach Parameters													
Drainage Area (SM)		0.64	0.64	3.77	0.44	1.92	0.77						
Impervious cover estimate (%)													
Rosgen Classification		C5/D5	G5	C5	E5	E5	C5/E5				C5		
Bankfull Velocity (fps)			3.80	1.20	1.00	1.50	1.90				2.08		
Bankfull Discharge (cfs)			15.70	22.30	8.50	30.60	18.00				18.00		
Valley length (ft)		2238	2238				2180.00				2180.00		
Channel Thalweg length (ft)		2350	2350				2703.00				2715.00		
Sinuosity (ft)		1.05	1.05	1.26	1.15	1.18	1.24				1.25		
Water Surface Slope (Channel) (ft/ft)		0.0066	0.0219	0.0005	0.0024	0.0026	0.0022				0.0060		
BF slope (ft/ft)							0.0022				0.0060		
Bankfull Floodplain Area (acres)													
Proportion over wide (%)													
Entrenchment Class (ER Range)													
Incision Class (BHR Range)													
BEHI VL% / L% / M% / H% / VH% / E%													
Channel Stability or Habitat Metric													
Biological or Other													

Table 11. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Section)

UT Rocky River - Harris Road Middle (EEP IMS No. 92383)

UT Rocky River: 2,715 lf

	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)						
Dimension and substrate¹	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	10.10	10.30	8.70	7.09				9.30	10.06	9.34	8.91			
Floodprone Width (ft)	185.00	185.00	185.00	185.00				175.00	175.00	175.00	175.00			
Bankfull Mean Depth (ft)	0.90	0.87	0.73	0.97				0.90	0.83	0.88	0.51			
Bankfull Max Depth (ft)	1.60	1.56	1.21	1.59				1.65	1.83	1.85	2.02			
Bankfull Cross Sectional Area (ft ²)	9.20	8.93	6.31	6.89				8.00	8.33	8.18	9.73			
Bankfull Width/Depth Ratio	11.10	11.85	11.99	7.31				10.80	12.12	10.67	17.47			
Bankfull Entrenchment Ratio	18.30	17.94	21.26	26.09				18.80	17.40	18.74	19.64			
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1			
	Cross Section 3 (Pool)							Cross Section 4 (Riffle)						
Dimension and substrate¹	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	11.02	10.13	10.73	11.16				8.50	8.88	8.75	9.10			
Floodprone Width (ft)	132.00	132.00	132.00	132.00				292.00	292.00	292.00	292.00			
Bankfull Mean Depth (ft)	0.97	0.96	0.92	0.87				0.80	0.85	0.69	0.51			
Bankfull Max Depth (ft)	2.00	1.97	2.15	1.67				1.40	1.38	1.33	1.56			
Bankfull Cross Sectional Area (ft ²)	10.68	9.75	9.84	9.75				6.70	7.50	6.01	7.09			
Bankfull Width/Depth Ratio	11.36	10.55	11.71	12.83				10.70	10.45	12.73	17.84			
Bankfull Entrenchment Ratio	12.00	13.03	12.30	11.83				34.30	32.88	33.38	32.09			
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1			
	Cross Section 5 (Pool)							Cross Section 6 (Pool/formerly Riffle) ²						
Dimension and substrate¹	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	13.30	13.71	12.84	10.80				11.60	11.24	11.17	10.80			
Floodprone Width (ft)	300.00	300.00	300.00	300.00				250.00	250.00	250.00	250.00			
Bankfull Mean Depth (ft)	0.90	1.09	0.99	1.13				0.90	1.18	1.31	1.61			
Bankfull Max Depth (ft)	2.05	2.45	2.29	2.50				1.90	2.62	3.11	3.41			
Bankfull Cross Sectional Area (ft ²)	12.30	14.95	12.72	12.28				10.70	13.27	14.64	17.41			
Bankfull Width/Depth Ratio	14.50	12.58	12.95	9.56				12.60	9.53	8.52	6.71			
Bankfull Entrenchment Ratio	22.60	21.88	23.37	27.78				21.60	22.24	22.38	23.15			
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1			

¹ = Based on current bankfull elevation, determined by field indicators of bankfull.

² = Cross Section 6 is no longer included in the Table 12 dimension and substrate averages.

Table 12. Monitoring Data - Stream Reach Data Summary
UT Rocky River - Harris Road Middle (EEP IMS No. 92383)

UT Rocky River - 2,715 lf

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5							
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n		
Dimension and substrate - Riffle only																																						
Bankfull Width (ft)	8.50	9.88	9.70	11.60	1.32	4	8.88	10.12	10.18	11.24	0.97	4	8.70	8.93	8.75	9.34	0.36	3	7.09	8.37	8.91	9.10	1.11	3														
Floodprone Width (ft)	175	226	218	292	55	4	175	226	218	292	55	4	175	217	185	292	65	3	175	217	185	292	65	3														
Bankfull Mean Depth (ft)	0.80	0.88	0.90	0.90	0.05	4	0.83	0.93	0.86	1.18	0.17	4	0.69	0.77	0.73	0.88	0.10	3	0.51	0.66	0.51	0.97	0.27	3														
² Bankfull Max Depth (ft)	1.40	1.64	1.63	1.90	0.21	4	1.38	1.85	1.70	2.62	0.55	4	1.21	1.46	1.33	1.85	0.34	3	1.56	1.72	1.59	2.02	0.26	3														
Bankfull Cross Sectional Area (ft ²)	6.70	8.65	8.60	10.70	1.71	4	7.50	9.51	8.63	13.27	2.58	4	6.01	6.83	6.31	8.18	1.18	3	6.89	7.90	7.09	9.73	1.59	3														
Width/Depth Ratio	10.70	11.30	10.95	12.60	0.88	4	9.53	10.99	11.15	12.12	1.22	4	10.67	11.80	11.99	12.73	1.04	3	7.31	14.21	17.47	17.84	5.98	3														
Entrenchment Ratio	18.30	23.25	20.20	34.30	7.51	4	17.40	22.62	20.09	32.88	7.18	4	18.74	24.46	21.26	33.38	7.83	3	19.64	25.94	26.09	32.09	6.22	3														
¹ Bank Height Ratio	1	1	1	1	0	4	1	1	1	1	0	4	1	1	1	1	0	3	1	1	1	1	0	3														
Profile																																						
Riffle Length (ft)	9.05	45.88	46.41	88.46	24.23	32	2.68	27.52	25.65	73.53	17.11	35	9.56	33.75	28.36	106.43	22.56	20	9.91	25.56	19.82	79.29	15.44	48														
Riffle Slope (ft/ft)	0.001	0.004	0.003	0.013	0.002	32	0.000	0.005	0.002	0.048	0.011	35	0.001	0.006	0.004	0.018	0.452	15	0.0053	0.025	0.025	0.048	0.009	48														
Pool Length (ft)	3.94	15.98	14.75	32.84	7.40	46	1.72	23.68	23.17	69.48	12.65	65	1.10	30.99	28.52	67.70	15.22	56	11.89	30.48	29.73	69.38	12.37	46														
Pool Max Depth (ft)	1.48	2.23	2.07	4.85	0.56	46	0.84	2.18	2.11	3.76	0.62	65	0.85	2.38	2.36	4.74	0.84	57	1.39	2.44	2.30	5.62	0.78	46														
Pool Spacing (ft)	13.31	45.43	37.86	98.34	24.40	45	7.52	40.69	35.43	99.43	22.98	64	6.47	46.65	40.30	122.14	22.64	56	6.47	52.19	48.56	176.41	29.41	45														
Pattern																																						
Channel Beltwidth (ft)																																						
Radius of Curvature (ft)																																						
Rc:Bankfull Width (ft/ft)																																						
Meander Wavelength (ft)																																						
Meander Width Ratio																																						
Additional Reach Parameters																																						
Rosen Classification	C5						C5						C5						C5																			
Channel Thalweg length (ft)	2715						2715						2715						2715																			
Simosity (ft)	1.25						1.25						1.25						1.25																			
Water Surface Slope (Channel) (ft/ft)	0.006						0.006						0.006						0.0053																			
BF slope (ft/ft)	0.006						0.006						0.006						0.006																			
¹ R% / P%	43% / 57%						38% / 62%						28% / 72%						45% / 55%																			
² SC% / Sa% / G% / C% / B% / Be%																																						
³ d16 / d35 / d50 / d84 / d95																																						
% of Reach with Eroding Banks																																						
Channel Stability or Habitat Metric																																						
Biological or Other																																						

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

¹ = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

² = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

³ = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

Appendix E. Hydrologic Data

Table 13. Verification of Bankfull Events

Date	Crest Gauge Info		Gauge Reading (ft)	Gauge Elevation (ft)	Crest Elevation (ft)	Bankfull Elevation (ft)	Height above Bankfull (ft)	Photo
	Site	Sta.						
3/8/2012	1	16+85	0.75	620.65	621.40	621.05	0.35	6.1
10/4/2012	1	16+85	1.13	620.65	621.78	621.05	0.73	6.2
3/20/2013	1	16+85	1.75	620.65	622.40	621.05	1.35	6.3
9/24/2013	2	29+70	1.30	611.80	613.10	612.33	0.77	6.4
9/23/2014	1	16+85	1.66	620.65	622.31	621.05	1.26	6.5
9/23/2014	2	29+70	1.83	611.80	613.65	612.33	1.32	6.6

Figures 6.1 - 6.6 Crest Gauge Photos



6.1 Crest Gauge 1 (3/8/2012)



6.2 Crest Gauge 1 (10/4/2012)



6.3 Crest Gauge 1 (3/12/2013)



6.4 Crest Gauge 2 (9/24/2013)



6.5 Crest Gauge 1 (9/23/2014)



6.6 Crest Gauge 2 (9/23/2014)