FINAL

AS-BUILT BASELINE MONITORING REPORT

UT TO MARTIN'S CREEK (CONTRERAS) MITIGATION PROJECT

Cherokee County, North Carolina
EEP Project No. 92766 (Contract No. 005717)
USACE Action ID No. 2010-00961/DWR Project No. 2010-00448
SCO No. 08-07249-01

Data Collection – March-April 2014

Hiwasssee River Basin
Cataloging Unit 06020002170010

SUBMITTED TO/PREPARED FOR:

North Carolina Department of Environment and Natural Resources
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MAY 2014

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APPENDICES

1.0 PROJECT SUMMARY

The North Carolina Ecosystem Enhancement Program (EEP) has established the UT to Martin's Creek (Contreras) Mitigation Project (Site) located in Cherokee County, just south of the town of Murphy. The Site is encompassed within 14-digit Cataloging Unit 06020002170010 of the Hiwassee River Basin (Figure 1, Appendix B and Table 4, Appendix A). Land use at the Site, prior to mitigation activities, was composed of agricultural uses, logging, grass land, single-family residences, and forested areas. Martin's Creek and its tributaries had been impaired by historical and current land management practices, which include timber harvesting, pasture conversion, channelization, and livestock grazing. Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A).

The Site is located on tributaries to Martin's Creek, which has been assigned Stream Index Number 1-49 and a Best Usage Classification of C. Site streams are listed on the NCDWQ draft 2014 and final 2012 Section 303(d) list of impaired streams due to a fair bioclassification for ecological/biological integrity and fish communities, and elevated levels of fecal coliform bacteria. The Site is located within a Targeted Local Watershed that has been identified for stream and buffer restoration opportunities (NCEEP 2008).

The Site lies within the focus area of the *Peachtree-Martins Creek Local Watershed Plan* (LWP). Goals of the LWP include working with local landowners, resource agencies and nongovernmental groups to implement wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffers, stabilizing stream banks, and restoring natural channel geomorphology, particularly in headwater streams. The NCEEP is also placing an emphasis on projects that contribute to the restoration and protection of habitat for priority fish, mussel, snail and crayfish species in the basin (NCEEP 2008).

The project goals will directly address stressors identified in the Peachtree-Martins Creek LWP, namely lack of riparian vegetation, channel modification, excess sediment inputs, excess nutrient inputs, and bacterial contamination as follows.

- Restore geomorphically stable stream channels within the Site;
- Restoration or enhancement of wetlands onsite;
- Exclude livestock from accessing project streams, wetlands, and riparian zones;
- Improve and restore hydrologic connections and achieve uplift of ecosystem functions;
- Improve water quality within the Site through reduction of bank erosion, improved nutrient and sediment removal, and stabilization of streambanks;
- Restore and preserve headwater tributaries in the Peachtree-Martins Creek Watershed and the Hiwassee River; and
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, reduction of water temperature, and restoration of riparian habitat.

In order to accomplish the goals of the project and contribute to the overall success of goals set forth for the greater Peachtree-Martin Creek local watershed planning area, a number of general project objectives and design objectives were identified for this project as follows.

General Project Objectives

- Utilize natural channel design concepts to restore or enhance channel profile, pattern, and dimension to reduce bank and channel profile degradation and to allow greater floodplain connectivity to aid in the dissipation of bankfull flows.
- Reduce streambank degradation and sediment and nutrient inputs by limiting livestock access of project tributaries to crossings agreed upon between the NCEEP and the landowner.
- Further reduce sediment and nutrient inputs and streambank instability by restoring or enhancing native riparian vegetation along a 30-foot buffer along the project reach.
- Improve bedform function and diversity by installing toe wood structures and grade control structures that also function to improve riffle and scour pool habitat.

Design Objectives

- Make important design decisions based on a geomorphic analyses of the Site, reference conditions, and hydraulic modeling.
- Consider field constraints and construction tolerances in order to produce a realistic design.
- Minimize disturbance to ecologically functional and physically stable areas, mimic the character of these areas to create a more natural design.
- Structures and over-all design will attempt to use native materials and minimize materials brought onsite to produce more favorable habitat for native flora and fauna, reduce compaction and onsite disturbance from material transport, and produce an aesthetically pleasing result.

The Site mitigation plan was completed in March 2010 with the final design and construction plans completed in November 2010 (Table 2, Appendix A). Project construction was completed between October 2012-July 2013. The implemented mitigation is as follows (Figure 2, Appendix B and Table 1, Appendix A).

- 4952 Stream Mitigation Units
    - Restoring approximately 3330 linear feet of stream channel through construction of stable channel at the historic floodplain elevation.
    - Enhancing (level I) approximately 1319 linear feet of stream channel through cessation of current land use practices, installing grade control structures, repairing bank erosion, restoring proper channel dimension and profile, and planting with native forest vegetation.
    - Enhancing (level II) approximately 1953 linear feet of stream channel through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
- 0.15 Riparian Wetland Mitigation Units
    - Enhancing approximately 0.3 acres of riparian wetland by filling ditches/abandoned channels and supplemental planting.
- Planting a native woody riparian buffer (at least 30 feet in width) adjacent to restored/enhanced streams and wetlands within the Site.
- Protecting the Site in perpetuity with a conservation easement.

Stream Success Criteria

Stream restoration success criteria for the Site are based on the *Stream Mitigation Guidelines* issued in April 2003 by the USACE and NCDWQ. Success criteria for stream restoration will include 1) documentation of two bankfull events, 2) little change in the channel cross-section from as-built conditions, 3) stable longitudinal profile, 4) substrate consistency, and 5) photographic evidence of stability.

Bankfull Events

Two bankfull flow events in separate years must be documented within the 5-year monitoring period. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

Cross-sections

Riffle cross-sections on the restoration and enhancement reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Riffle cross-sections should generally fall within the parameters defined for channels of the appropriate Rosgen stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth.

Longitudinal Profile

Longitudinal profile data for the stream reach should show that bedform features are remaining stable. The riffles should be steeper and shallower than the pools, while the pools should be deep with flat water surface slopes. The relative percentage of riffles and pools should not change significantly from the design parameters.

Bed Material Analysis

Substrate materials in the restoration reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and smaller particles in the pool features.

Photo Reference Sites

Photographs will be used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively. Lateral photos should not indicate excessive erosion or continuing degradation of the banks. A series of photos over time should indicate successive maturation of riparian vegetation.

Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria for this project includes an average density of 320 planted stems per acre must be surviving in the first three monitoring years. Subsequently, 290 planted stems per acre must be surviving in year 4, and 260 planted stems per acre in year 5.

2.0 METHODOLOGY

Monitoring of the Site's restoration efforts will be performed until agreed upon success criteria are fulfilled. Monitoring is proposed for the stream channel, riparian vegetation, and hydrology for a period of five years (Figure 2, Appendix B). Monitoring reports of collected data will be submitted no later than December of each monitoring year.

2.1 Streams

Post-restoration monitoring will be conducted for five years following the completion of construction to evaluate the effectiveness of the restoration practices. Monitored stream parameters include stream

dimension (cross-sections), pattern (longitudinal survey), profile (profile survey), and photographic documentation. Baseline stream data can be found in Appendix D.

Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of a crest gauge and photographs. One crest gauge was installed to record the highest watermark between site visits, and the gauge will be checked each time there is a Site visit to determine if a bankfull event has occurred (Figure 2, Appendix B). Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Cross-sections

A total of 14 permanent cross-sections, 10 riffle and 4 pool, were established and will be used to evaluate stream dimension; locations are depicted on Figure 2 (Appendix B) Because riffle cross-sections are critical in determining bankfull design parameters, the number of riffle cross-sections established will generally outnumber pool cross-sections. Each cross-section will be marked on both banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross-sections and consistently used to facilitate easy comparison of year-to-year data. The annual cross-section survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross sections will be classified using the Rosgen Stream Classification System.

Longitudinal Profile

After Site construction, approximately 4640 linear feet of longitudinal profile was completed to document baseline conditions. Longitudinal profile will be resurveyed annually for the duration of the five-year monitoring period. Measurements include thalweg, water surface, bankfull, and top of low bank. Each of these measurements will be taken at the head of each channel unit (e.g., riffle, pool) and at the maximum pool depth. The survey will be tied to a permanent benchmark.

Bed Material Analysis

Pebble counts will be conducted annually on one permanent riffle cross-section (100-counts) at the time cross-section and longitudinal surveys are performed during the five year monitoring period. These samples will reveal changes in sediment gradation over time as the stream adjusts to upstream sediment loads.

Photo Reference Sites

A total of 24 photographs will be used to visually document restoration success for at least five years following construction. Photographs will be taken from a height of approximately five to six feet. Photo locations will be recorded using sub-meter GPS to ensure that the same locations (and view directions) on the Site are monitored in each monitoring period.

2.2 Vegetation

After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Eleven sample vegetation plots (10-meter by 10-meter) were installed and measured within the Site as per guidelines established in *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008). Vegetation plots are permanently monumented with 6-foot metal t-posts at each corner. In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of

shrub and herbaceous species will also be documented by photograph. Baseline vegetation plot information can be found in Appendix C. Initial stem count measurements indicate an average of 416 planted stems per acre (excluding livestakes) across the Site.

3.0 REFERENCES

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Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

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United States Geological Survey (USGS). 1974. Hydrologic Unit Map - 1974. State of North Carolina.

Appendix A.
Background Tables

Table 1. Project Components and Mitigation Units
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table

Table 1. Project Components and Mitigation Credits
UT to Martin's Creek (Contreras) Mitigation Site

Mitigation Credit Summations		
Stream	**Riparian Wetland**	**Nonriparian Wetland**
4952	**0.15**	**--**

Project Components

Station Range	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Mitigation Credits	Comment
UT1-1 Station 00+00 to 06+02	602	---	Enhance I	602-54 =548	1.5:1	365.3	Forded Crossing (54 linear feet) removed from credit
UT1-1	346	---	Enhance II	346	2.5:1	138.4	
UT1-1-1	106	---	Enhance II	106	2.5:1	42.4	
UT1-2 Station 00+00 to 02+07	141	PI	Restoration	207	1:1	207	
UT1-3 Station 00+00 to 08+33	767	---	Enhance I	767-62=705	1.5:1	470	Stream under power line easement (66 linear feet) will generate half credit and piped stream crossing (62 linear feet) removed from credit.
	66			66	3:1*	22.0	
UT1-4	1099	---	Enhance II	1014-53=961	2.5:1	384.4	Stream under two power line easements (40 and 45 linear feet) will generate half credit and forded crossing (53 linear feet) removed from credit.
	40			40	5:1**	8	
	45			45	5:1**	9	
UT 1 to Martin's Creek	455	---	Enhance II	455	2.5:1	182	
UT1 to Martin's Creek Station 00+00 to 32+74	2674	PI	Restoration	3274-53-47-51 =3123	1:1	3123	Three crossings (53, 47, and 51 linear feet) removed from credit.
Wetland Enhancement	0.3	---	Enhancement	0.3	2:1	0.15	Enhancement of existing riparian wetlands characterized by removal of invasive species and supplemental planting.

Component Summation

Restoration Level	Stream (linear footage)	Riparian Wetland (acreage)	Nonriparian Wetland (acreage)
Restoration	3330	--	--
Enhancement (Level 1)	1319	--	--
Enhancement (Level II)	1953	--	--
Enhancement	--	0.3	--
Totals	**6602**	**0.3**	**--**
Mitigation Units	**4952 SMUs**	**0.15 Riparian WMUs**	**0.00 Nonriparian WMUs**

*66 linear feet of stream under the power line easement is receiving a mitigation ratio of 3:1 (half credit for enhancement [level I]).
**85 linear feet of stream under two power line easements is receiving a mitigation ratio of 5:1 (half credit for enhancement [level II]).

Table 2. Project Activity and Reporting History
UT to Martin's Creek (Contreras) Mitigation Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Mitigation Plan	September 2009-March 2010	March 2010
Final Design – Construction Plans	March 2010-November 2010	November 2010
Construction	--	October 2012-July 2013
Temporary S&E Mix applied to Entire Project Site	--	October 2012-July 2013
Permanent Seed Mix applied to the Entire Project Site	--	October 2012-July 2013
Bare Root; Containerized; and B&B Plantings for the Entire Project Site	--	March 2014
Mitigation Plan/ As-Built (Year 0 Monitoring Baseline)	March-April 2014	April 2014
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts Table
Martin's Creek II Mitigation Site

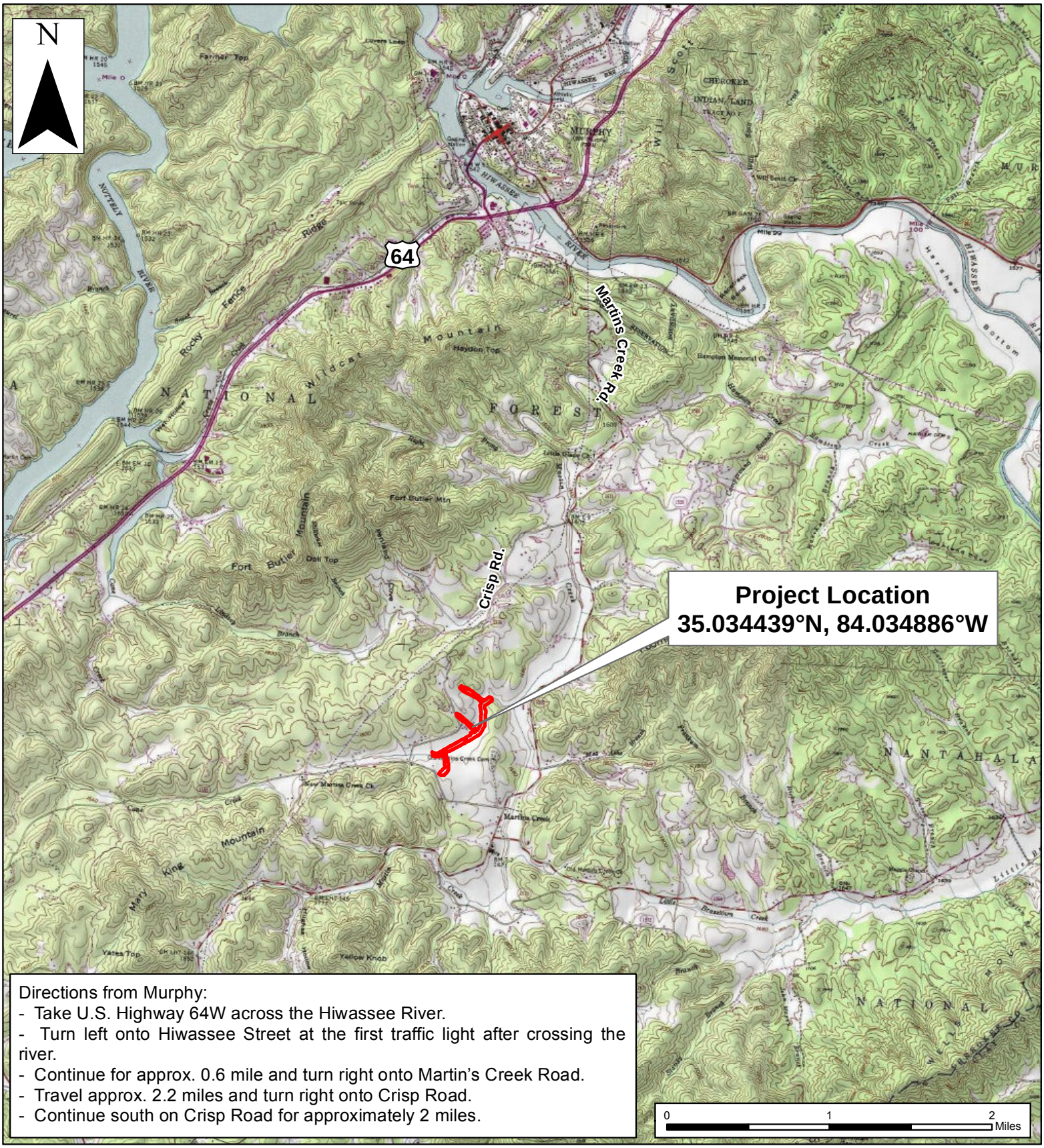
Designer	Michael Baker Engineering, Inc. 797 Haywood Road, Suite 201 Asheville, NC 28806 Micky Clemmons 828-350-1408
Construction Plans and Sediment and Erosion Control Plans	Michael Baker Engineering, Inc. 797 Haywood Road, Suite 201 Asheville, NC 28806 Micky Clemmons 828-350-1408
Construction Contractor	River Works, Inc. 6105 Chapel Hill Rd. Raleigh, NC 27607 919-582-3574
Planting Contractor	Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932 (252) 482-8491
As-built Surveyor	Turner Land Surveying. PLLC 3201 Glenridge Drive Raleigh, NC 27604 919-875-1378
Baseline Data Collection	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
UT to Martin's Creek (Contreras) Mitigation Site

Project County	Cherokee County, North Carolina									
Physiographic Region	Blue Ridge									
Ecoregion	Broad Basins									
Project River Basin	Hiwassee									
USGS HUC for Project (14 digit)	06020002170010									
NCDWQ Sub-basin for Project	04-05-02									
Planning Area	Yes – Peachtree-Martins Creek LWP									
WRC Class (Warm, Cool, Cold)	Cold									
% of easement fenced/demarcated	100% fenced to exclude livestock									
Beaver activity observed during design phase?	Yes, on UT1 below lower limits of project area									
	Restoration Component Attribute Table									
	UT 1-1		UT 1-1-1	UT 1-2	UT 1-3		UT 1-4		UT1 to Martin Cr	
Drainage Area	.018	.028	.004	.005	.074	.082	.023		.79	.82
Stream Order (USGS topo)	1st	2nd	1st	1st	1st	1st	2nd		3rd	3rd
Restored Length (feet)	346	548	106	207	----	738	----	1099	3123	----
Perennial or Intermittent	I	P	I	I	I	P	I	P	P	P
Watershed Type	Rural									
Watershed impervious cover	<10%									
NCDWQ AU/Index number	1-49									
NCDWQ Classification	C		C	C	C		C		C	
303d listed?	No									
Upstream of a 303d listed	No									
Reasons for 303d listed segment	NA									
Total acreage of easement	15.63									
Total existing vegetated acreage of easement	---									
Total planted restoration acreage	~15.63									
Rosgen Classification of preexisting	B/E/Eb		E	F	G/C/B		B		G/Eb/Cb	
Rosgen Classification of As-built	B		---	C	B		B		C	
Valley type	II		II	II	II		II		II	
Valley slope	.034		---	.010	.029		---		.009	
Cowardin classification of proposed	N/A		N/A	N/A	N/A		N/A		N/A	
Trout waters designation	No									
Species of concern, endangered etc.	No									
Dominant Soil Series	Junaluska Brasstown Complex/ Thurmont-Dillard Complex/Arc aqua loam		Junaluska Brasstown Complex	Arc qua loam	Thurmont-Dillard Complex		Junaluska Tsali Complex		Arc qua loam	

Appendix B
Visual Assessment Data

Figure 1. Vicinity Map
Figure 2. Current Conditions Plan View
Figure 3. Project Components Map
Stream Fixed Station Photo Points
Vegetation Plot Photographs



Directions from Murphy:
- Take U.S. Highway 64W across the Hiwassee River.
- Turn left onto Hiwassee Street at the first traffic light after crossing the river.
- Continue for approx. 0.6 mile and turn right onto Martin's Creek Road.
- Travel approx. 2.2 miles and turn right onto Crisp Road.
- Continue south on Crisp Road for approximately 2 miles.

Prepared by:	Prepared for:
Axiom Environmental, Inc.	Ecosystem Enhancement Program

VICINITY MAP
UT TO MARTINS CREEK (CONTRERAS)
EEP PROJECT NUMBER 92766
Cherokee County, North Carolina

Dwn. by. KRJ	FIGURE
Date: April 2014	1
Project: 12.004.16	

N

UT1-4

UT1-3

UT1-2

UT1

UT1-1

UT1-1-1

XS1r XS2r XS3p XS4r XS5r XS6p XS7r XS8r XS9p XS10p XS11r XS12r XS13r XS14r

0 125 250 500 750 1,000 Feet

Legend

- Easement Boundary
- Streams
- Instream Stuctures
- Constructed Riffles
- Crossings
- Powerline Right of Way
- Monitoring Reach
- Cross Sections
- Crest Gauge
- CVS Plots
- Wetlands
- Photo Points

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CURRENT CONDITIONS PLAN VIEW
UT TO MARTINS CREEK (CONTRERAS)
EEP PROJECT # 92766
Cherokee County, North Carolina

Dwn. by. KRJ	FIGURE 2
Date: May 2014	
Project: 12-004.16	

N

UT1-4

40 ft Powerline Right of Way
(1/2 Credit)

50 ft Stream Crossing
(No Credit)

UT1-3

UT1

UT1-2

40 ft Stream Crossing
(No Credit)

UT1

50 ft Stream Crossing
(No Credit)

UT1-1

UT1-1-1

0 125 250 500 750 1,000
Feet

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Easement Boundary

Stream Assets

- Restoration
- Enhancement I
- Enhancement II
- Wetland Enhancement
- Crossings
- Powerline Right of Way

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PROJECT COMPONENTS MAP
UT TO MARTINS CREEK (CONTRERAS)
EEP PROJECT # 92766
Cherokee County, North Carolina

Dwn. by.	KRJ
Date:	May 2014
Project:	12-004.16

FIGURE
3

UT to Martin's Creek (Contreras)
Baseline Fixed Station Photographs
Taken April 2014

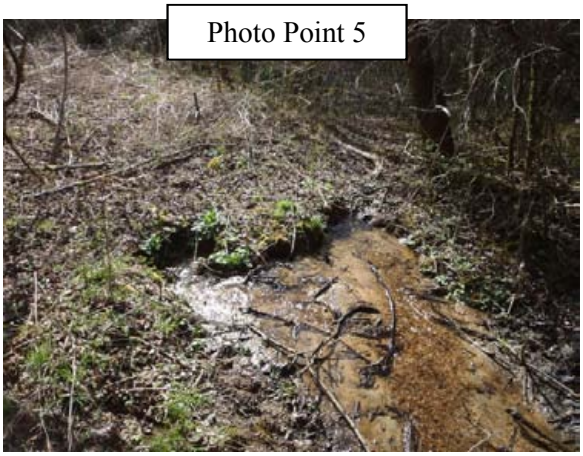
Photo Point 1

Photo Point 2

Photo Point 3

Photo Point 4

Photo Point 5



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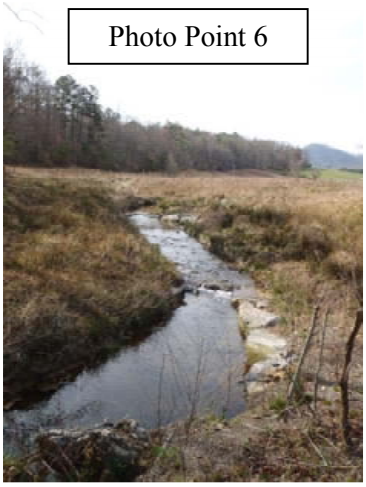


UT to Martin's Creek (Contreras)
Baseline Fixed Station Photographs (continued)
Taken April 2014

Photo Point 7

Photo Point 8

Photo Point 9

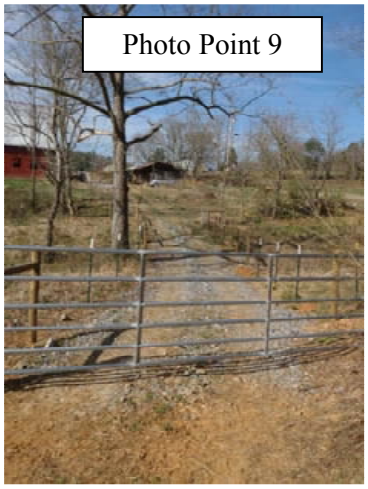


Photo Point 10

Photo Point 11

Photo Point 12

UT to Martin's Creek (Contreras)
Baseline Fixed Station Photographs (continued)
Taken April 2014

Photo Point 13

Photo Point 14

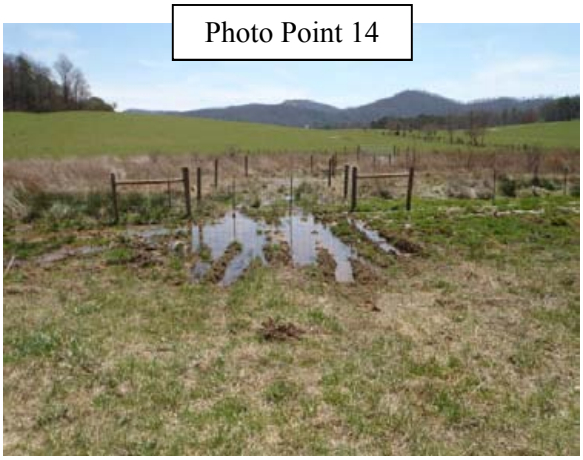
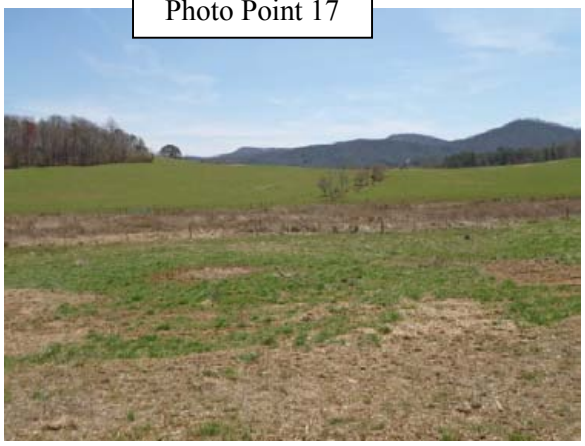


Photo Point 15

Photo Point 16

Photo Point 17



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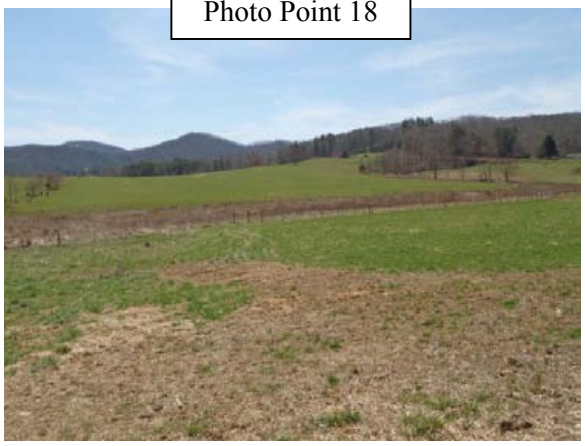


UT to Martin's Creek (Contreras)
Baseline Fixed Station Photographs (continued)
Taken April 2014

Photo Point 19

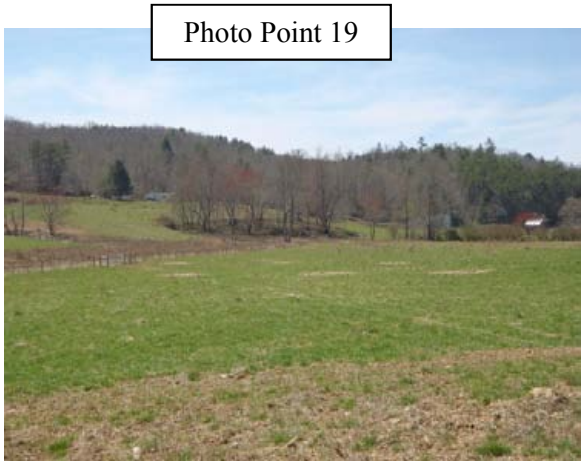


Photo Point 20

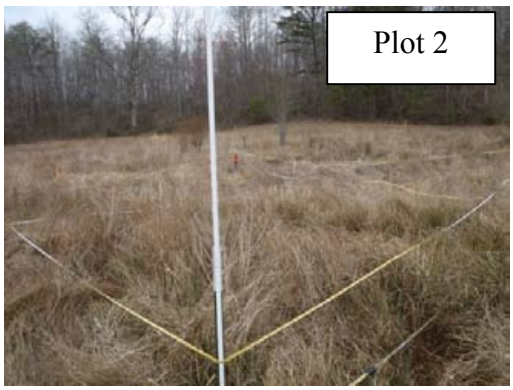
Photo Point 21

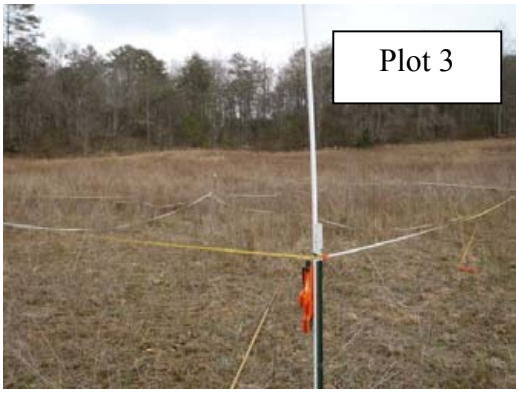
Photo Point 22

Photo Point 23

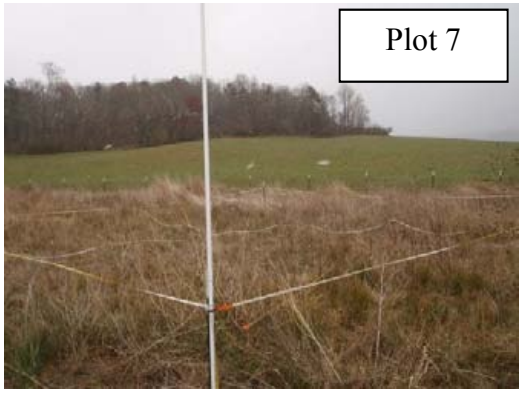
Photo Point 24

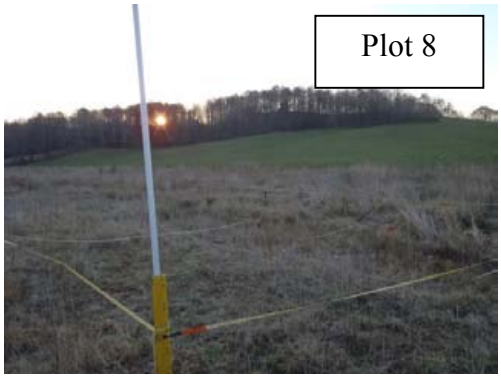
UT to Martin's Creek (Contreras)
Baseline Vegetation Monitoring Photographs
Taken March 25-26, 2014

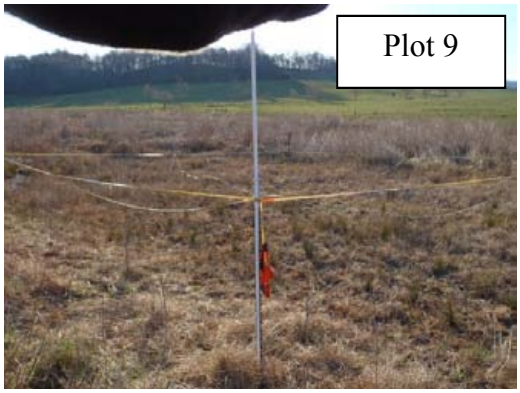


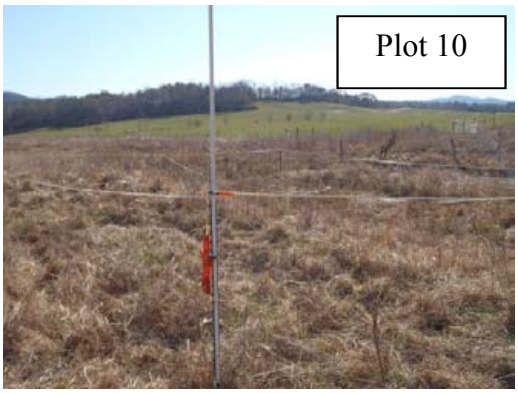


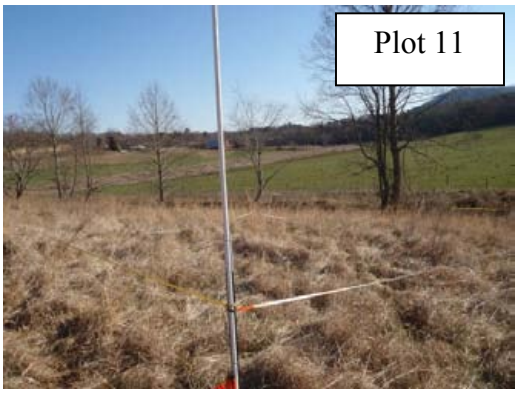
UT to Martin's Creek (Contreras)
Baseline Vegetation Monitoring Photographs
Taken March 25-26, 2014
(continued)











Appendix C.
Vegetation Plot Data

Table 5. Planted Stems
Table 6. Planted and Total Stem Counts

Table 5. Planted Woody Vegetation

Species	Quantity
Bare Root	
River birch (*Betula nigra*)	410
Pignut hickory (*Carya glabra*)	400
Mockernut hickory (*Carya tomentosa/alba*)	400
Persimmon (*Diospyros virginiana*)	200
Tulip poplar (*Liriodendron tulipifera*)	410
Sycamore (*Platanus occidentalis*)	412
Scarlet oak (*Quercus coccinea*)	700
Cherrybark oak (*Quercus pagoda*)	512
Water oak (*Quercus nigra*)	12
Northern red oak (*Quercus rubra*)	412
1-gallon Containers	
Common serviceberry (*Amelanchier arborea*)	25
Tag alder (*Alnus serrulata*)	3
Ironwood (*Carpinus caroliniana*)	50
Winterberry (*Ilex verticillata*)	3
TOTAL	**3949**

Table 6. Total and Planted Stem Counts
EEP Project Code 92766. Project Name: UT to Martin's Creek (Contreras)

			Current Plot Data (MY0 2014)																						
			92766-01-0001			92766-01-0002			92766-01-0003			92766-01-0004			92766-01-0005			92766-01-0006			92766-01-0007			92766-01-0008		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub																							
Amelanchier arborea	common serviceberry	Tree																							
Betula nigra	river birch	Tree	4	4	4							2	2	2	2	2	2	5	5	5	3	3	3			
Carpinus caroliniana	American hornbeam	Tree													4	4	4									
Carya	hickory	Tree				2	2	2																		
Carya alba	mockernut hickory	Tree	1	1	1	1	1	1	3	3	3															
Carya glabra	pignut hickory	Tree										1	1	1							1	1	1			
Cornus amomum	silky dogwood	Shrub														1	1									
Diospyros virginiana	common persimmon	Tree																								
Liriodendron tulipifera	tuliptree	Tree													3	3	3	1	1	1				1	1	1
Platanus occidentalis	American sycamore	Tree																								
Quercus	oak	Tree	5	5	5	4	4	4	3	3	3	6	6	6	1	1	1	8	8	8	4	4	4	7	7	7
Quercus pagoda	cherrybark oak	Tree										2	2	2							1	1	1			
Quercus nigra	water oak	Tree																						1	1	1
Quercus rubra	northern red oak	Tree																						1	1	1
Salix nigra	black willow	Tree			1																					
Unknown		Shrub or Tree																								
		Stem count	10	10	11	7	7	7	6	6	6	11	11	11	10	11	11	14	14	14	9	9	9	10	10	10
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	3	3	4	3	3	3	2	2	2	4	4	4	4	5	5	3	3	3	4	4	4	4	4	4
		Stems per ACRE	404.7	404.7	445.2	283.3	283.3	283.3	242.8	242.8	242.8	445.2	445.2	445.2	404.7	445.2	445.2	566.6	566.6	566.6	364.2	364.2	364.2	404.7	404.7	404.7

Color for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

PnoLS = Planted stems excluding live stakes
P-all = Planted stems including live stakes
T = Planted stems and natural recruits
Total includes stems of natural recruits

Table 6. Total and Planted Stem Counts
EEP Project Code 92766. Project Name: UT to Martin's Creek (Contreras)

			Current Plot Data (MY) 2014)									Annual Means		
			92766-01-0009			92766-01-0010			92766-01-0011			MY0 (2014)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub						1						1
Amelanchier arborea	common serviceberry	Tree	3	3	3							3	3	3
Betula nigra	river birch	Tree				3	3	3				19	19	19
Carpinus caroliniana	American hornbeam	Tree	1	1	1							5	5	5
Carya	hickory	Tree										2	2	2
Carya alba	mockernut hickory	Tree										5	5	5
Carya glabra	pignut hickory	Tree							3	3	3	5	5	5
Cornus amomum	silky dogwood	Shrub									1		1	2
Diospyros virginiana	common persimmon	Tree	1	1	1							1	1	1
Liriodendron tulipifera	tuliptree	Tree	1	1	1				1	1	1	7	7	7
Platanus occidentalis	American sycamore	Tree	6	6	6	3	3	3	1	1	1	10	10	10
Quercus	oak	Tree	6	6	6	1	1	1	4	4	4	49	49	49
Quercus pagoda	cherrybark oak	Tree				2	2	2				5	5	5
Quercus nigra	water oak	Tree										1	1	1
Quercus rubra	northern red oak	Tree										1	1	1
Salix nigra	black willow	Tree												1
Unknown		Shrub or Tree									6			6
		Stem count	18	18	18	9	9	10	9	9	16	113	114	123
		size (ares)	1			1			1			11		
		size (ACRES)	0.02			0.02			0.02			0.27		
		Species count	6	6	6	4	4	5	4	4	6	13	14	17
		Stems per ACRE	728.4	728.4	728.4	364.2	364.2	404.7	364.2	364.2	647.5	415.7	419.4	452.5

Color for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

PnoLS = Planted stems excluding live stakes
P-all = Planted stems including live stakes
T = Planted stems and natural recruits
Total includes stems of natural recruits

Appendix D.
Stream Geomorphology Data

Tables 7a-7f. Baseline Stream Data Summary
Tables 8a-8f. Monitoring Data-Dimensional Data Summary
Cross-section Plots
Longitudinal Profile Plots

Table 7a. Baseline Stream Data Summary (UT -1 to Martin's Creek)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Gauge	Regional Curve			Pre-Existing Condition (UT-1)					Reference Reach(es) Data					Design (UT-1)			Monitoring Baseline				
Dimension and Substrate - Riffle Only		**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Max**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)					9.2			16.9		11.7			21.7		12.5	15.0		11.7	12.3	12.2	13.8	0.7
Floodprone Width (ft)					31.0			51.0		20			410		50	100		50	71	50	100	27
BF Mean Depth (ft)					1.0			1.6		0.6			1.0		1.0	1.2		0.9	1.0	1.1	1.1	0.1
BF Max Depth (ft)					2.1			2.6		0.9			2.5		1.2	1.7		1.5	1.7	1.7	1.8	0.2
BF Cross Sectional Area (ft^2)					12.8			18.8		10.2			13.1		12.5	18.0		11.5	12.7	12.8	14.7	1.2
Width/Depth Ratio					6.0			17.6		10.7			17.0		12.5	12.5		10.6	11.9	11.7	13.7	1.0
Entrenchment Ratio					>2.4			>5		1.7			32.0		3.5	7.7		4.1	5.8	5.8	8.5	2.1
Bank Height Ratio					1.1			1.7		1.0			1.0		1.0	1.0			1.0	1.0		
Profile																						
Riffle length (ft)																		5	33	35	55	12.2
Riffle slope (ft/ft)										0.2000			1.9000		0.0140	0.0140		0.0000	0.0107	0.0115	0.0230	0.0053
Pool length (ft)																		10.0	40.0	36.0	82.0	17.4
Pool Max depth (ft)										2.2			2.5		2.0	3.6		2.3	2.6	2.7	2.8	0.2
Pool spacing (ft)										48.0			231.0		50.0	105.0		10.0	66.0	70.0	118.0	31.0
Pattern																						
Channel Beltwidth (ft)										16			55		19	60		19			60	
Radius of Curvature (ft)										28			47		23	53		23			53	
Rc:Bankfull width (ft/ft)										2			3		1.8	3.5		1.8			3.5	
Meander Wavelength (ft)										70			260		87.5	180		87.5			180	
Meander Width ratio										4.4			17.6		7	12		7			12	
Transport parameters																						
Reach Shear Stress (competency) lbs/ft^2																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m^2																						
Additional Reach Parameters																						
Rosgen Classification					Bc/Cc/E					Aa/Bc					C			E				
Bankfull Velocity (fps)					3.6 - 4.2										3.5 - 4.2							
Bankfull Discharge (cfs)					46 - 60																	
Valley Length (ft)																						
Channel Thalweg Length (ft)																		3180				
Sinuosity					1.17					1.19					1.5			1.5				
Water Surface Slope (ft/ft)					0.0075					0.0333					0.0058			0.0069				
BF slope (ft/ft)																						
Bankfull Floodplain Area (acres)																						
% of Reach with Eroding Banks					----					----												
Channel Stability or Habitat Metric					----					----												
Biological or Other					----					----												

Table 7b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							Monitoring Baseline						
Ri%/RU%P%G%/S%																											
SC%/SA%/G%/C%/B%BE%																											
d16/d35/d50/d84/d95	3.0	12.6	17.9	72.3	84.0																						
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																											
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0																											

Table 7c. Baseline Stream Data Summary (UT 1-1 and UT 1-2 to Martin's Creek)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Gauge	Regional Curve			Pre-Existing Condition					Reference Reach(es) Data					Design			Monitoring Baseline				
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Max	Med	Min	Mean	Med	Max	SD
BF Width (ft)					4.5			6.7		11.7			21.7				4.5		2.9			
Floodprone Width (ft)					5.4			8.5		20			410				13.5		14			
BF Mean Depth (ft)					0.3			0.4		0.6			1.0				0.4		0.5			
BF Max Depth (ft)					0.5			1.0		0.9			2.5				0.5		0.7			
BF Cross Sectional Area (ft^2)					1.5			2.4		10.2			13.1				1.7		1.4			
Width/Depth Ratio					13.2			18.9		10.7			17.0				12.0		6.0			
Entrenchment Ratio					1.2			1.6		1.7			32.0				3.0		4.8			
Bank Height Ratio					1.0			4.4		1.0			1.0				1.0		1.0			
Profile																						
Riffle length (ft)																		5	24	15	67	21
Riffle slope (ft/ft)										0.2000			1.9000				0.0140	0.0000	0.0357	0.0332	0.1101	0.0245
Pool length (ft)																		4.0	8.0	8.0	14.0	2.3
Pool Max depth (ft)										2.2			2.5				0.8	----	----	----	----	----
Pool spacing (ft)										48.0			231.0				32.0	6.0	32.0	23.0	78.0	22.0
Pattern																						
Channel Beltwidth (ft)										16			55									
Radius of Curvature (ft)										28			47				34			34		
Rc:Bankfull width (ft/ft)										2			3				7.6			7.6		
Meander Wavelength (ft)										70			260									
Meander Width ratio										4.4			17.6									
Transport parameters																						
Reach Shear Stress (competency) lbs/ft^2																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m^2																						
Additional Reach Parameters																						
Rosgen Classification					C					Aa/Bc					C			E				
Bankfull Velocity (fps)					3.5 - 4.1										3.5 - 4.1							
Bankfull Discharge (cfs)					6.0 - 7.0																	
Valley Length (ft)																						
Channel Thalweg Length (ft)																		580				
Sinuosity					1.02 - 1.08					1.19					1.03			1.03				
Water Surface Slope (ft/ft)					0.0096 - 0.0333					0.0333					0.0096 - 0.0333			0.0383				
BF slope (ft/ft)					----					----					----							
Bankfull Floodplain Area (acres)					----					----					----							
% of Reach with Eroding Banks					----					----												
Channel Stability or Habitat Metric					----					----												
Biological or Other					----					----												

Table 7d. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							Monitoring Baseline						
Ri%/RU%P%G%/S%																											
SC%/SA%/G%/C%/B%BE%																											
d16/d35/d50/d84/d95																											
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																											
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0																											

Table 7e. Baseline Stream Data Summary (UT 1-3 to Martin's Creek)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Gauge	Regional Curve			Pre-Existing Condition					Reference Reach(es) Data					Design			Monitoring Baseline				
Dimension and Substrate - Riffle Only		**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Max**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)					6.3			14.3		11.7			21.7				6.5	5.9	6.6	6.6	7.3	1
Floodprone Width (ft)					10.2			32.6		20			410				14.0		25	25		
BF Mean Depth (ft)					0.2			0.5		0.6			1.0				0.5	0.4	0.5	0.5	0.5	0.1
BF Max Depth (ft)					0.8			1.0		0.9			2.5				0.7	0.9	1.0	1.0	1.0	0.1
BF Cross Sectional Area (ft^2)					3.2			3.5		10.2			13.1				3.5	2.7	3.2	3.2	3.6	0.6
Width/Depth Ratio					12.5			58.6		10.7			17.0				12.0	14.6	14.7	14.7	14.8	0.1
Entrenchment Ratio					>1.6			2.3		1.7			32.0				2.2	3.4	3.8	3.8	4.2	0.6
Bank Height Ratio					1.2			1.3		1.0			1.0				1.0		1.0	1.0		
Profile																						
Riffle length (ft)																		4	41	22	173	44
Riffle slope (ft/ft)										0.2000			1.9000				0.0140	0.0047	0.0318	0.0326	0.0913	0.0218
Pool length (ft)																		5.0	12.0	7.0	50.0	11.0
Pool Max depth (ft)										2.2			2.5				1.1					
Pool spacing (ft)										48.0			231.0				45.0	11.0	51.0	31.0	178.0	43.0
Pattern																						
Channel Beltwidth (ft)										16			55									
Radius of Curvature (ft)										28			47									
Rc:Bankfull width (ft/ft)										2			3									
Meander Wavelength (ft)										70			260									
Meander Width ratio										4.4			17.6									
Transport parameters																						
Reach Shear Stress (competency) lbs/ft^2																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m^2																						
Additional Reach Parameters																						
Rosgen Classification					B					Aa/Bc					B			C/E				
Bankfull Velocity (fps)					2.5 - 2.9										2.3							
Bankfull Discharge (cfs)					8.0 - 10.0																	
Valley Length (ft)																						
Channel Thalweg Length (ft)																		813				
Sinuosity					1.08					1.19					1.08			1.08				
Water Surface Slope (ft/ft)					0.0275					0.0333					0.0275			0.0321				
BF slope (ft/ft)					----					----					----							
Bankfull Floodplain Area (acres)					----					----					----							
% of Reach with Eroding Banks					----					----												
Channel Stability or Habitat Metric					----					----												
Biological or Other					----					----												

Table 7f. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							Monitoring Baseline						
Ri%/RU%P%G%/S%																												
SC%/SA%/G%/C%/B%BE%																												
d16/d35/d50/d84/d95																												
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																												
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0																												

Table 8a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Cross Section 1 UT - 1 Riffle							Cross Section 2 UT - 1 Riffle							Cross Section 3 UT - 1 Pool							Cross Section 4 UT - 1 Riffle							Cross Section 5 UT - 1 Riffle							Cross Section 6 UT - 1 Pool						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	11.7							12.5							16.4							13.8							12.1							13.0						
Floodprone Width (ft) (approx)	100.0							100.0							NA							100.0							50.0							NA						
BF Mean Depth (ft)	1.1							1.1							1.2							1.1							1.1							1.4						
BF Max Depth (ft)	1.7							1.8							2.5							1.8							1.8							2.8						
BF Cross Sectional Area (ft^2)	13.3							13.4							19.9							14.7							12.8							18.3						
Width/Depth Ratio	10.3							11.7							NA							13.0							11.4							NA						
Entrenchment Ratio	8.5							8.0							NA							7.2							4.1							NA						
Bank Height Ratio	1.0							1.0							1.0							1.0							1.0							1.0						
d50 (mm)	----							----							----							----							28.6							----						

Parameter	Cross Section 7 UT - 1 Riffle							Cross Section 8 UT - 1 Riffle							Cross Section 9 UT - 1 Pool							Cross Section 10 UT - 1 Pool							Cross Section 11 UT - 1 Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	11.7							12.2							9.4							9.6							12.3						
Floodprone Width (ft) (approx)	50.0							50.0							NA							NA							50.0						
BF Mean Depth (ft)	1.0							1.0							1.6							1.8							0.9						
BF Max Depth (ft)	1.5							1.5							2.3							2.8							1.5						
BF Cross Sectional Area (ft^2)	11.7							11.8							15.5							17.0							11.5						
Width/Depth Ratio	11.7							12.6							NA							NA							13.2						
Entrenchment Ratio	4.3							4.1							NA							NA							4.1						
Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						
d50 (mm)	----							----							----							----							----						

Table 8b. Monitoring Data - Stream Reach Data Summary
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Baseline (UT - 1)					MY-1 (UT - 1)					MY-2 (UT - 1)					MY-3 (UT - 1)					MY-4 (UT - 1)					MY-5 (UT - 1)				
Dimension and Substrate - Riffle Only	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)	11.7	12.3	12.2	13.8	0.7																									
Floodprone Width (ft)	50	71	50	100	27																									
BF Mean Depth (ft)	0.9	1.0	1.1	1.1	0.1																									
BF Max Depth (ft)	1.5	1.7	1.7	1.8	0.2																									
BF Cross Sectional Area (ft^2)	11.5	12.7	12.8	14.7	1.2																									
Width/Depth Ratio	10.6	11.9	11.7	13.7	1.0																									
Entrenchment Ratio	4.1	5.8	5.8	8.5	2.1																									
Bank Height Ratio		1.0	1.0																											
Profile - UT -1																														
Riffle length (ft)	5	33	35	55	12.2																									
Riffle slope (ft/ft)	0.0000	0.0107	0.0115	0.0230	0.0053																									
Pool length (ft)	10	40	36	82	17																									
Pool Max depth (ft)	2.3	2.6	2.7	2.8	0.2																									
Pool spacing (ft)	10	66	70	118	31																									
Pattern																														
Channel Beltwidth (ft)	19			60																										
Radius of Curvature (ft)	23			53																										
Rc:Bankfull width (ft/ft)	1.8			3.5																										
Meander Wavelength (ft)	87.5			180																										
Meander Width ratio	7			12																										
Additional Reach Parameters																														
Rosgen Classification	E-Type																													
Channel Thalweg Length (ft)	3180																													
Sinuosity	1.5																													
Water Surface Slope (Channel) (ft/ft)	0.0069																													
BF slope (ft/ft)	-----																													
Ri%/RU%P%/G%/S%																														
SC%/SA%/G%/C%/B%BE%																														
d16/d35/d50/d84/d95																														
% of Reach with Eroding Banks	-----																													
Channel Stability or Habitat Metric	-----																													
Biological or Other	-----																													

Table 8c. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Cross Section 12 UT 1 -1 Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	2.9						
Floodprone Width (ft) (approx)	14.0						
BF Mean Depth (ft)	0.5						
BF Max Depth (ft)	0.7						
BF Cross Sectional Area (ft^2)	1.4						
Width/Depth Ratio	6.0						
Entrenchment Ratio	4.8						
Bank Height Ratio	1.0						
d50 (mm)	----						

Table 8d. Monitoring Data - Stream Reach Data Summary
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Baseline (UT 1 - 1)					MY-1 (UT 1 - 1)					MY-2 (UT 1 - 1)					MY-3 (UT 1 - 1)					MY-4 (UT 1 - 1)					MY-5 (UT 1 - 1)				
Dimension and Substrate - Riffle Only	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)		2.9																												
Floodprone Width (ft)		14																												
BF Mean Depth (ft)		0.5																												
BF Max Depth (ft)		0.7																												
BF Cross Sectional Area (ft^2)		1.4																												
Width/Depth Ratio		6.0																												
Entrenchment Ratio		4.8																												
Bank Height Ratio		1.0																												
Profile - UT 1 - 1																														
Riffle length (ft)	5	24	15	67	21																									
Riffle slope (ft/ft)	0.0000	0.0357	0.0332	0.1101	0.0245																									
Pool length (ft)	4	8	8	14	2																									
Pool Max depth (ft)	----	----	----	----	----																									
Pool spacing (ft)	6	32	23	78	22																									
Pattern																														
Channel Beltwidth (ft)																														
Radius of Curvature (ft)			34																											
Rc:Bankfull width (ft/ft)			7.6																											
Meander Wavelength (ft)																														
Meander Width ratio																														
Additional Reach Parameters																														
Rosgen Classification	E-type																													
Channel Thalweg Length (ft)	580																													
Sinuosity	1.03																													
Water Surface Slope (Channel) (ft/ft)	0.0383																													
BF slope (ft/ft)	-----																													
Ri%/RU%P%G%/S%																														
SC%/SA%/G%/C%/B%BE%																														
d16/d35/d50/d84/d95																														
% of Reach with Eroding Banks	-----																													
Channel Stability or Habitat Metric	-----																													
Biological or Other	-----																													

Table 8e. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

Parameter	Cross Section 13 UT 1 - 3 Riffle							Cross Section 14 UT 1 - 3 Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	5.9							7.3						
Floodprone Width (ft) (approx)	25.0							25.0						
BF Mean Depth (ft)	0.5							0.5						
BF Max Depth (ft)	0.9							1.0						
BF Cross Sectional Area (ft^2)	2.7							3.6						
Width/Depth Ratio	12.9							14.8						
Entrenchment Ratio	4.2							3.4						
Bank Height Ratio	1.0							1.0						
d50 (mm)	----							----						

Table 8f. Monitoring Data - Stream Reach Data Summary
UT to Martin's Creek Mitigation Project - EEP Project Number 92766

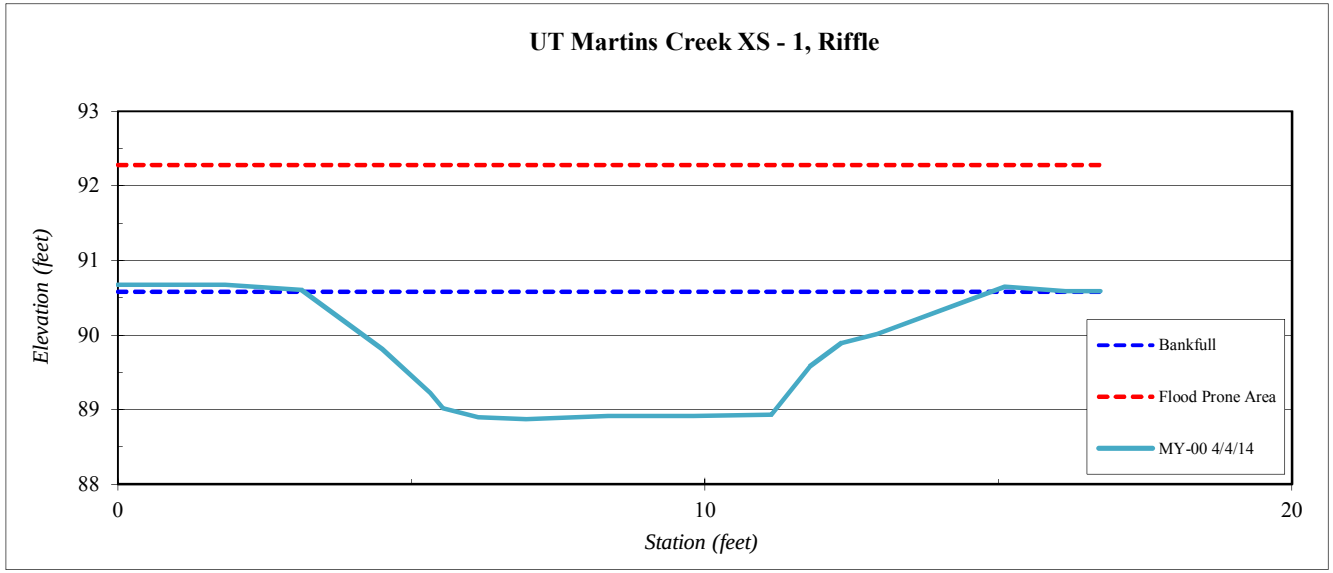
Parameter	Baseline (UT 1 - 3)					MY-1 (UT 1 - 3)					MY-2 (UT 1 - 3)					MY-3 (UT 1 - 3)					MY-4 (UT 1 - 3)					MY-5 (UT 1 - 3)				
Dimension and Substrate - Riffle Only	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)	5.9	6.6	6.6	7.3	1																								
Floodprone Width (ft)		25	25																										
BF Mean Depth (ft)	0.4	0.5	0.5	0.5	0.1																								
BF Max Depth (ft)	0.9	1.0	1.0	1.0	0.1																								
BF Cross Sectional Area (ft^2)	2.7	3.2	3.2	3.6	0.6																								
Width/Depth Ratio	14.6	14.7	14.7	14.8	0.1																								
Entrenchment Ratio	3.4	3.8	3.8	4.2	0.6																								
Bank Height Ratio		1.0	1.0																										
Profile - UT 1 - 3																													
Riffle length (ft)	4	41	22	173	44																								
Riffle slope (ft/ft)	0.0047	0.0318	0.0326	0.0913	0.0218																								
Pool length (ft)	5	12	7	50	11																								
Pool Max depth (ft)																													
Pool spacing (ft)	11	51	31	178	43																								
Pattern																													
Channel Beltwidth (ft)																													
Radius of Curvature (ft)																													
Rc:Bankfull width (ft/ft)																													
Meander Wavelength (ft)																													
Meander Width ratio																													
Additional Reach Parameters																													
Rosgen Classification	C/E type																												
Channel Thalweg Length (ft)	813																												
Sinuosity	1.08																												
Water Surface Slope (Channel) (ft/ft)	0.0321																												
BF slope (ft/ft)	-----																												
Ri%/RU%P%G%/S%																													
SC%/SA%/G%/C%/B%BE%																													
d16/d35/d50/d84/d95																													
% of Reach with Eroding Banks	-----																												
Channel Stability or Habitat Metric	-----																												
Biological or Other	-----																												

Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 1, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	90.67
1.84	90.67
3.11	90.60
4.50	89.81
5.32	89.22
5.54	89.02
6.14	88.90
6.96	88.87
8.35	88.91
9.82	88.91
11.13	88.93
11.79	89.58
12.33	89.89
12.93	90.02
15.11	90.65
16.1	90.59
16.7	90.59

SUMMARY DATA	
Bankfull Elevation:	90.6
Bankfull Cross-Sectional Area:	13.3
Bankfull Width:	11.7
Flood Prone Area Elevation:	92.3
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	1.1
W / D Ratio:	10.3
Entrenchment Ratio:	8.5
Bank Height Ratio:	1.0

Stream Type	E

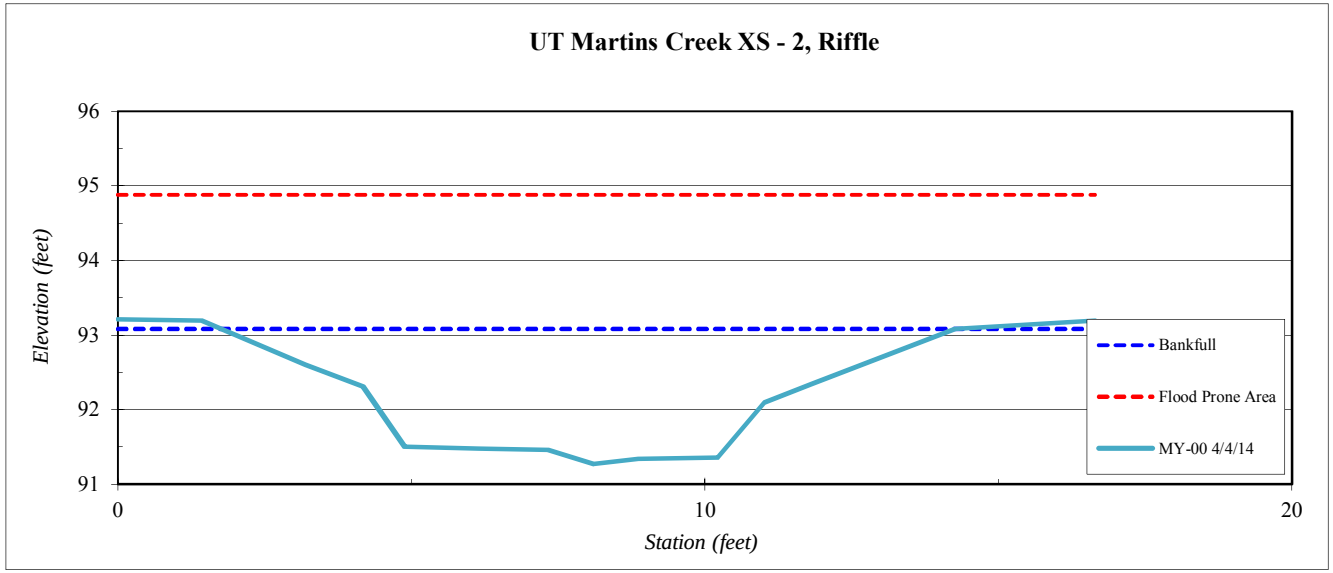


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 2, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	93.21
1.43	93.19
3.20	92.61
4.17	92.31
4.89	91.50
6.15	91.48
7.33	91.46
8.10	91.27
8.86	91.34
10.21	91.36
11.01	92.10
11.82	92.34
14.26	93.08
16.64	93.19

SUMMARY DATA	
Bankfull Elevation:	93.1
Bankfull Cross-Sectional Area:	13.4
Bankfull Width:	12.5
Flood Prone Area Elevation:	94.9
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.1
W / D Ratio:	11.7
Entrenchment Ratio:	8.0
Bank Height Ratio:	1.0

Stream Type	E

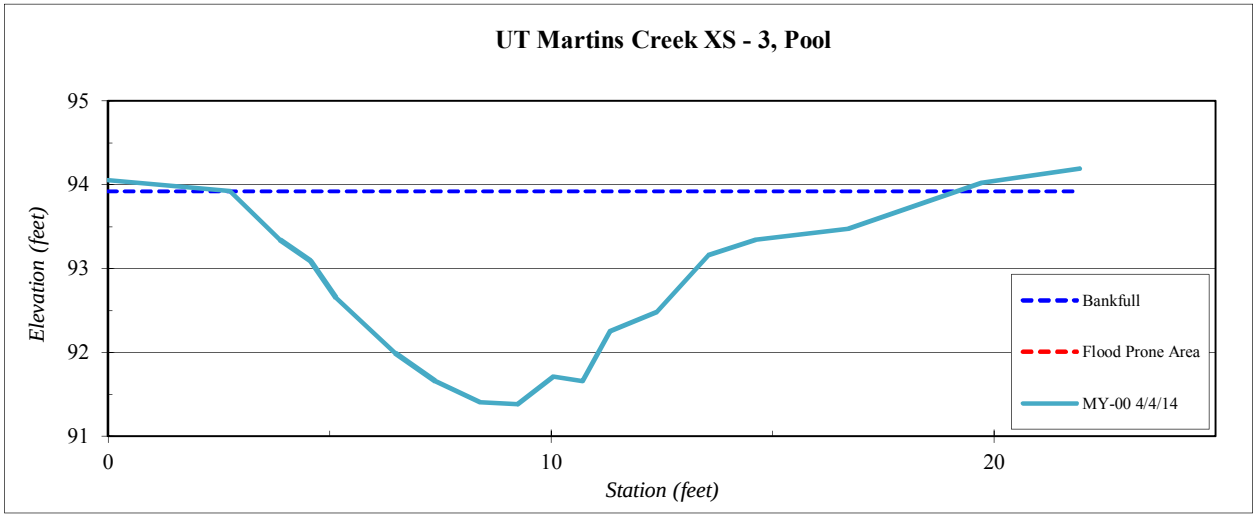


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 3, Pool
Feature	Pool
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	94.1
2.8	93.9
3.9	93.3
4.6	93.1
5.1	92.6
6.5	92.0
7.4	91.7
8.4	91.4
9.2	91.4
10.1	91.7
10.7	91.7
11.3	92.3
12.4	92.5
13.5	93.2
14.6	93.3
16.7	93.5
19.7	94.0
21.9	94.2

SUMMARY DATA	
Bankfull Elevation:	93.9
Bankfull Cross-Sectional Area:	19.9
Bankfull Width:	16.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	1.2
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E

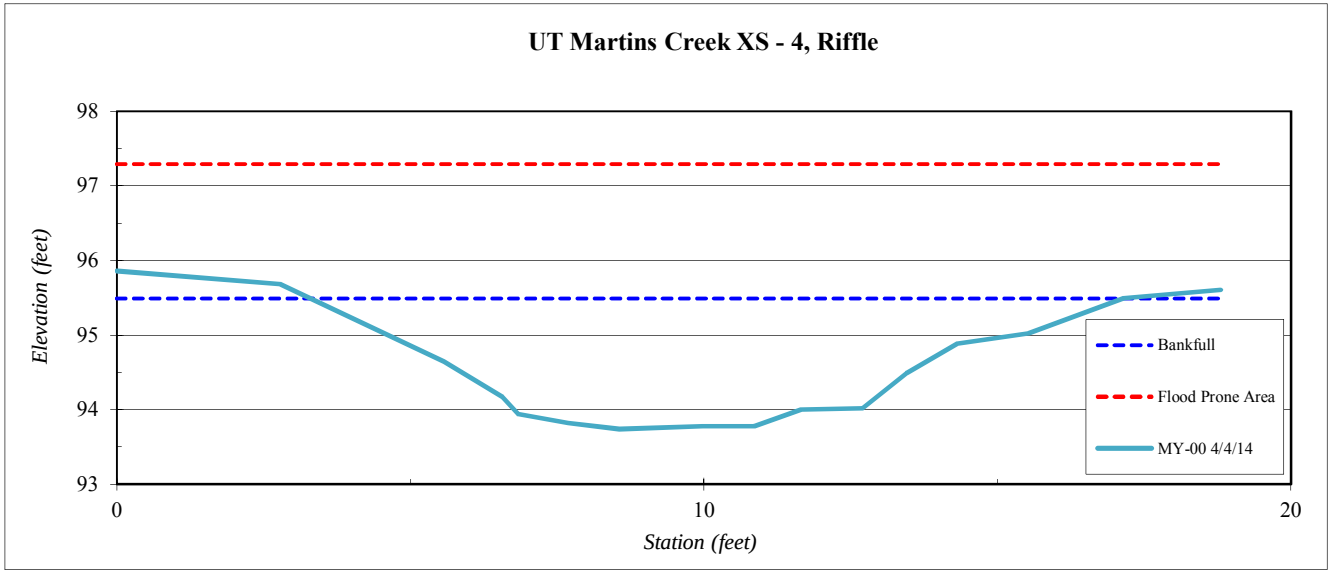


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 4, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	95.86
2.78	95.68
5.57	94.64
6.56	94.17
6.83	93.94
7.69	93.82
8.56	93.74
9.97	93.78
10.86	93.78
11.65	94.00
12.70	94.02
13.46	94.49
14.31	94.88
15.52	95.02
17.15	95.49
18.8	95.61

SUMMARY DATA	
Bankfull Elevation:	95.5
Bankfull Cross-Sectional Area:	14.7
Bankfull Width:	13.8
Flood Prone Area Elevation:	97.3
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.1
W / D Ratio:	13.0
Entrenchment Ratio:	7.2
Bank Height Ratio:	1.0

Stream Type	E

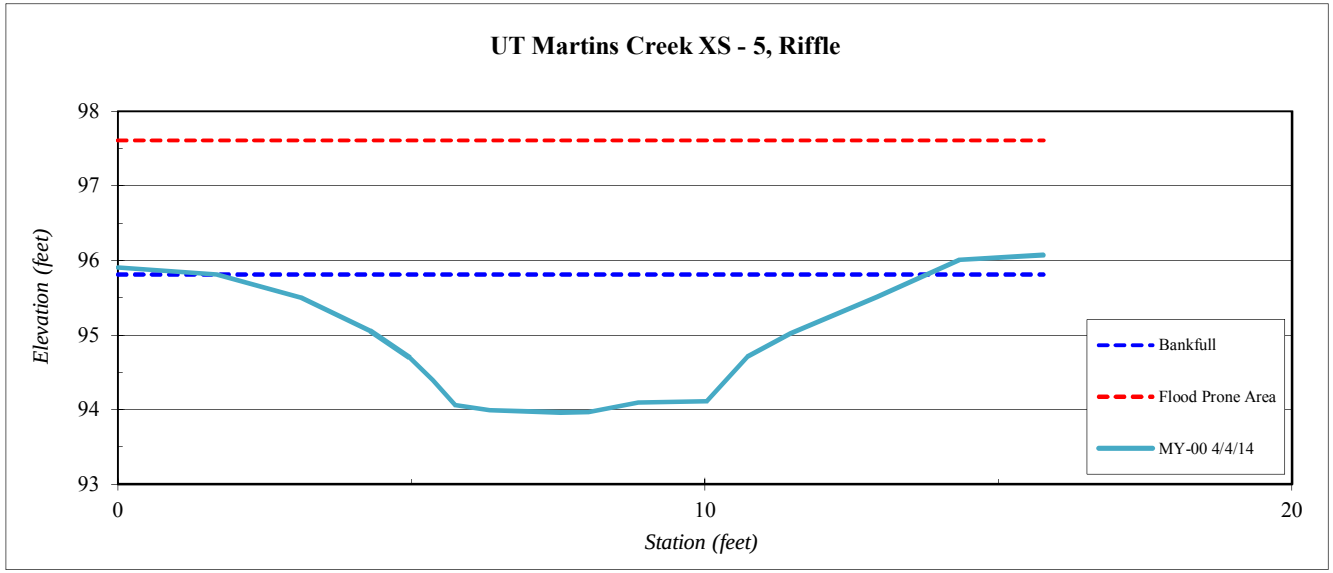


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 5, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	95.91
1.69	95.81
3.12	95.51
4.30	95.06
4.97	94.69
5.37	94.40
5.75	94.06
6.34	93.99
7.54	93.96
8.01	93.97
8.86	94.10
10.03	94.11
10.73	94.71
11.46	95.02
12.93	95.51
14.3	96.01
15.8	96.07

SUMMARY DATA	
Bankfull Elevation:	95.8
Bankfull Cross-Sectional Area:	12.8
Bankfull Width:	12.1
Flood Prone Area Elevation:	97.6
Flood Prone Width:	50.0
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.1
W / D Ratio:	11.4
Entrenchment Ratio:	4.1
Bank Height Ratio:	1.0

Stream Type	E

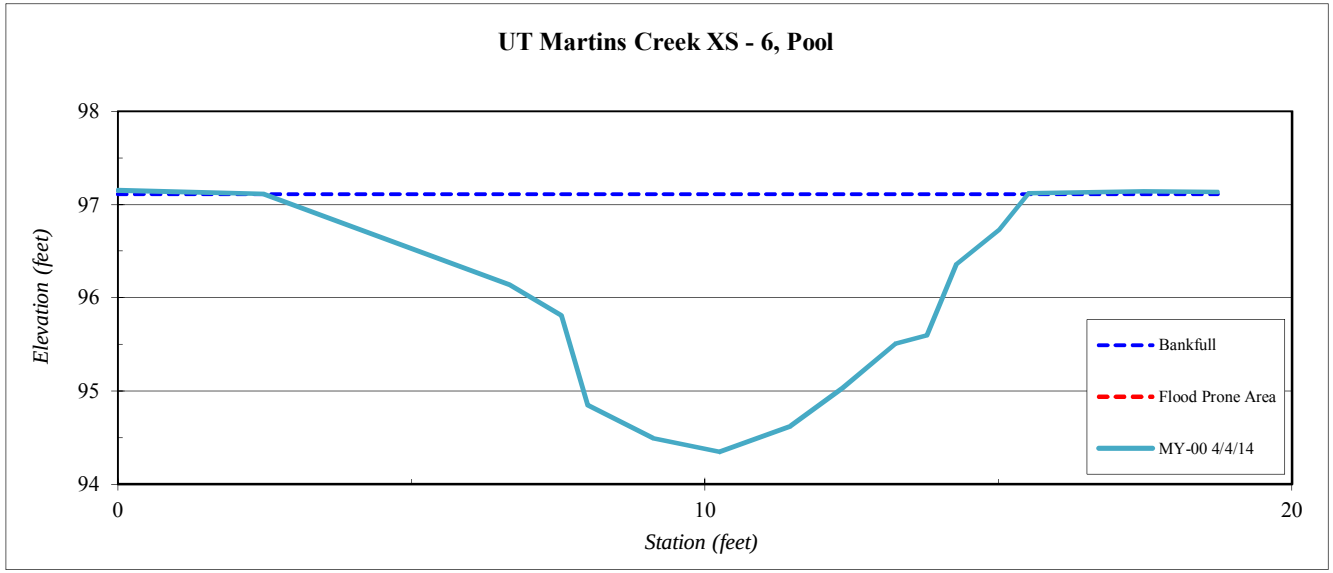


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 6, Pool
Feature	Pool
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	97.15
2.48	97.11
6.67	96.14
7.56	95.81
8.00	94.85
9.12	94.49
10.25	94.35
11.46	94.62
12.34	95.03
13.24	95.50
13.78	95.60
14.28	96.36
15.02	96.73
15.52	97.12
17.48	97.14
18.73	97.13

SUMMARY DATA	
Bankfull Elevation:	97.1
Bankfull Cross-Sectional Area:	18.3
Bankfull Width:	13.0
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.4
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E

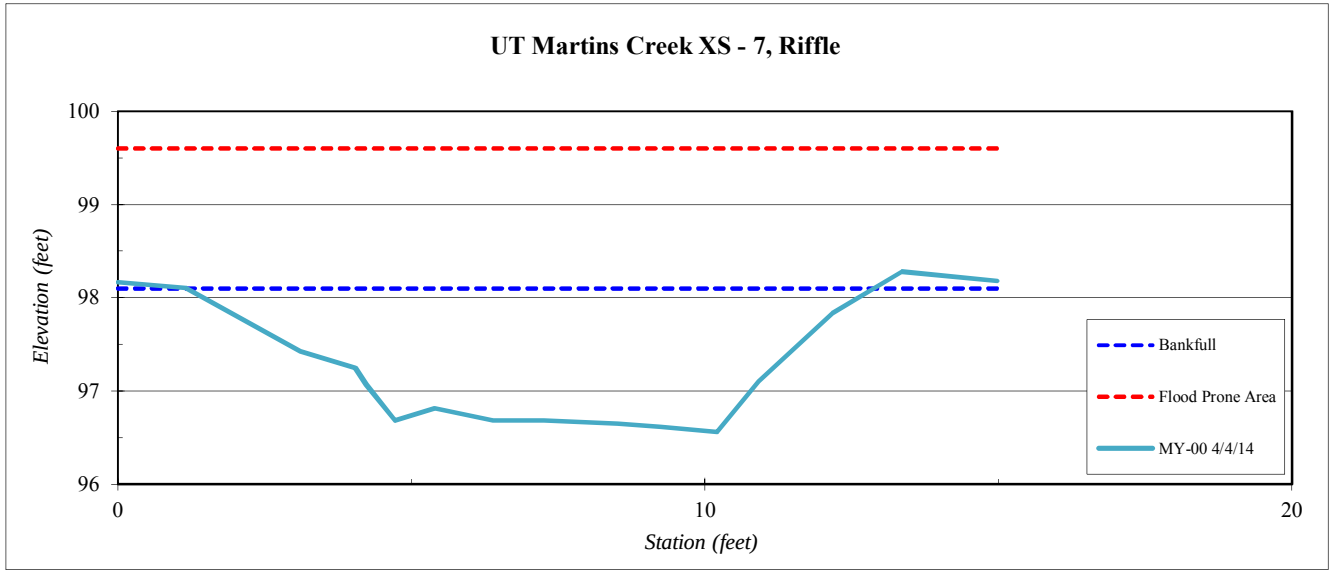


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 7, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	98.16
1.15	98.11
3.11	97.42
4.05	97.25
4.23	97.07
4.72	96.69
5.39	96.81
6.39	96.68
7.26	96.68
8.51	96.65
9.25	96.62
10.20	96.56
10.91	97.10
12.18	97.84
13.36	98.28
15.0	98.18

SUMMARY DATA	
Bankfull Elevation:	98.1
Bankfull Cross-Sectional Area:	11.7
Bankfull Width:	11.7
Flood Prone Area Elevation:	99.6
Flood Prone Width:	50.0
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	11.7
Entrenchment Ratio:	4.3
Bank Height Ratio:	1.0

Stream Type	E

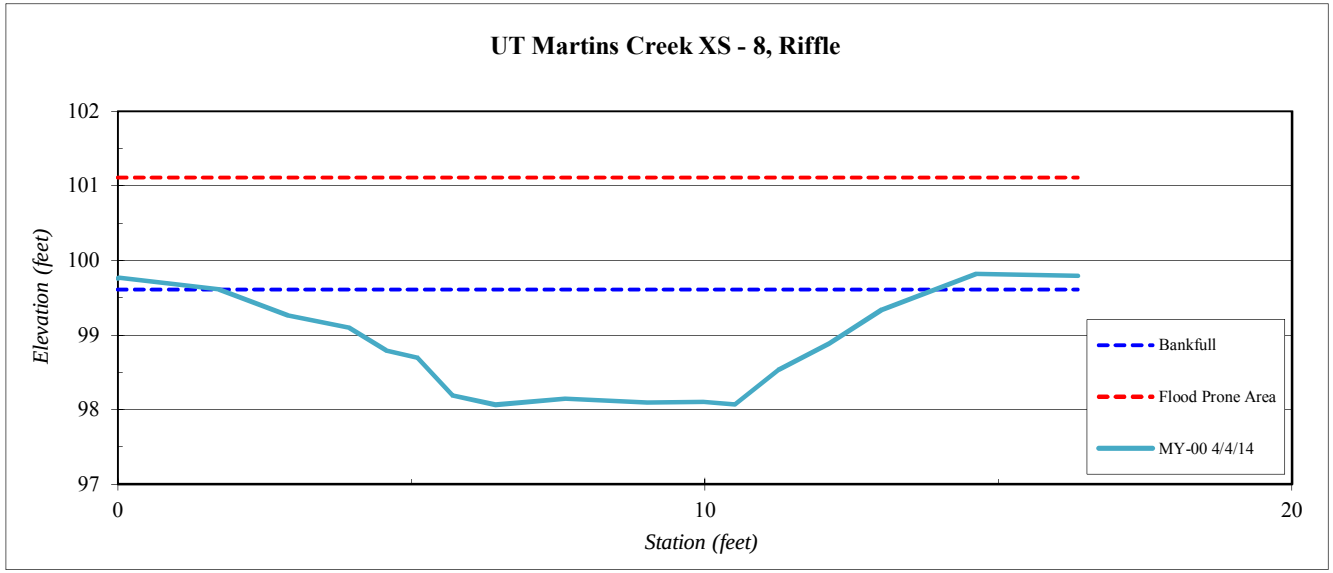


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 8, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	99.76
0.03	99.77
1.71	99.61
2.90	99.26
3.93	99.10
4.58	98.79
5.11	98.70
5.70	98.19
6.43	98.06
7.62	98.14
9.02	98.09
9.97	98.11
10.51	98.07
11.25	98.54
12.12	98.88
13.0	99.34
14.6	99.82
16.3	99.80

SUMMARY DATA	
Bankfull Elevation:	99.6
Bankfull Cross-Sectional Area:	11.8
Bankfull Width:	12.2
Flood Prone Area Elevation:	101.1
Flood Prone Width:	50.0
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	12.6
Entrenchment Ratio:	4.1
Bank Height Ratio:	1.0

Stream Type	E

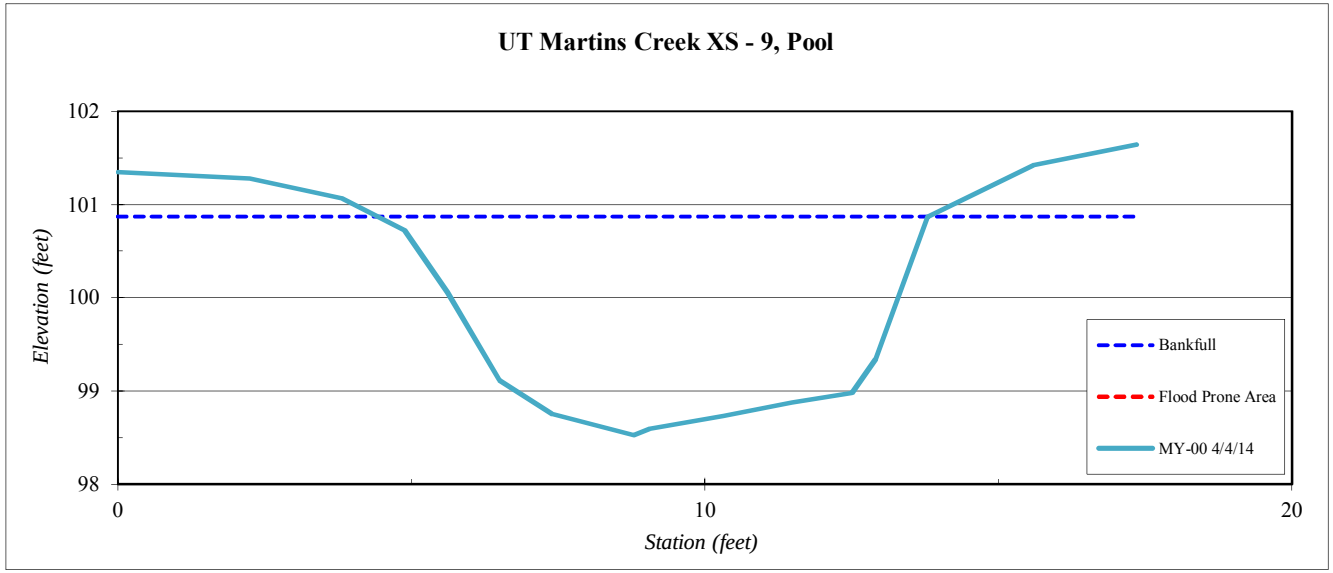


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 9, Pool
Feature	Pool
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	101.35
2.25	101.28
3.81	101.07
4.89	100.72
5.62	100.06
6.50	99.12
7.41	98.76
8.79	98.53
9.06	98.60
10.32	98.73
11.49	98.88
12.50	98.98
12.91	99.34
13.79	100.87
15.60	101.42
17.35	101.64

SUMMARY DATA	
Bankfull Elevation:	100.9
Bankfull Cross-Sectional Area:	15.5
Bankfull Width:	9.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.6
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E

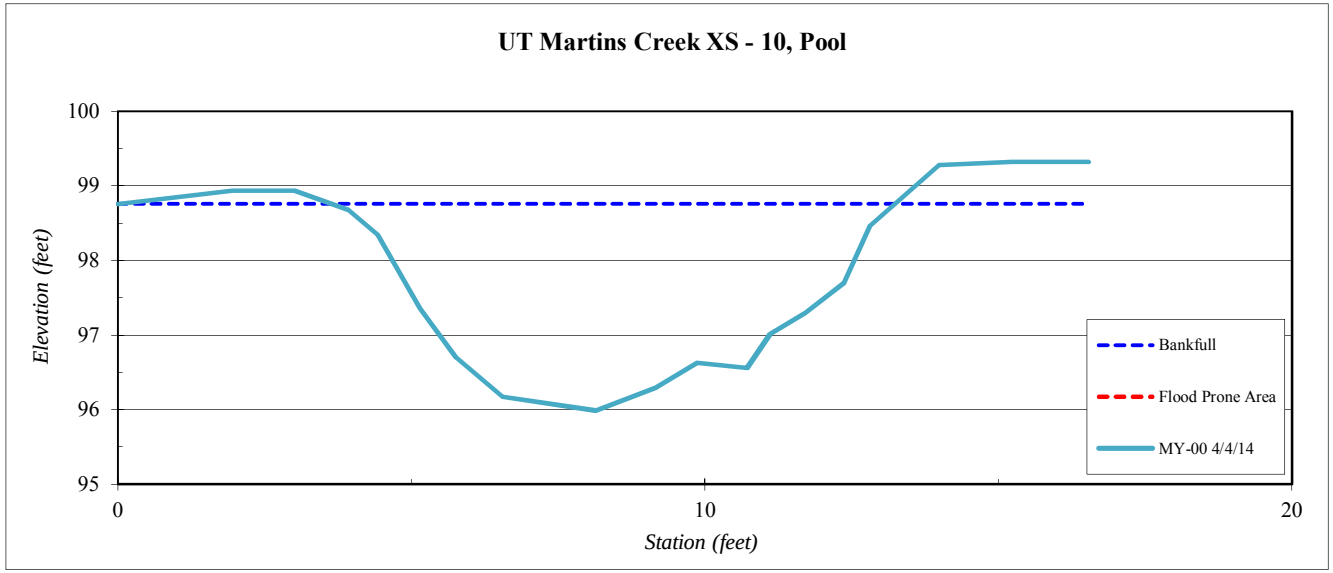


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 10, Pool
Feature	Pool
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	98.76
1.96	98.93
3.01	98.93
3.93	98.68
4.42	98.35
5.14	97.36
5.77	96.69
6.56	96.17
8.13	95.99
9.16	96.29
9.86	96.63
10.72	96.56
11.11	97.01
11.72	97.29
12.36	97.69
12.82	98.47
13.99	99.28
15.23	99.32
16.54	99.32

SUMMARY DATA	
Bankfull Elevation:	98.8
Bankfull Cross-Sectional Area:	17.0
Bankfull Width:	9.6
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.8
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E

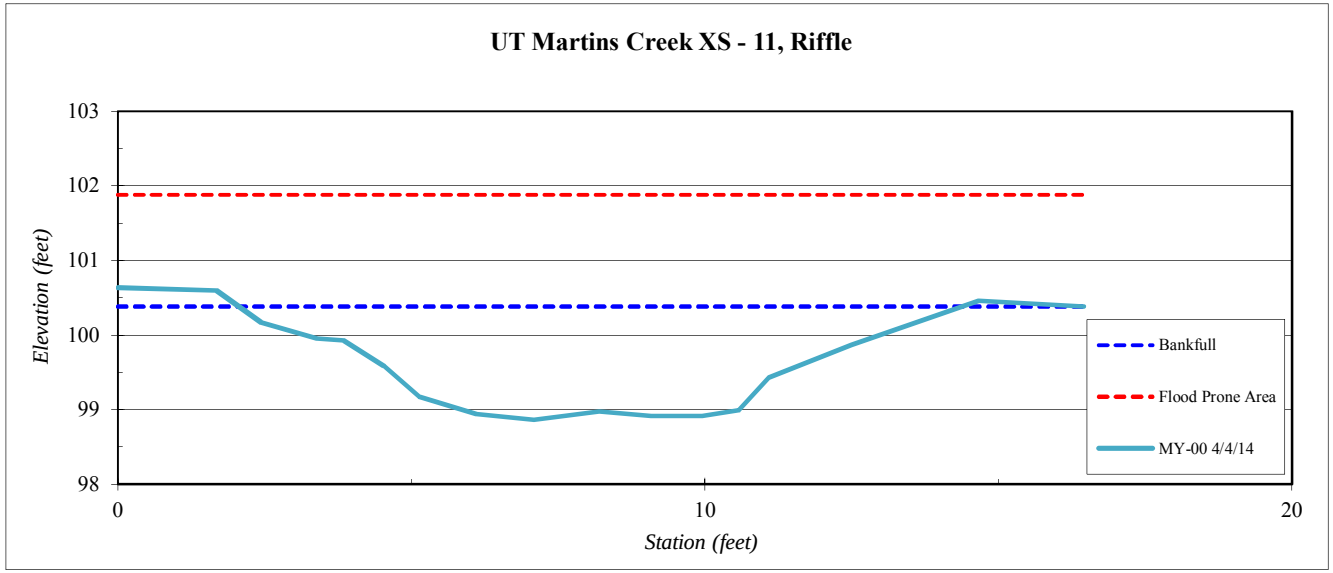


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 11, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	100.63
1.68	100.60
2.44	100.17
3.39	99.95
3.84	99.93
4.54	99.58
5.14	99.18
6.11	98.94
7.09	98.86
8.19	98.97
9.08	98.92
9.95	98.92
10.58	98.99
11.09	99.43
12.50	99.87
14.7	100.46
16.5	100.38

SUMMARY DATA	
Bankfull Elevation:	100.4
Bankfull Cross-Sectional Area:	11.5
Bankfull Width:	12.3
Flood Prone Area Elevation:	101.9
Flood Prone Width:	50.0
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.9
W / D Ratio:	13.2
Entrenchment Ratio:	4.1
Bank Height Ratio:	1.0

Stream Type	E

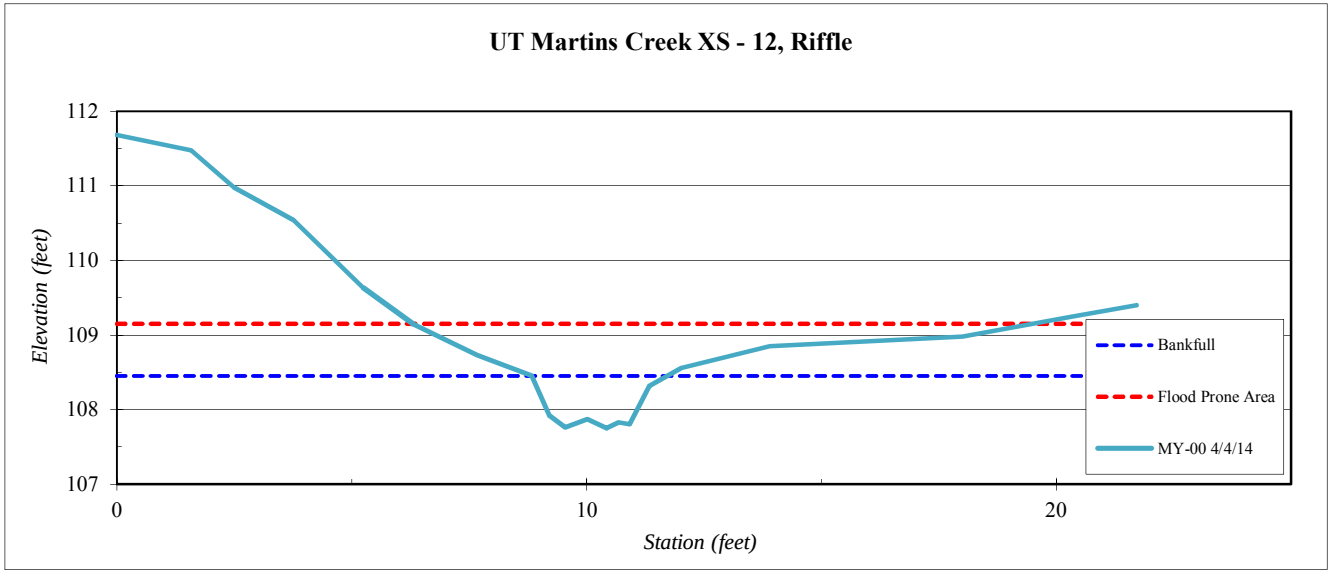


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 12, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	111.68
1.58	111.47
2.50	110.98
3.76	110.54
5.24	109.64
6.32	109.14
7.68	108.73
8.83	108.45
9.21	107.91
9.54	107.76
10.02	107.87
10.43	107.75
10.68	107.83
10.92	107.80
11.34	108.32
12.0	108.56
13.9	108.85
18.0	108.98
20.3	109.24
21.7	109.40

SUMMARY DATA	
Bankfull Elevation:	108.5
Bankfull Cross-Sectional Area:	1.4
Bankfull Width:	2.9
Flood Prone Area Elevation:	109.2
Flood Prone Width:	14.0
Max Depth at Bankfull:	0.7
Mean Depth at Bankfull:	0.5
W / D Ratio:	6.0
Entrenchment Ratio:	4.8
Bank Height Ratio:	1.0

Stream Type	E

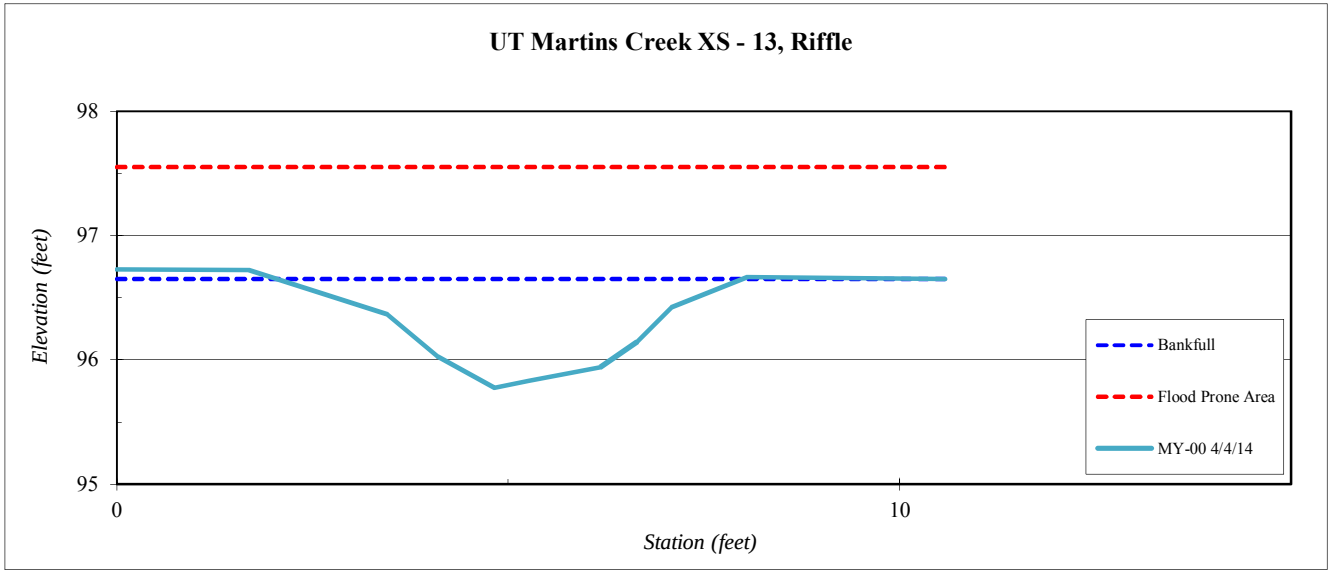


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 13, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	96.73
1.69	96.72
3.45	96.37
4.10	96.03
4.82	95.78
5.27	95.83
6.18	95.94
6.65	96.15
7.09	96.42
8.05	96.67
10.58	96.65

SUMMARY DATA	
Bankfull Elevation:	96.7
Bankfull Cross-Sectional Area:	2.7
Bankfull Width:	5.9
Flood Prone Area Elevation:	97.6
Flood Prone Width:	25.0
Max Depth at Bankfull:	0.9
Mean Depth at Bankfull:	0.5
W / D Ratio:	12.9
Entrenchment Ratio:	4.2
Bank Height Ratio:	1.0

Stream Type	C/E

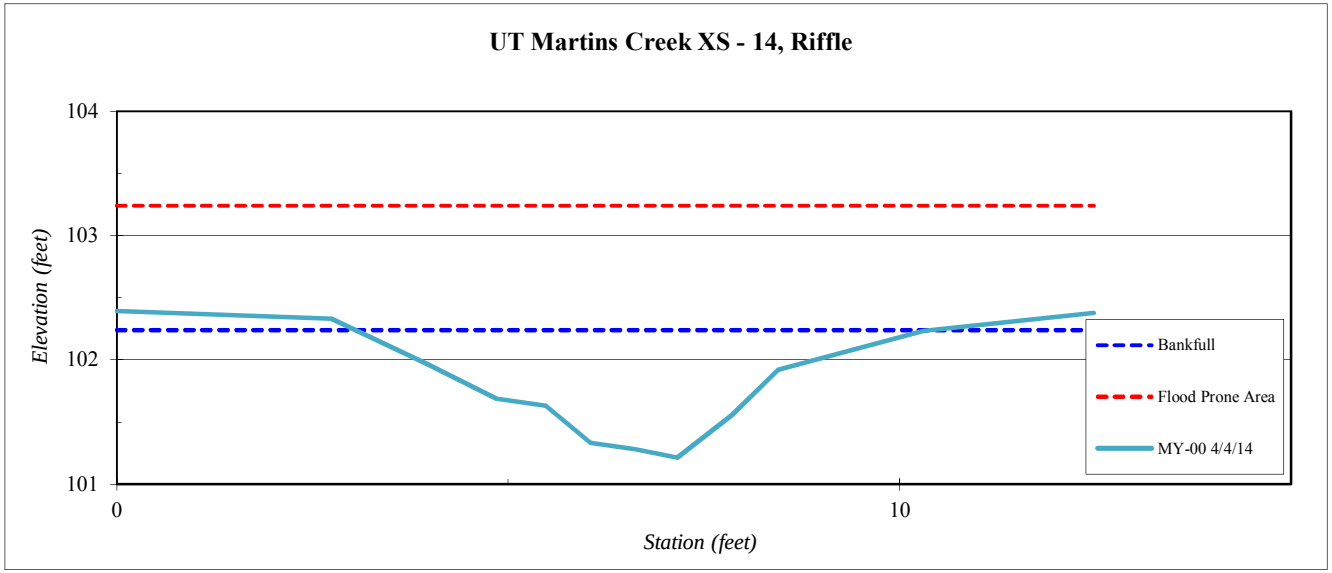


Site	UT to Martins
Watershed:	Hiwassee
XS ID	XS - 14, Riffle
Feature	Riffle
Date:	4/4/2014
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	102.39
2.74	102.33
3.95	101.97
4.85	101.69
5.48	101.63
6.05	101.33
6.62	101.28
7.15	101.21
7.86	101.55
8.44	101.92
10.31	102.24
12.48	102.38

SUMMARY DATA	
Bankfull Elevation:	102.2
Bankfull Cross-Sectional Area:	3.6
Bankfull Width:	7.3
Flood Prone Area Elevation:	103.2
Flood Prone Width:	25.0
Max Depth at Bankfull:	1.0
Mean Depth at Bankfull:	0.5
W / D Ratio:	14.8
Entrenchment Ratio:	3.4
Bank Height Ratio:	1.0

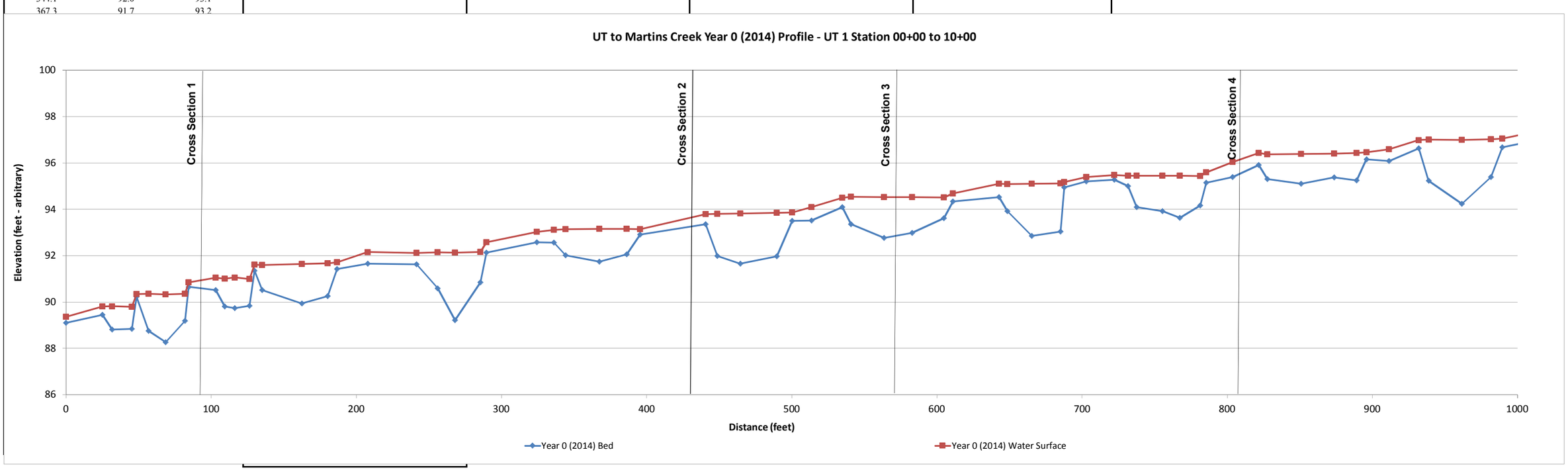
Stream Type	C/E



Project Name	UT to Martins Creek - Profile
Reach	UT 1 Station 00+00 - 10+00
Feature	Profile
Date	4/4/14
Crew	Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	89.1	89.4												
25.0	89.5	89.8												
31.7	88.8	89.8												
45.4	88.8	89.8												
48.5	90.2	90.3												
56.8	88.7	90.4												
68.6	88.3	90.3												
82.0	89.2	90.4												
84.6	90.7	90.8												
103.2	90.5	91.0												
109.4	89.8	91.0												
116.3	89.7	91.1												
126.5	89.8	91.0												
129.8	91.3	91.6												
135.2	90.5	91.6												
162.4	89.9	91.6												
180.3	90.3	91.7												
186.8	91.4	91.7												
207.9	91.7	92.2												
241.5	91.6	92.1												
255.9	90.6	92.1												
268.0	89.2	92.1												
285.6	90.8	92.2												
289.7	92.1	92.6												
324.3	92.6	93.0												
336.1	92.6	93.1												
344.1	92.0	93.1												
367.3	91.7	93.2												

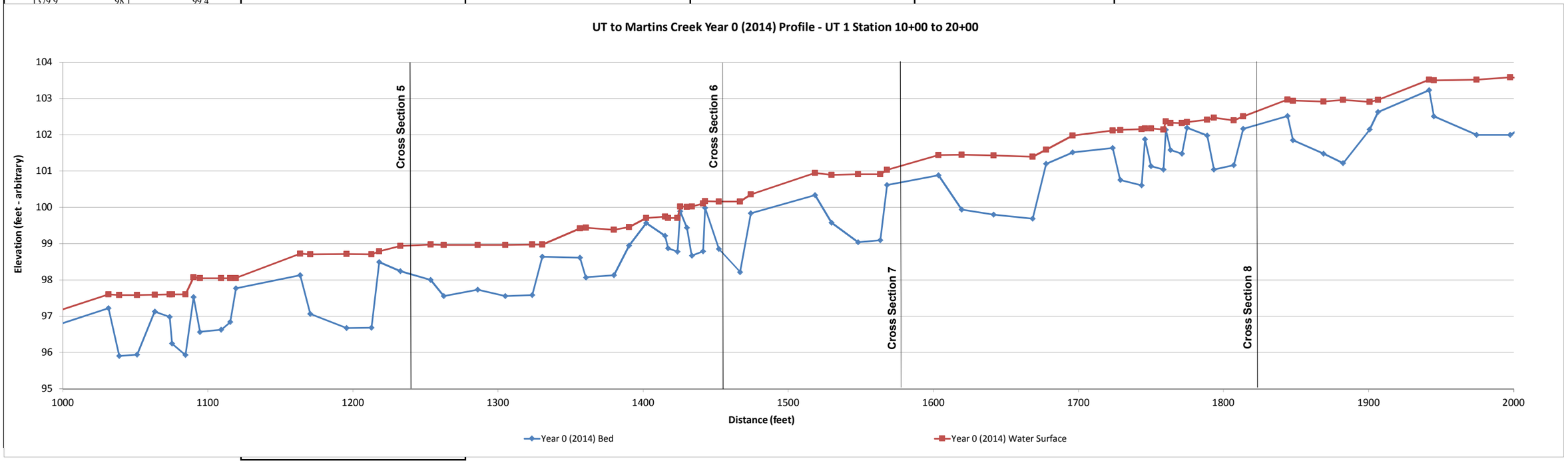
	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0069				
Riffle Length	33				
Avg. Riffle Slope	0.0107				
Pool Length	40				
Pool to Pool Spacing	66				



Project Name	UT to Martins Creek - Profile
Reach	UT 1 Station 10+00 - 20+00
Feature	Profile
Date	4/4/14
Crew	Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
989.7	96.7	97.0												
1031.5	97.2	97.6												
1038.8	95.9	97.6												
1051.3	95.9	97.6												
1063.4	97.1	97.6												
1073.6	97.0	97.6												
1075.3	96.2	97.6												
1084.7	95.9	97.6												
1090.1	97.5	98.1												
1094.6	96.6	98.0												
1109.2	96.6	98.0												
1115.5	96.8	98.0												
1119.4	97.8	98.0												
1163.7	98.1	98.7												
1170.6	97.1	98.7												
1195.7	96.7	98.7												
1212.9	96.7	98.7												
1218.0	98.5	98.8												
1232.6	98.2	98.9												
1253.5	98.0	99.0												
1262.6	97.5	99.0												
1286.1	97.7	99.0												
1304.9	97.6	99.0												
1323.5	97.6	99.0												
1330.4	98.6	99.0												
1356.5	98.6	99.4												
1360.5	98.1	99.4												
1379.9	98.1	99.4												

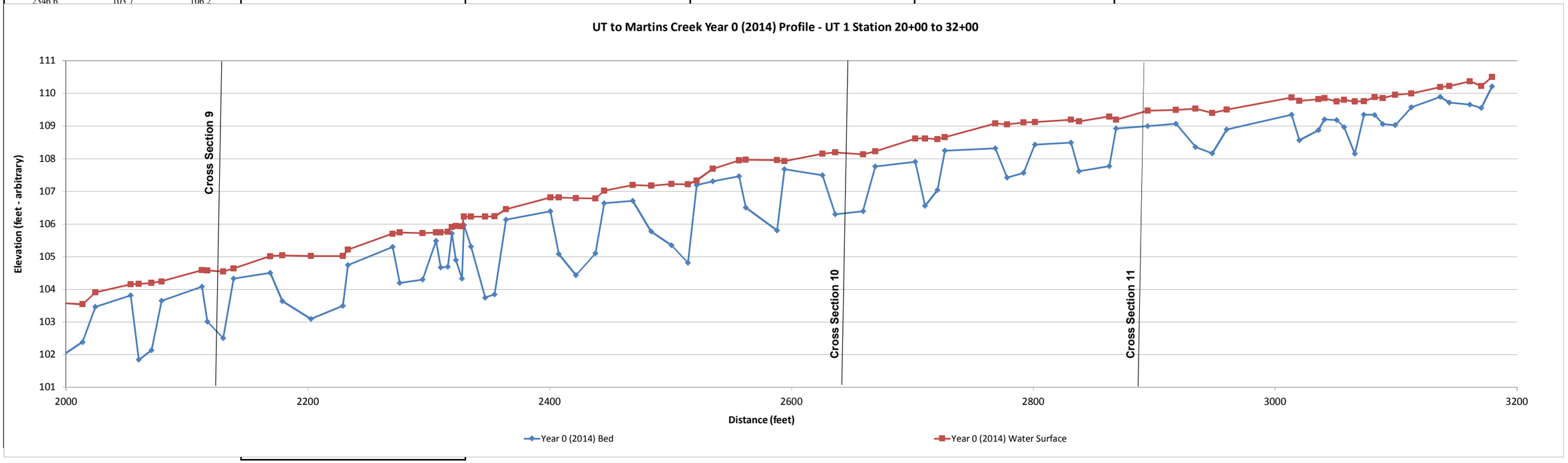
	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0069				
Riffle Length	33				
Avg. Riffle Slope	0.0107				
Pool Length	40				
Pool to Pool Spacing	66				



Project Name	UT to Martins Creek - Profile
Reach	UT 1 Station 20+00 - 32+00
Feature	Profile
Date	4/4/14
Crew	Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
1997.6	102.0	103.6												
2013.7	102.4	103.5												
2024.1	103.5	103.9												
2053.3	103.8	104.2												
2060.1	101.8	104.2												
2070.6	102.1	104.2												
2079.0	103.7	104.2												
2112.4	104.1	104.6												
2116.8	103.0	104.6												
2129.8	102.5	104.5												
2138.4	104.3	104.6												
2169.0	104.5	105.0												
2179.0	103.6	105.0												
2202.4	103.1	105.0												
2228.9	103.5	105.0												
2233.1	104.7	105.2												
2270.1	105.3	105.7												
2275.9	104.2	105.7												
2294.9	104.3	105.7												
2306.1	105.5	105.7												
2309.8	104.7	105.7												
2315.6	104.7	105.8												
2318.9	105.7	105.9												
2322.4	104.9	105.9												
2327.5	104.3	105.9												
2329.1	106.0	106.2												
2335.0	105.3	106.2												
2346.6	103.7	106.2												

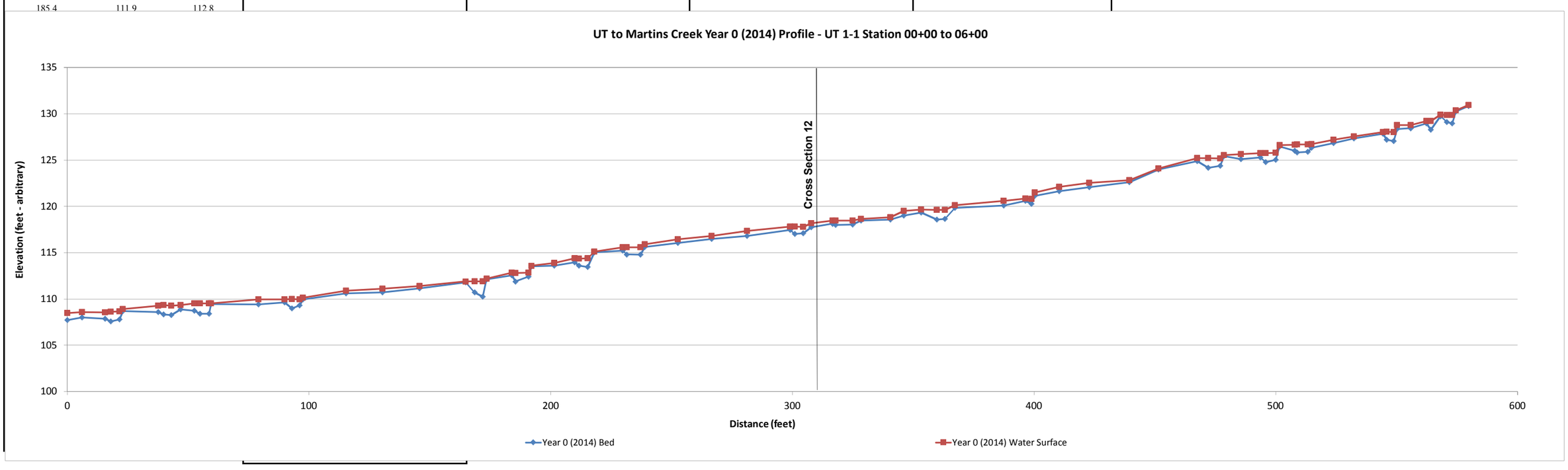
	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0069				
Riffle Length	33				
Avg. Riffle Slope	0.0107				
Pool Length	40				
Pool to Pool Spacing	66				



Project Name	UT to Martins Creek - Profile
Reach	UT 1-1 Station 00+00 - 06+00
Feature	Profile
Date	4/4/14
Crew	Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	107.7	108.5												
6.1	108.0	108.6												
15.6	107.9	108.5												
17.9	107.6	108.6												
21.6	107.8	108.7												
23.0	108.7	108.9												
37.6	108.6	109.3												
39.8	108.3	109.3												
43.1	108.3	109.3												
46.9	108.9	109.3												
52.5	108.7	109.5												
54.9	108.4	109.5												
58.7	108.4	109.5												
59.4	109.5	109.5												
79.1	109.4	110.0												
89.9	109.6	109.9												
92.9	109.0	110.0												
96.0	109.3	109.9												
97.4	110.0	110.1												
115.3	110.6	110.9												
130.4	110.7	111.1												
145.7	111.1	111.4												
164.9	111.8	111.9												
168.5	110.7	111.9												
171.9	110.3	111.9												
173.5	112.1	112.2												
183.9	112.5	112.8												
185.4	111.9	112.8												

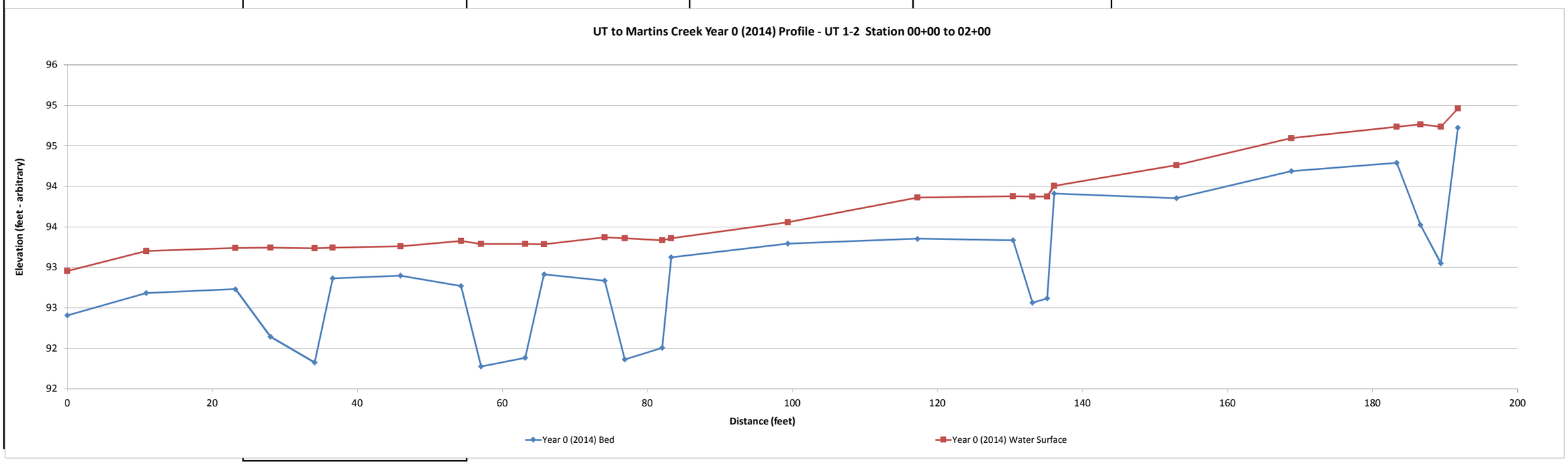
	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0383				
Riffle Length	24				
Avg. Riffle Slope	0.0357				
Pool Length	8				
Pool to Pool Spacing	32				



Project Name	UT to Martins Creek - Profile
Reach	UT 1-2 Station 00+00 - 02+00
Feature	Profile
Date	4/4/14
Crew	Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	92.4	93.0												
10.9	92.7	93.2												
23.2	92.7	93.2												
28.0	92.1	93.2												
34.1	91.8	93.2												
36.6	92.9	93.2												
46.0	92.9	93.3												
54.3	92.8	93.3												
57.1	91.8	93.3												
63.2	91.9	93.3												
65.7	92.9	93.3												
74.1	92.8	93.4												
76.9	91.9	93.4												
82.0	92.0	93.3												
83.3	93.1	93.4												
99.4	93.3	93.6												
117.3	93.4	93.9												
130.4	93.3	93.9												
133.1	92.6	93.9												
135.1	92.6	93.9												
136.1	93.9	94.0												
152.9	93.9	94.3												
168.8	94.2	94.6												
183.3	94.3	94.7												
186.6	93.5	94.8												
189.4	93.1	94.7												
191.8	94.7	95.0												

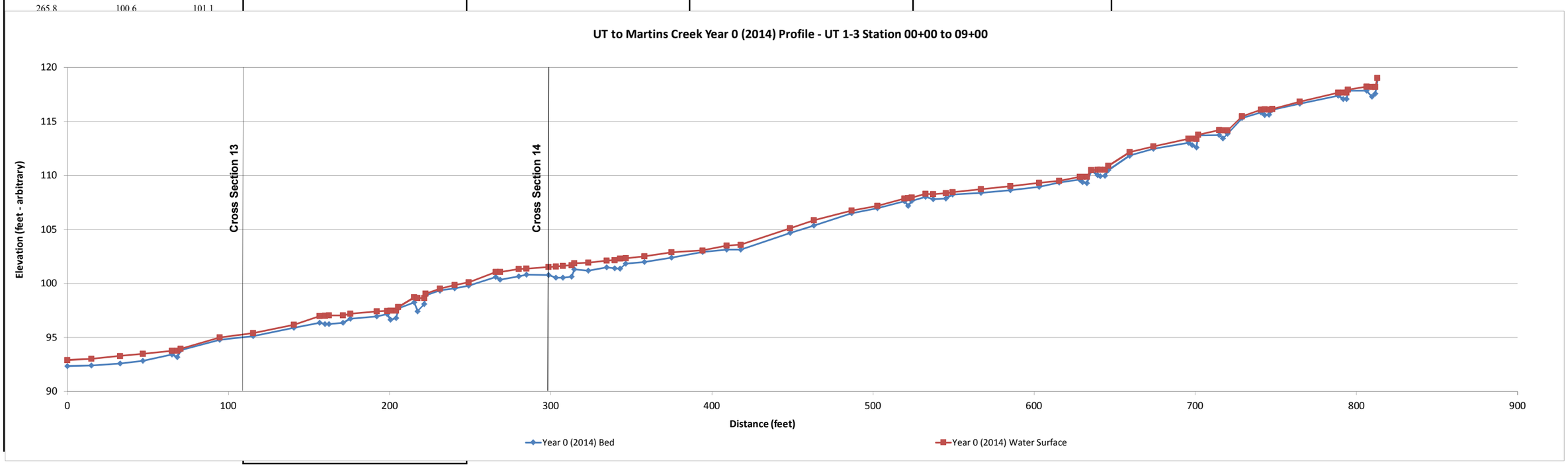
	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0105				
Riffle Length	29				
Avg. Riffle Slope	0.0108				
Pool Length	10				
Pool to Pool Spacing	38				



Project Name	UT to Martins Creek - Profile
Reach	UT 1-3 Station 00+00 - 09+00
Feature	Profile
Date	4/4/14
Crew	Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	92.4	92.9												
15.0	92.4	93.0												
32.8	92.6	93.3												
46.8	92.8	93.5												
64.9	93.4	93.8												
68.3	93.2	93.8												
70.4	93.8	93.9												
94.5	94.8	95.0												
115.4	95.1	95.4												
140.7	95.9	96.2												
156.6	96.4	97.0												
160.0	96.3	97.0												
162.4	96.2	97.0												
171.0	96.4	97.1												
175.6	96.7	97.2												
192.1	97.0	97.4												
198.4	97.2	97.5												
200.6	96.7	97.5												
204.2	96.8	97.5												
205.4	97.7	97.8												
215.2	98.2	98.7												
217.4	97.4	98.7												
221.5	98.1	98.6												
222.3	98.9	99.1												
231.3	99.3	99.5												
240.3	99.5	99.9												
249.2	99.8	100.1												
265.8	100.6	101.1												

	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0321				
Riffle Length	41				
Avg. Riffle Slope	0.0318				
Pool Length	12				
Pool to Pool Spacing	51				



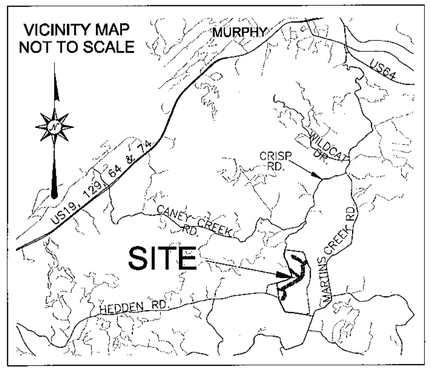
Appendix E.
As-built Plan Sheets

AS-BUILT SURVEY OF

UT TO MARTINS CREEK (CONTRERAS) MITIGATION PROJECT

CHEROKEE COUNTY, NC

SCO PROJECT NO. #08-07249-01
EEP PROJECT ID #92766



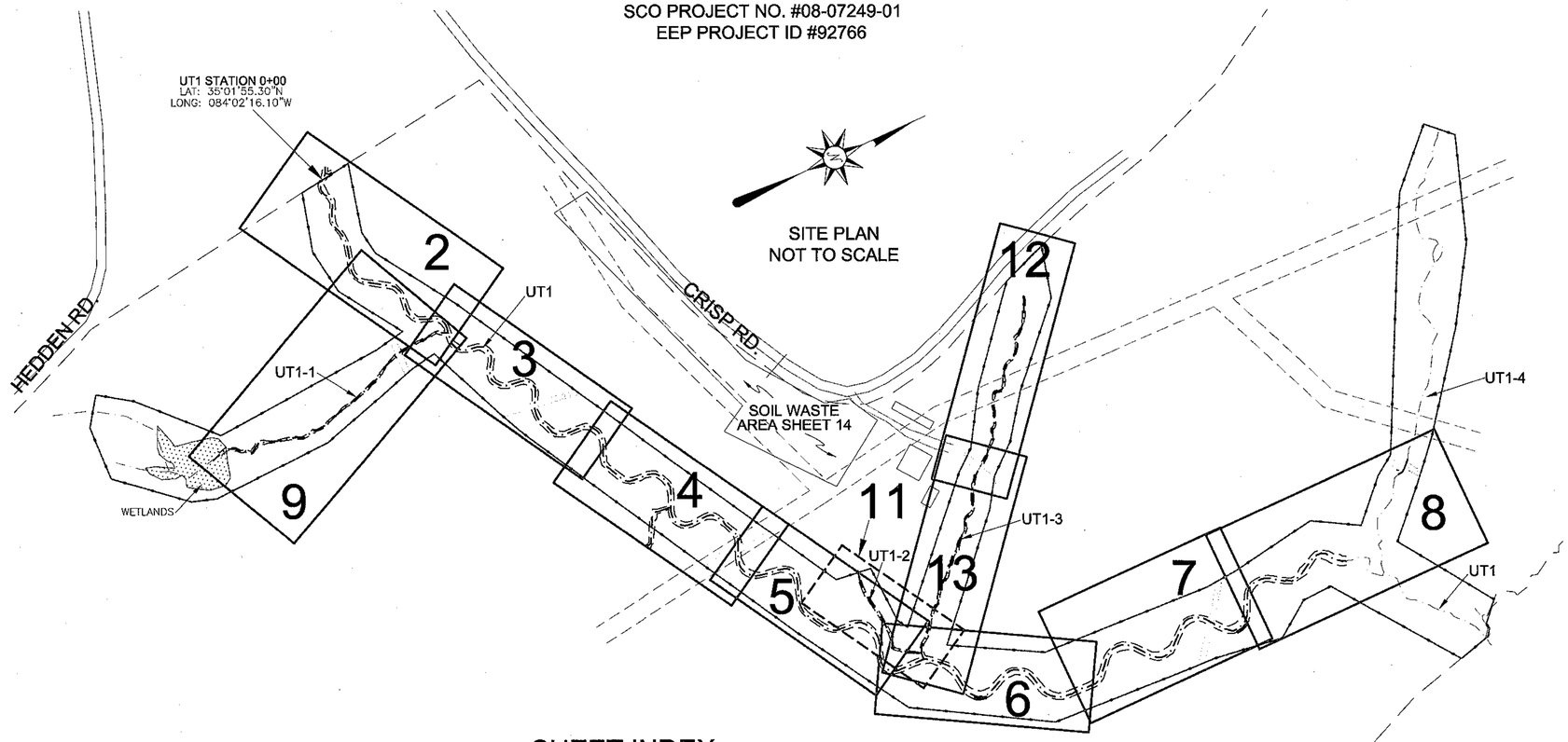
I, ELISABETH G. TURNER, AS A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF NORTH CAROLINA, HEREBY CERTIFY THAT THE DATA SHOWN ON THIS DRAWING, WAS OBTAINED UNDER MY SUPERVISION, IS AN ACCURATE AND COMPLETE REPRESENTATION OF WHAT WAS CONSTRUCTED IN THE FIELD, AND THAT THE PHYSICAL DIMENSIONS OR ELEVATIONS SHOWN THUS ARE AS-BUILT CONDITIONS EXCEPT WHERE OTHERWISE NOTED HEREON. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 2nd DAY OF AUGUST, 2013.

ELISABETH G. TURNER, P.L.S. #L-4440

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

GENERAL NOTES

1. ALL DISTANCES ARE HORIZONTAL UNLESS OTHERWISE NOTED.
2. THE VERTICAL DATUM IS NAVD88.
3. THE BASIS OF BEARINGS IS NCGS STATE PLANE GRID COORDINATES NAD83 (NSRS 2007) DATUM.
4. CONTROL IS BASED ON EXISTING CONTROL DATA AS SHOWN ON SHEET 48 OF THE DESIGN PLANS AND RECOVERED DURING THE CONSTRUCTION & AS-BUILT SURVEYS. ADDITIONAL CONTROL POINTS WERE ESTABLISHED FROM EXISTING CONTROL PRIOR TO CONSTRUCTION. THE CONTROL POINTS USED DURING THE AS-BUILT SURVEY ARE LISTED BELOW.
5. THIS MAP IS NOT FOR RECORDATION, SALES, OR CONVEYANCES AND DOES NOT COMPLY WITH G.S. 47-30 MAPPING REQUIREMENTS.
6. THE SOLE PURPOSE OF THIS SURVEY IS TO SHOW THE CONSTRUCTED STREAM AND THE FEATURES RELATED TO THE RESTORATION PROJECT.
7. THE 0+00 STATIONS ARE MATCHED WITH THE DESIGN 0+00 STATIONS, HOWEVER THE AS-BUILT SURVEY LENGTH MAY VARY SLIGHTLY FROM THE DESIGN LENGTH.
8. FEATURES OUTSIDE THE AS-BUILT LIMITS OF DISTURBANCE INCLUDING BUT NOT LIMITED TO EXISTING UTILITIES, EASEMENTS, DRAINAGE, & PROPERTY LINES WERE NOT LOCATED BY TURNER LAND SURVEYING, PLLC. ALL FEATURES SHOWN OUTSIDE THE AS-BUILT LIMITS WERE TAKEN FROM EXISTING CONDITIONS AND DESIGN DATA PROVIDED BY THE DESIGNER.
9. CONSERVATION EASEMENT PROVIDED BY DESIGNER.



SHEET INDEX

AS-BUILT CONTROL:

PT#	Northing(Y)	Easting(X)	Elev(Z)	Description
1	505438.99	493163.10	1679.61	EX GPS1
2	505167.51	493211.22	1654.92	EX GPS2
3	504800.49	494574.90	1771.87	EX GPS3
4	505035.71	493009.43	1655.83	TLS#4 NAIL
11	505171.16	493571.56	1651.22	TLS#11 NAIL
14	505550.89	493956.54	1647.06	TLS#14 MON7
20	505746.92	493776.10	1661.60	TLS#20 REBAR W/CAP
21	505850.53	493605.40	1670.87	TLS#21 NAIL
22	506028.78	493420.69	1678.32	TBM#211 HUB & TACK
25	506434.38	494133.09	1640.21	TLS#25 MON25
200	504901.54	493023.29	1657.17	TBM#200 MON60
202	504435.95	492992.33	1681.81	TBM#202 HUB & TACK
205	505436.43	493668.73	1650.59	TBM#205 HUB & TACK
206	505494.23	494133.55	1646.56	TBM#206 MON54
208	506175.73	494306.05	1640.68	TBM#208 HUB & TACK
210	505923.12	493676.89	1661.66	TBM#210 HUB & TACK
212	506088.00	493464.63	1673.53	TBM#212 BENCHTIE IN TREE
240	506678.36	494106.33	1645.78	TBM#240 HUB & TACK

REFERENCES:

OWNER:
NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM
1652 MAIL SERVICE CENTER
RALEIGH, NC 27099-1652
(919)715-1157
PROJ. MGR.: PAUL WIESNER

CONTRACTOR:
RIVER WORKS, INC.
RALEIGH, NC
(919)582-3574

DESIGNER:
MICHAEL BAKER ENGINEERING, INC.
ASHEVILLE, NC
(828)350-1408

PROPERTY OWNER:
NANCY KETNER CONTRERAS
CONSERVATION EASEMENT
RECORDED IN DB 1004, PG 1017 IN THE CHEROKEE COUNTY NC REGISTER OF DEEDS.

TURNER LAND SURVEYING, PLLC
3201 Glenridge Drive, Raleigh, NC 27604 -- (919)875-1378
P-0702 -- Lturner921@att.net -- Dturner119@att.net
www.TURNERLANDSURVEYING.com

REVISIONS, DATE, AND INITIAL:

TITLE, VICINITY MAP, SHEET INDEX, & GENERAL NOTES

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS) MITIGATION PROJECT
CHEROKEE COUNTY
MURPHY
NORTH CAROLINA

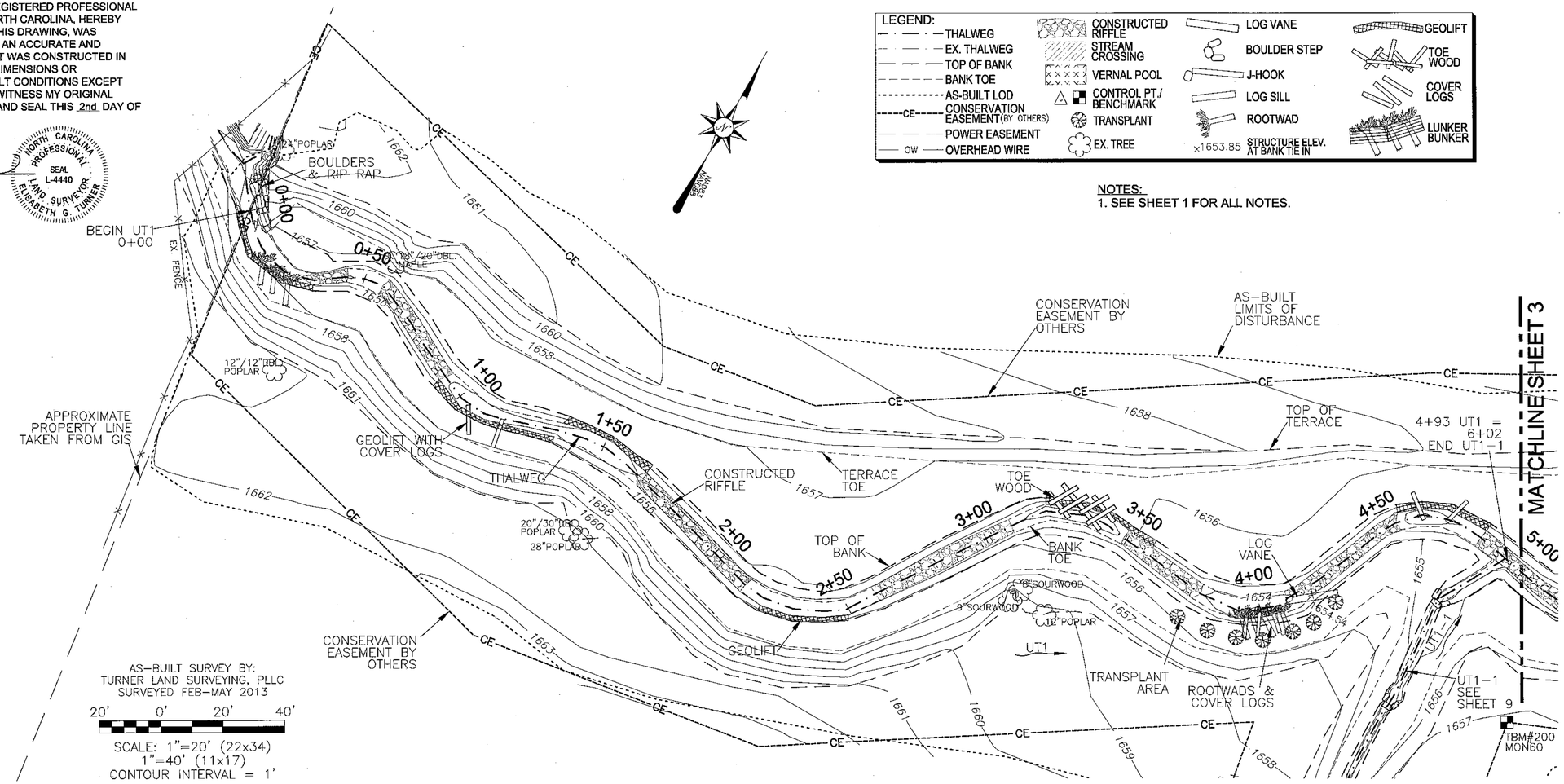
DATE: 04/24/13
SURVEYED BY: DST/EGT
DRAWN BY: DST/EGT
REVIEWED BY: DST/EGT
PROJECT: TLS-12-021
FILE: UTMC-CONTRERAS _92766_TLS_AB_F
SCALE: AS SHOWN

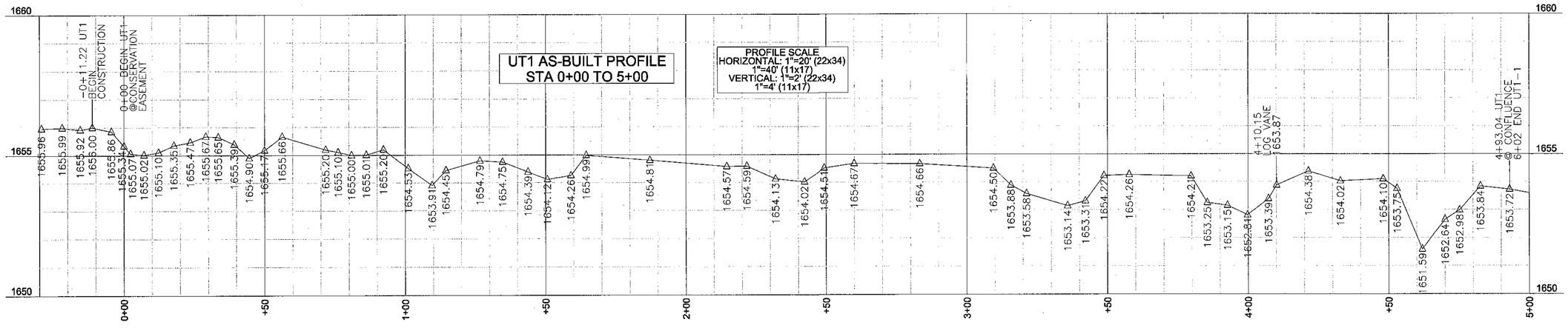
SHEET 1 of 14

I, ELISABETH G. 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 HEREON. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 2nd DAY OF AUGUST, 2013.

ELISABETH G. TURNER, P.L.S. #L-4440

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER





REVISIONS, DATE, AND INITIAL:

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3201 Glenridge Drive, Raleigh, NC 27604 -- (919)875-1378
P-0702 -- LturnerS21@att.net -- Dturner119@att.net
www.TURNERLANDSURVEYING.com

UT1 STA 0+00 TO 5+00 PLAN & PROFILE

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS)
MITIGATION PROJECT

CHEROKEE COUNTY MURPHY NORTH CAROLINA

DATE:	04/24/13
SURVEYED BY:	DST/EGT
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SCALE:	AS SHOWN

SHEET 2 of 14

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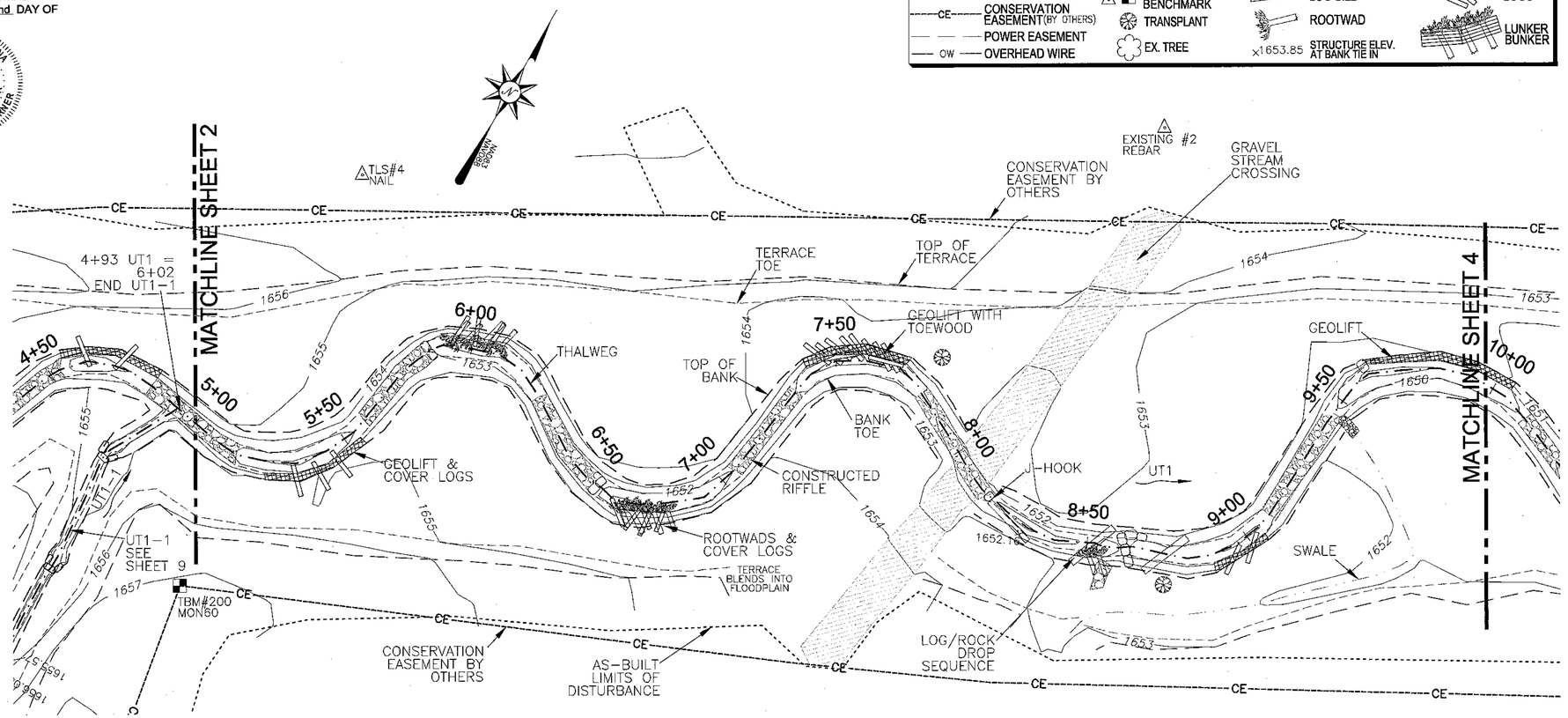
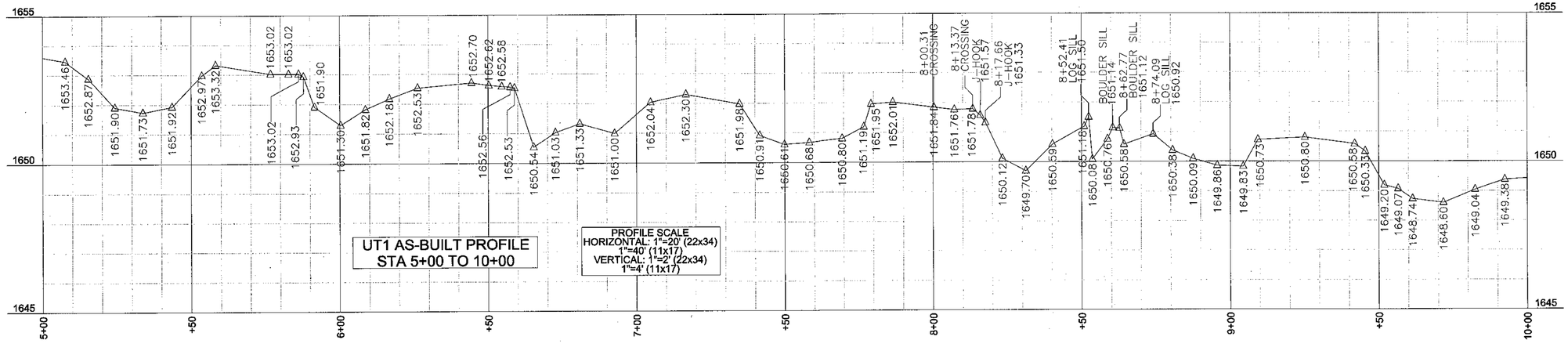
ELISABETH G. TURNER, P.L.S. #L-4440

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

NOTES:
1. SEE SHEET 1 FOR ALL NOTES.

LEGEND:
- THALWEG
- EX. THALWEG
- TOP OF BANK
- BANK TOE
- AS-BUILT LOD
- CE — CONSERVATION EASEMENT (BY OTHERS)
- POWER EASEMENT
- OW — OVERHEAD WIRE
- CONSTRUCTED RIFFLE
- STREAM CROSSING
- VERNAL POOL
- CONTROL PT./ BENCHMARK
- TRANSPLANT
- EX. TREE
- LOG VANE
- BOULDER STEP
- J-HOOK
- LOG SILL
- ROOTWAD
- x1653.85 STRUCTURE ELEV. AT BANK TIE IN
- GEOLIFT
- TOE WOOD
- COVER LOGS
- LUNKER BUNKER





AS-BUILT SURVEY BY:
TURNER LAND SURVEYING, PLLC
SURVEYED FEB-MAY 2013

20' 0' 20' 40'

SCALE: 1"=20' (22x34)
1"=40' (11x17)
CONTOUR INTERVAL = 1'

REVISIONS, DATE, AND INITIAL:

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UT1 STA 5+00 TO 10+00 PLAN & PROFILE

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS)
MITIGATION PROJECT

CHEROKEE COUNTY NORTH CAROLINA
MURPHY

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FILE:	UTMC-CONTRERAS _92766_TLS_AB_F
SCALE:	AS SHOWN

SHEET 3 of 14

I, ELISABETH G. 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 HEREON. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 2nd DAY OF AUGUST, 2013.

ELISABETH G. TURNER, P.L.S. #L-4440

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

LEGEND:
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- EX. THALWEG
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- CONTROL PT./ BENCHMARK
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NOTES:
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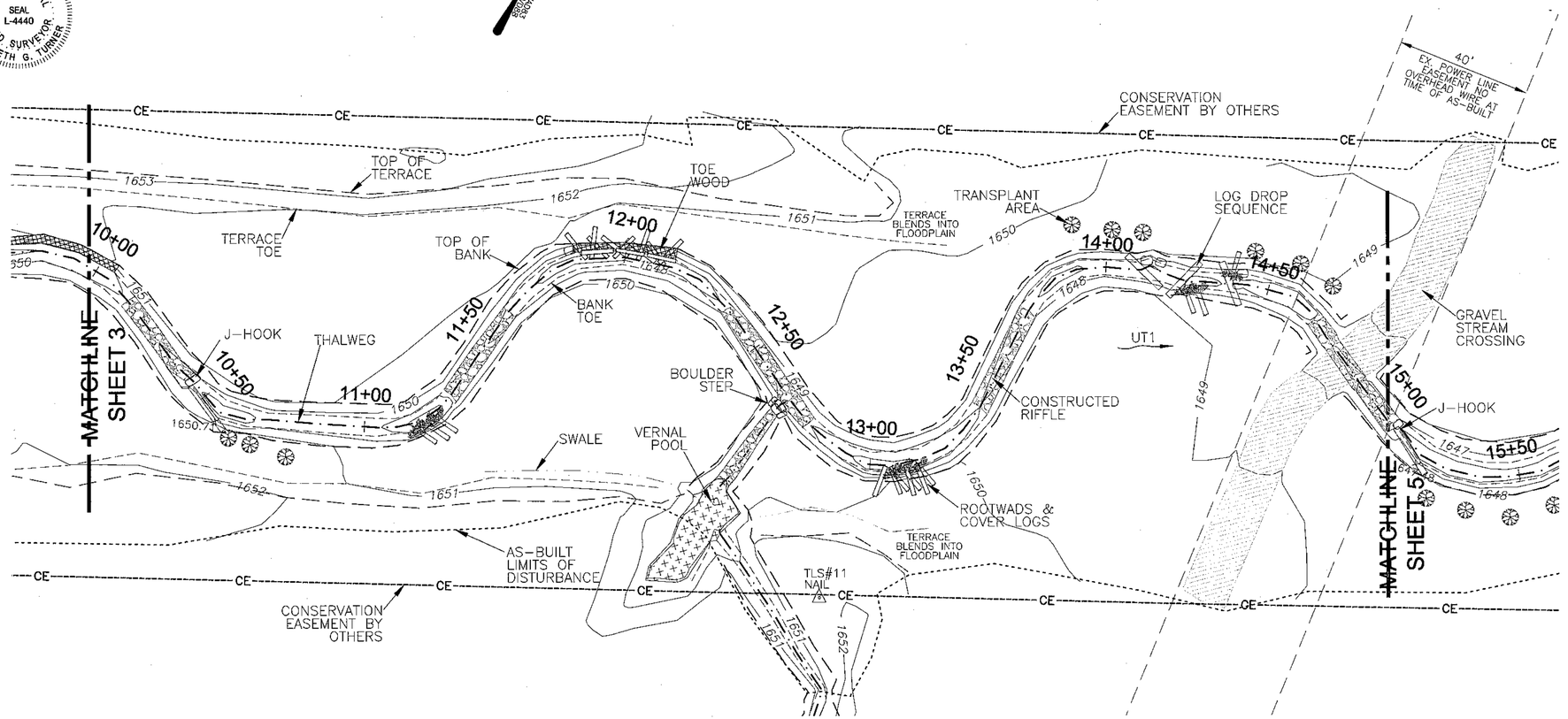

AS-BUILT SURVEY BY:
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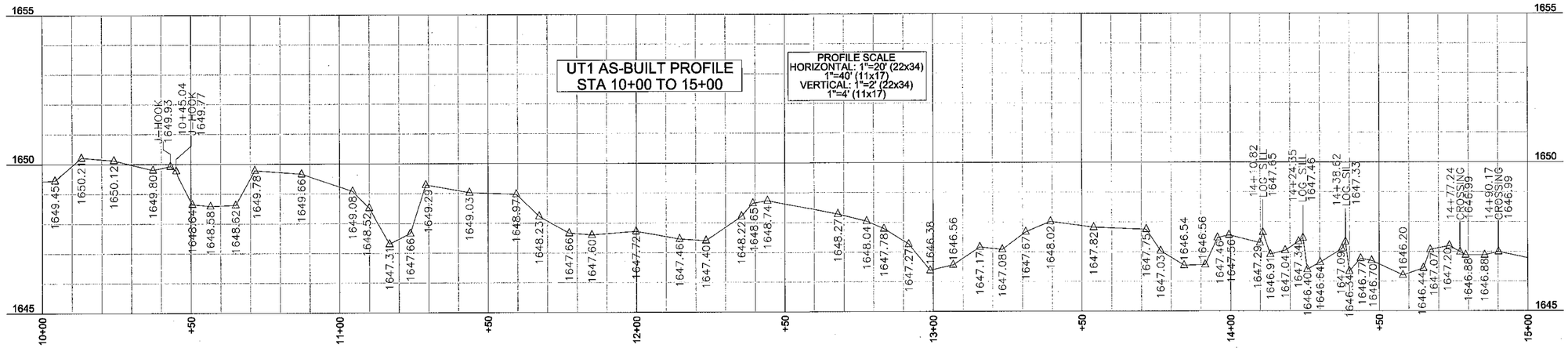

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REVISIONS, DATE, AND INITIAL:

UT1 STA 10+00 TO 15+00 PLAN & PROFILE

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS)
MITIGATION PROJECT

CHEROKEE COUNTY NORTH CAROLINA
MURPHY

DATE:	04/24/13
SURVEYED BY:	DST/EGT
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FILE:	UTMC-CONTRERAS _92766_TLS_AB_F
SCALE:	AS SHOWN
SHEET	4 of 14

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ELISABETH G. TURNER, P.L.S. #L-4440

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

NOTES:
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AS-BUILT SURVEY BY:
TURNER LAND SURVEYING, PLLC
SURVEYED FEB-MAY 2013

20' 0' 20' 40'

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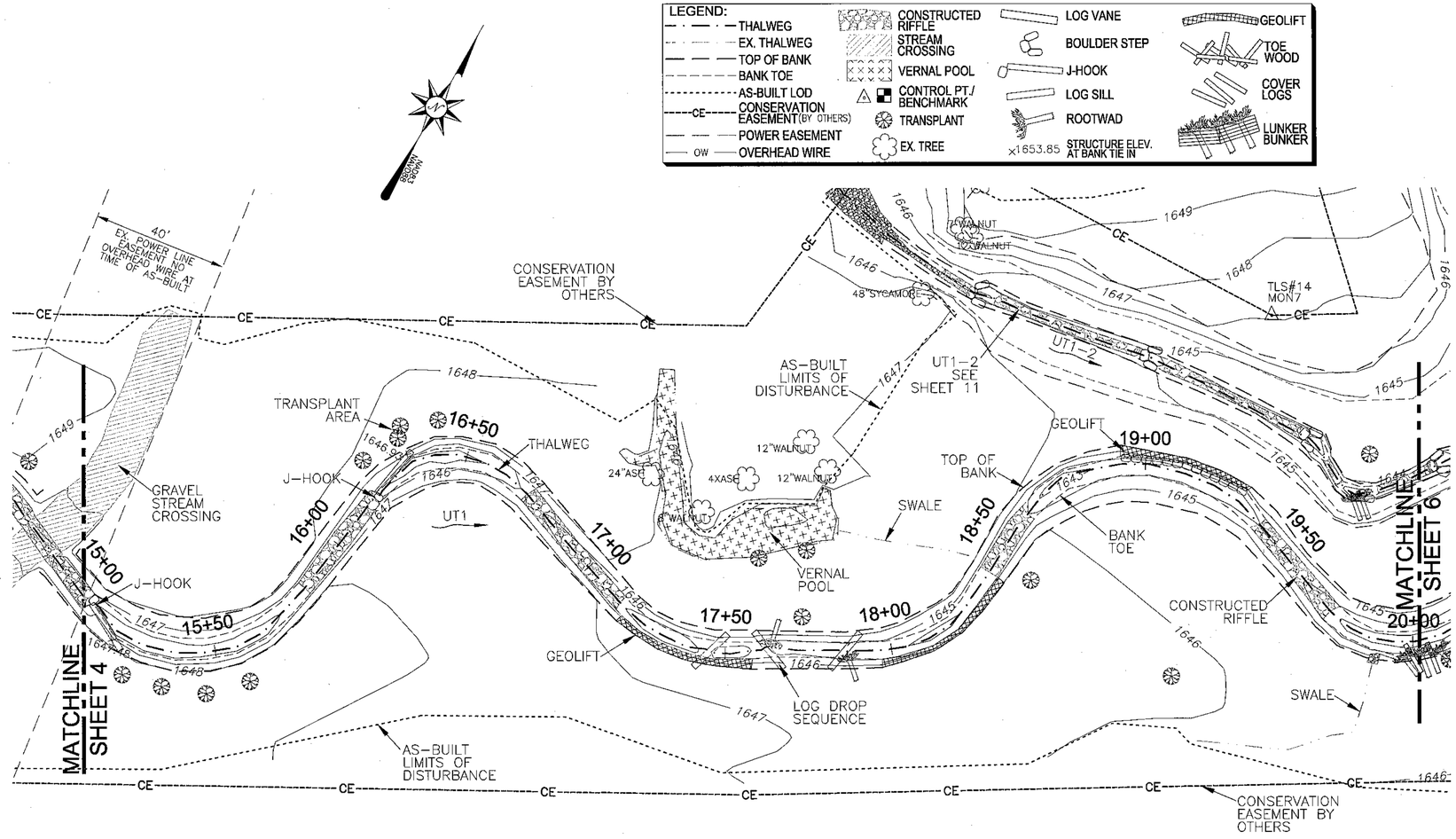

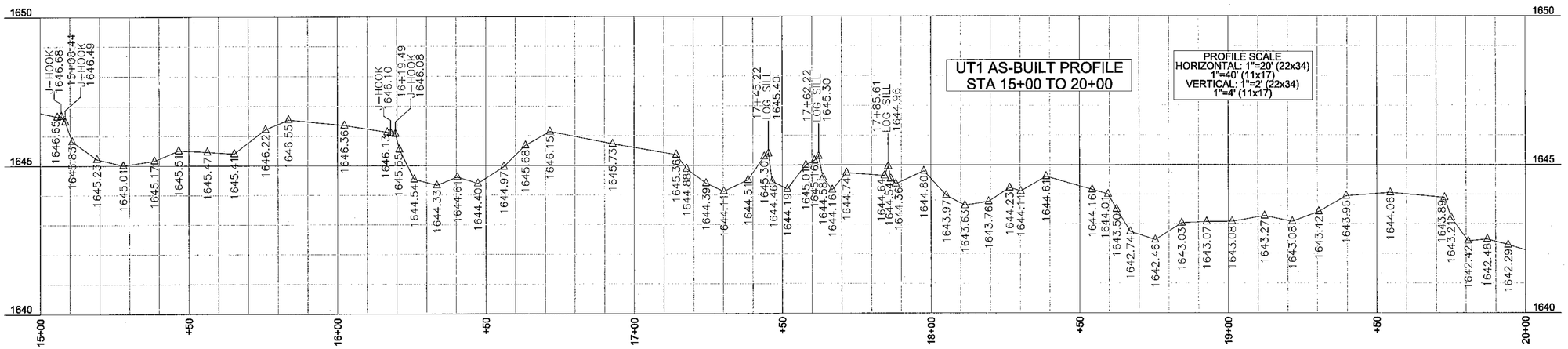

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UT1 STA 15+00 TO 20+00 PLAN & PROFILE

AS-BUILT SURVEY OF
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MITIGATION PROJECT

CHEROKEE COUNTY NORTH CAROLINA MURPHY

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FILE:	UTMC-CONTRERAS _92766_TLS_AB_F
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SHEET
5 of 14

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LEGEND:
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- EX. THALWEG
- TOP OF BANK
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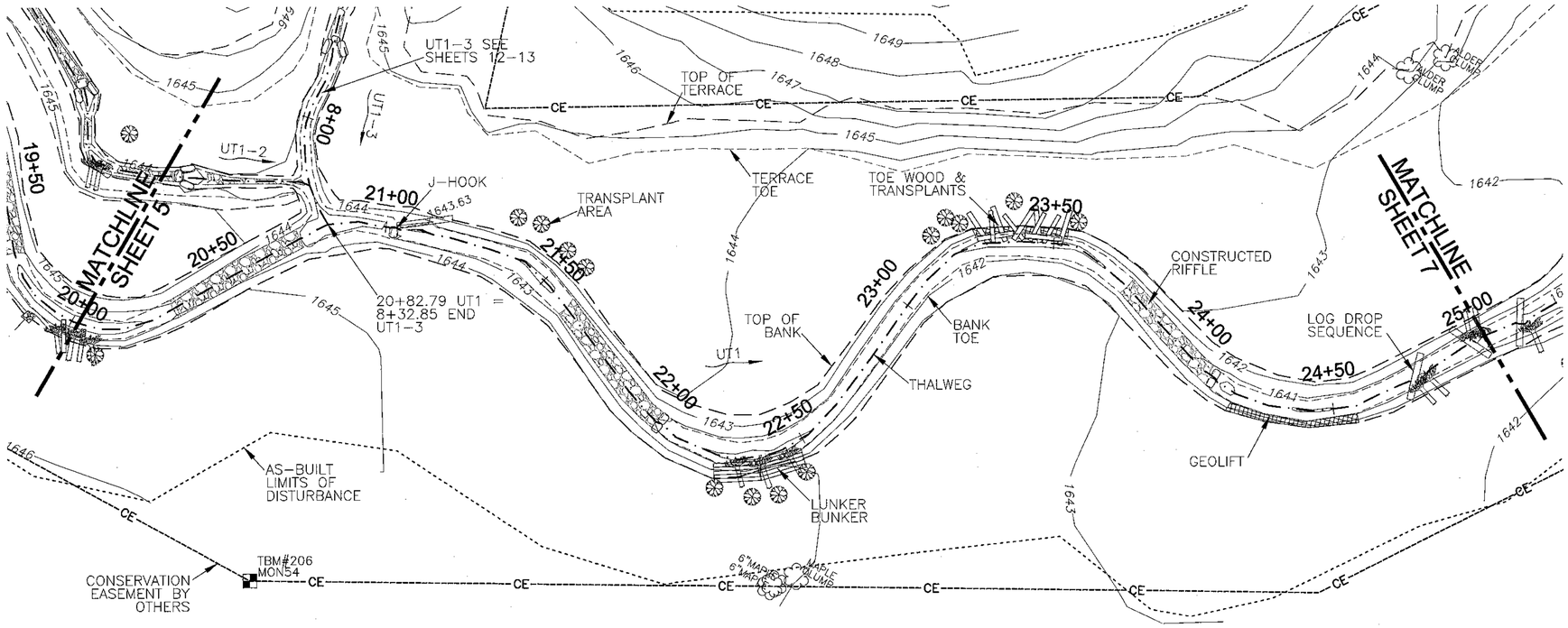

AS–BUILT SURVEY BY:
TURNER LAND SURVEYING, PLLC
SURVEYED FEB–MAY 2013

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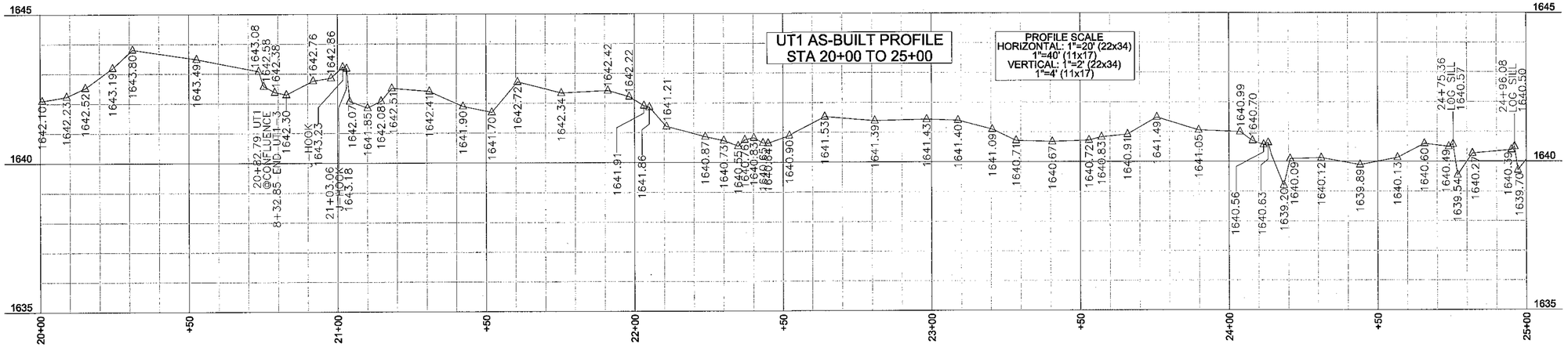

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UT1 STA 20+00 TO 25+00 PLAN & PROFILE

AS-BUILT SURVEY OF
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CHEROKEE COUNTY NORTH CAROLINA
MURPHY

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SCALE:	AS SHOWN

SHEET 6 of 14

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NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

NOTES:
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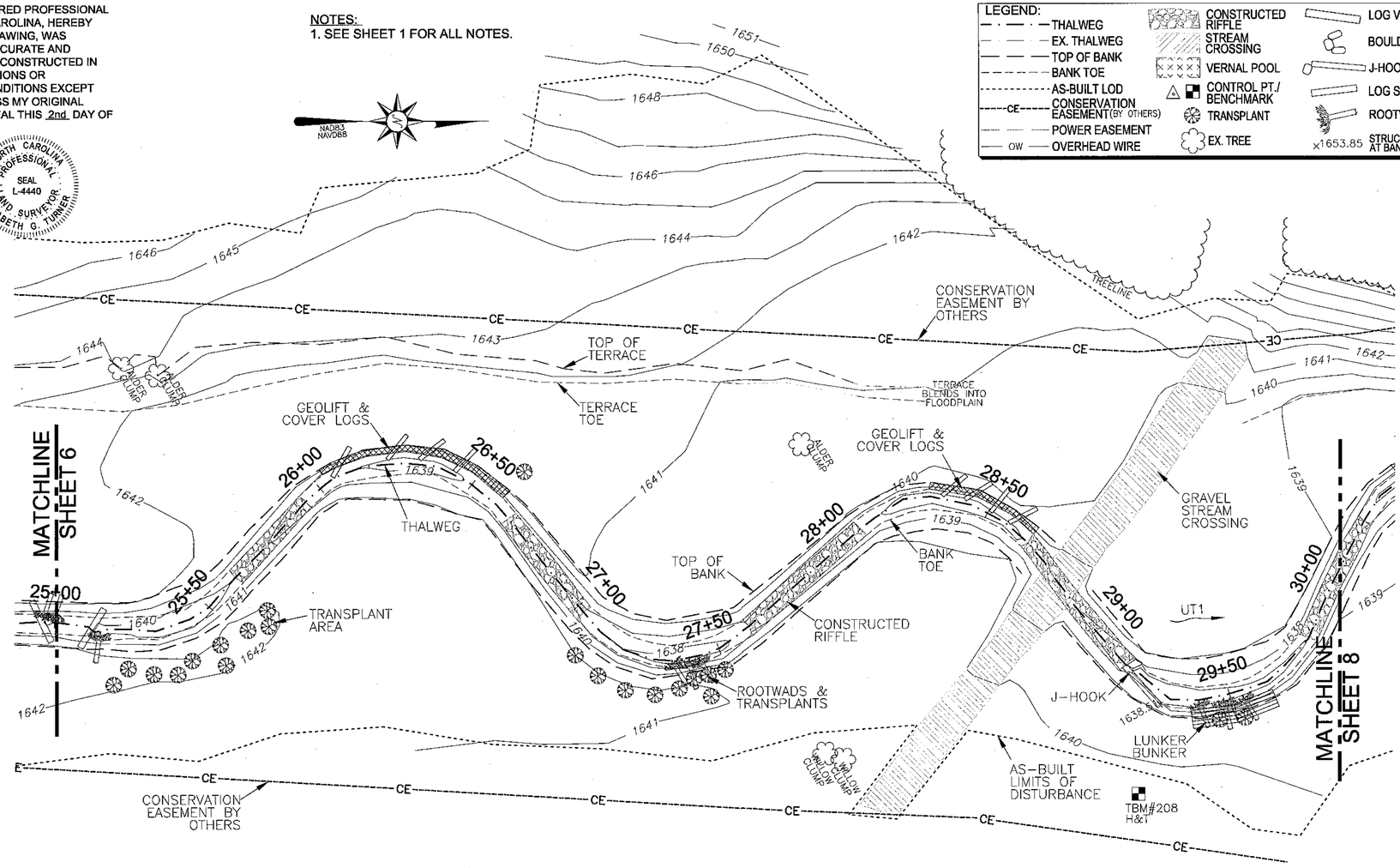

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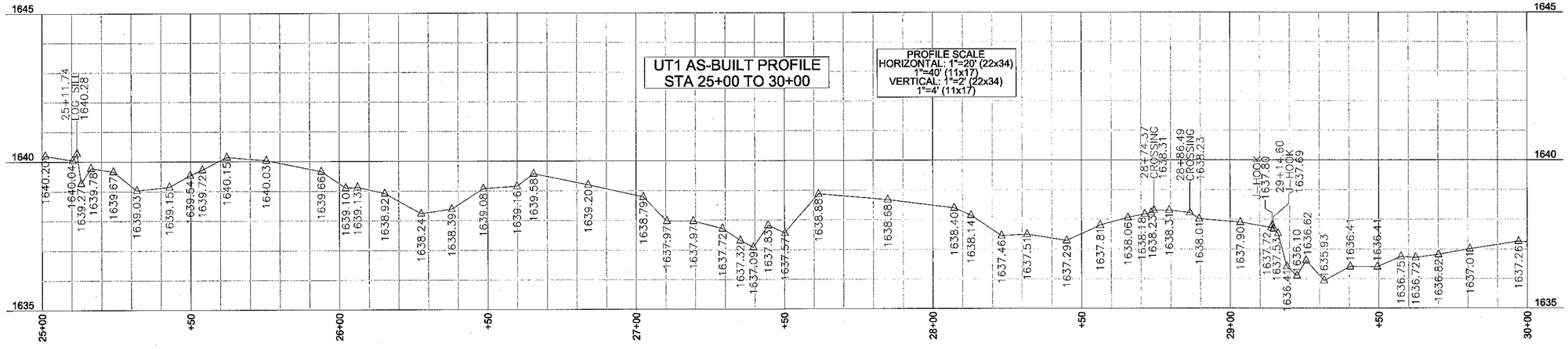

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UT1 STA 25+00 TO 30+00 PLAN & PROFILE

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS) MITIGATION PROJECT

CHEROKEE COUNTY, NORTH CAROLINA
MURPHY

DATE:	04/24/13
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SCALE:	AS SHOWN

SHEET
7 of 14

I, ELISABETH G. 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 HEREON. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 2nd DAY OF AUGUST, 2013.

ELISABETH G. TURNER, P.L.S. #L-4440

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

NOTES:
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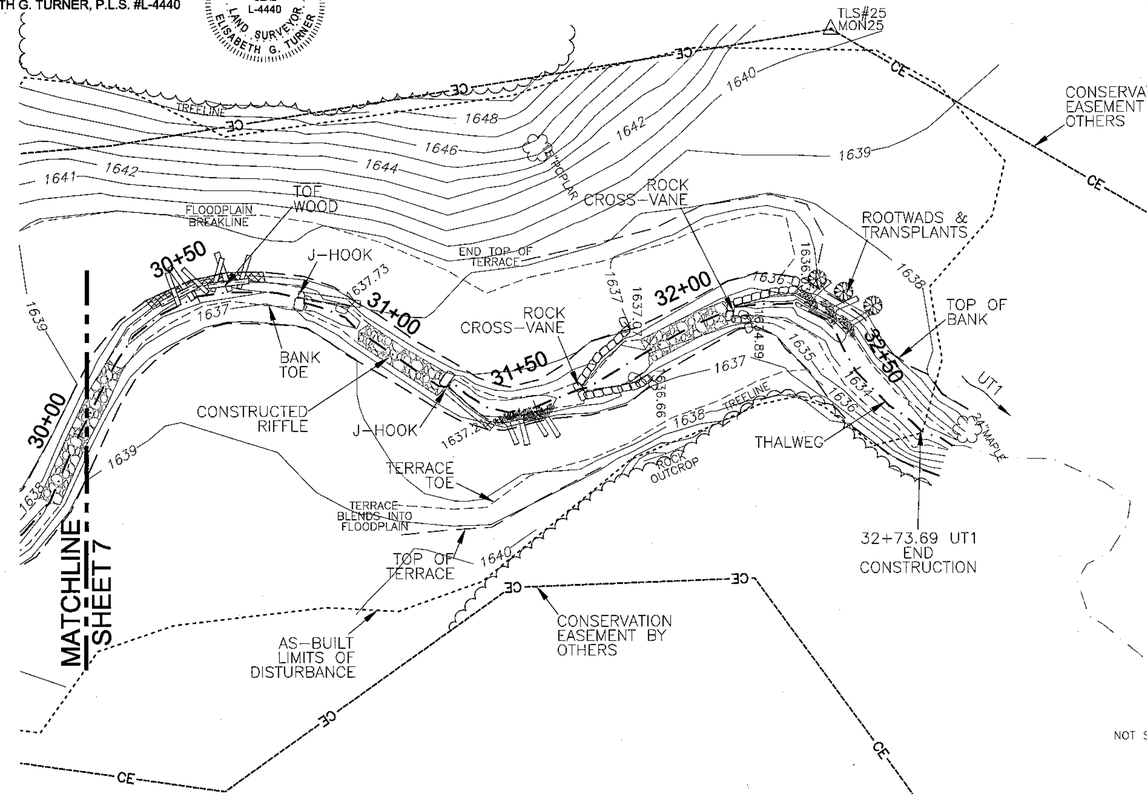

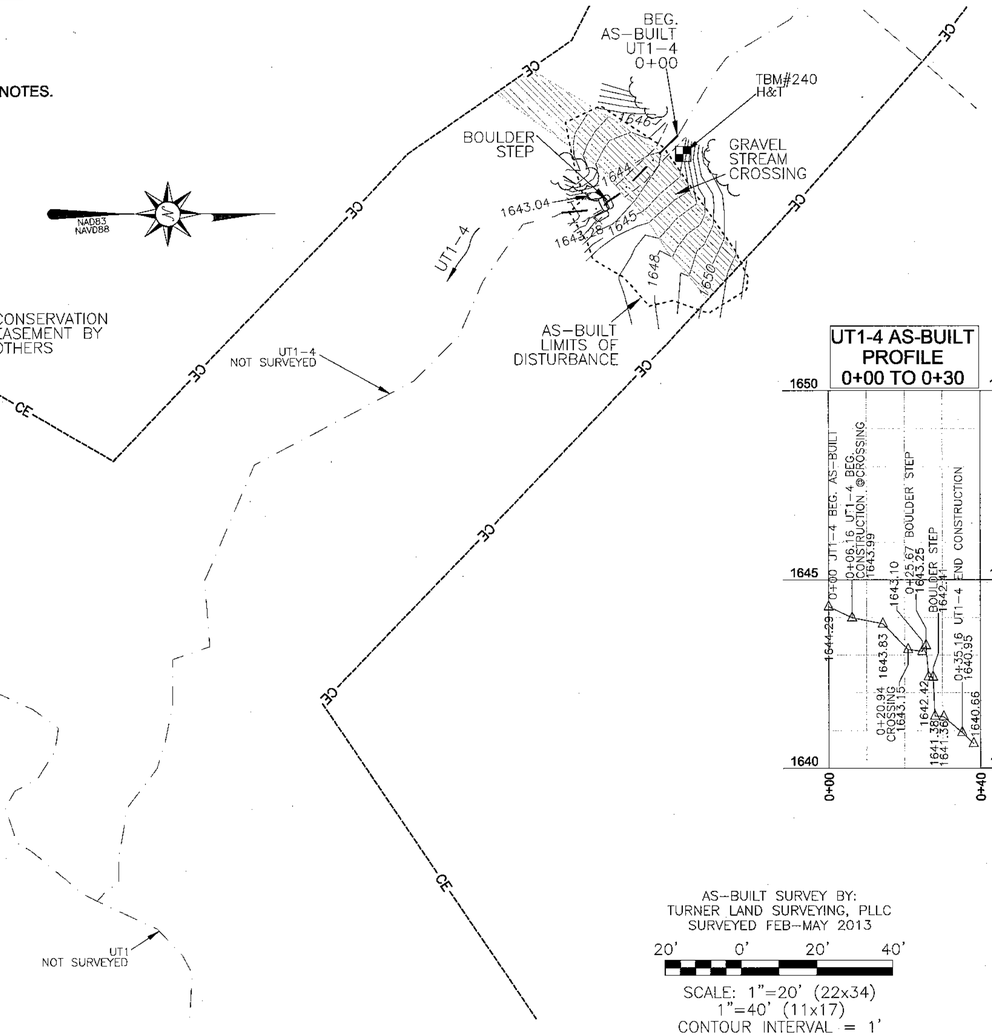

AS-BUILT SURVEY BY:
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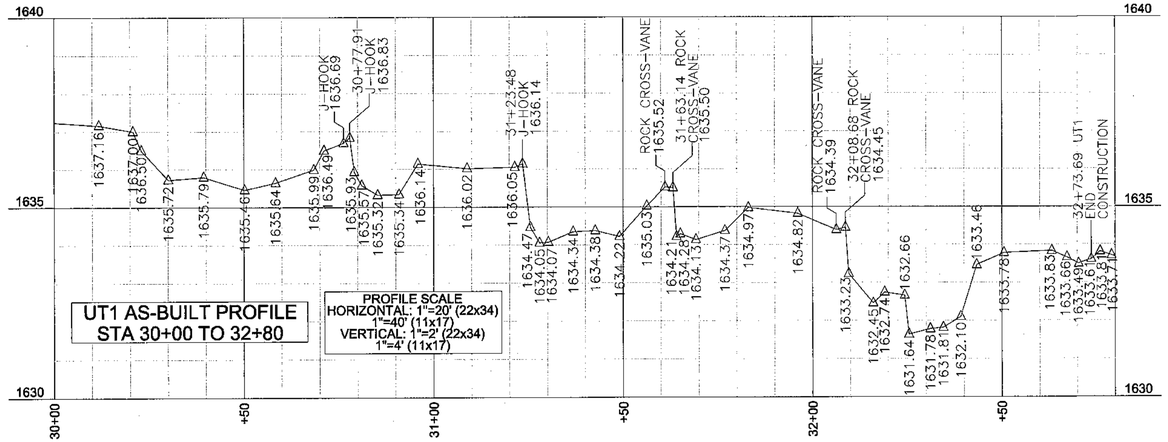

LEGEND:

THALWEG	CONSTRUCTED RIFFLE	LOG VANE	GEOLIFT
EX. THALWEG	STREAM CROSSING	BOULDER STEP	TOE WOOD
TOP OF BANK	VERNAL POOL	J-HOOK	COVER LOGS
BANK TOE	CONTROL PT./ BENCHMARK	LOG SILL	LUNKER BUNKER
AS-BUILT LOD	TRANSPLANT	ROOTWAD	
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REVISIONS, DATE, AND INITIAL:

UT1 STA 30+00 TO 32+80 PLAN & PROFILE
AND UT-4 CROSSING & STRUCTURE
AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS)
MITIGATION PROJECT
CHEROKEE COUNTY NORTH CAROLINA
MURPHY

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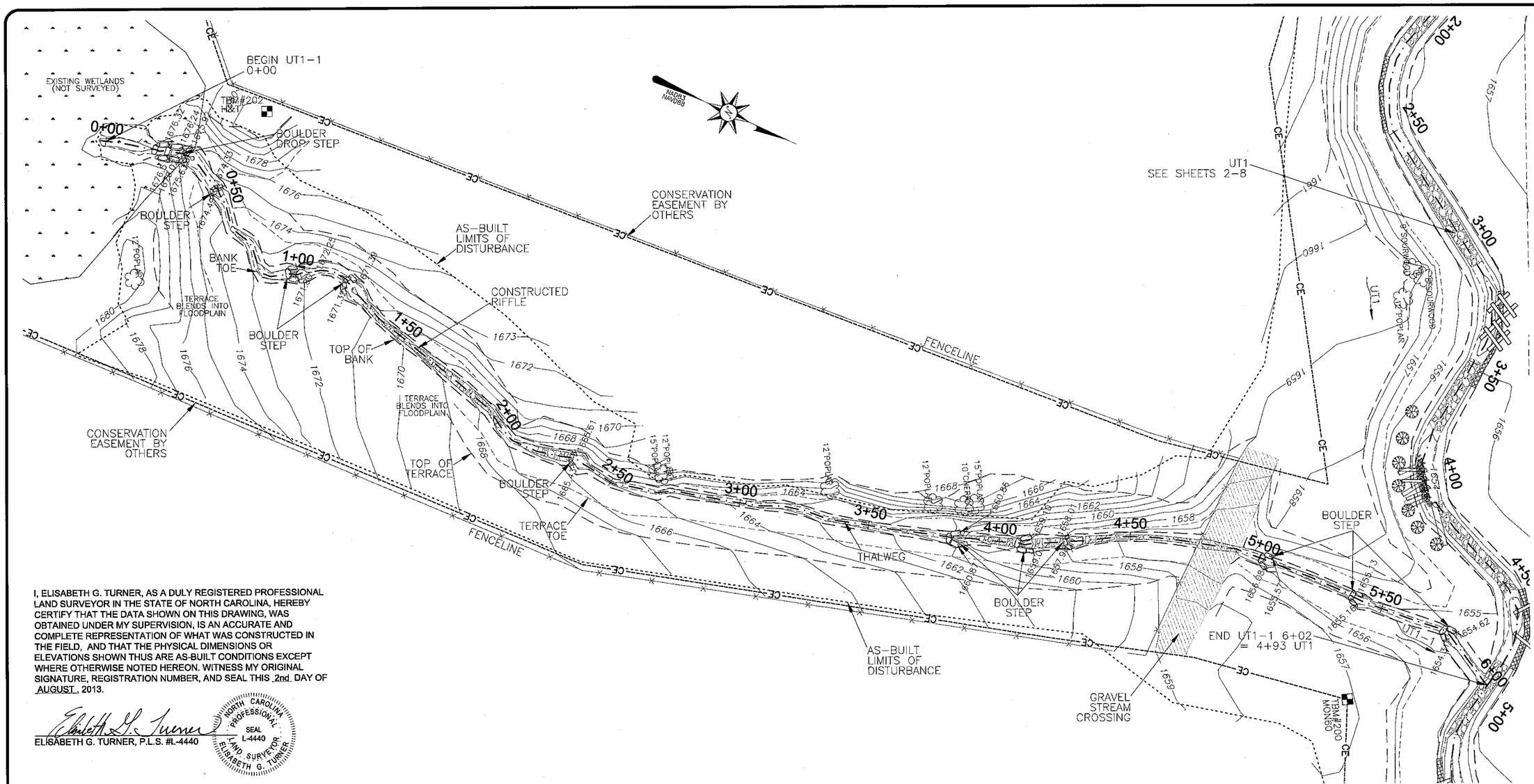

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NOTES:

1. SEE SHEET 1 FOR ALL NOTES.
2. SEE SHEET 10 FOR UT1-1 PROFILE.

AS-BUILT SURVEY BY:
TURNER LAND SURVEYING, PLLC
SURVEYED FEB-MAY 2013

20' 0' 20' 40'

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UT1-1 STA 0+00 TO 6+02 PLAN VIEW

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS)
MITIGATION PROJECT

CHEROKEE COUNTY MURPHY NORTH CAROLINA

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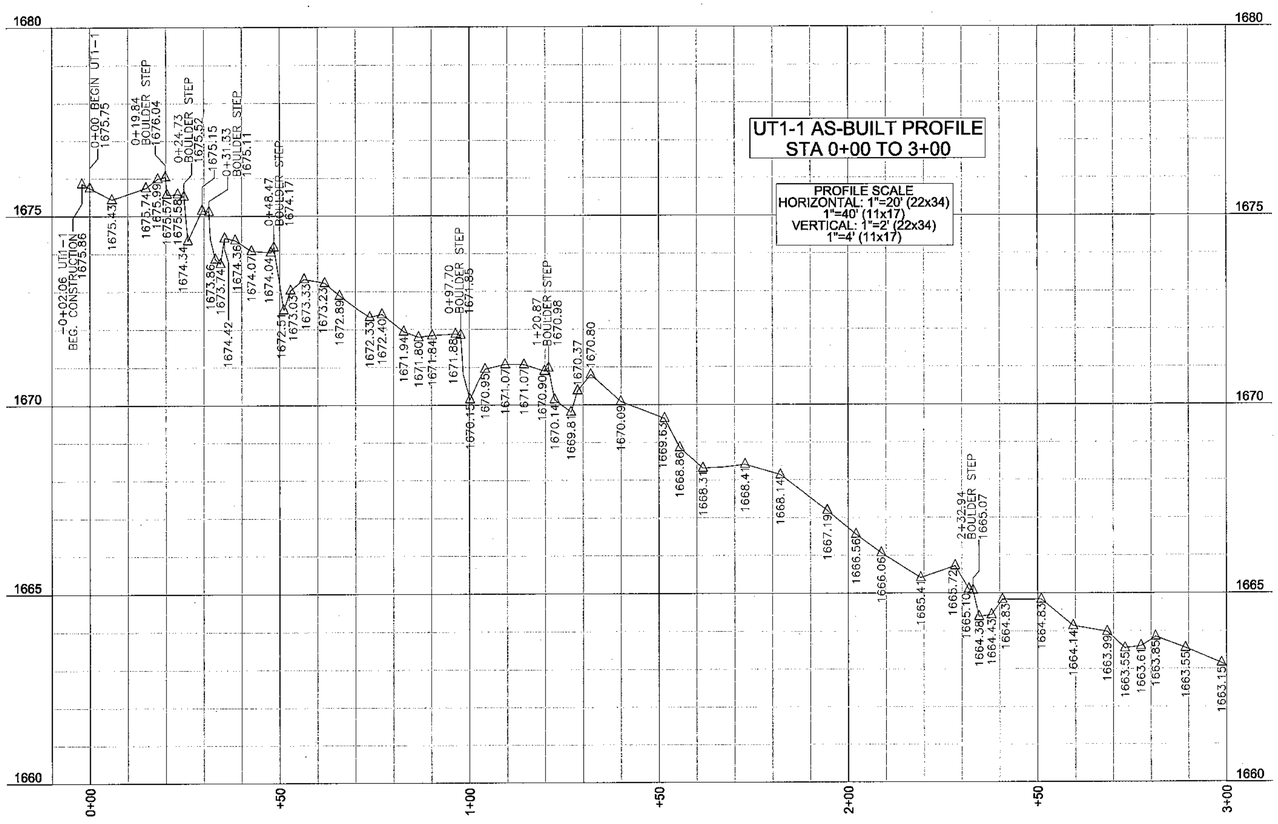
9 of 14



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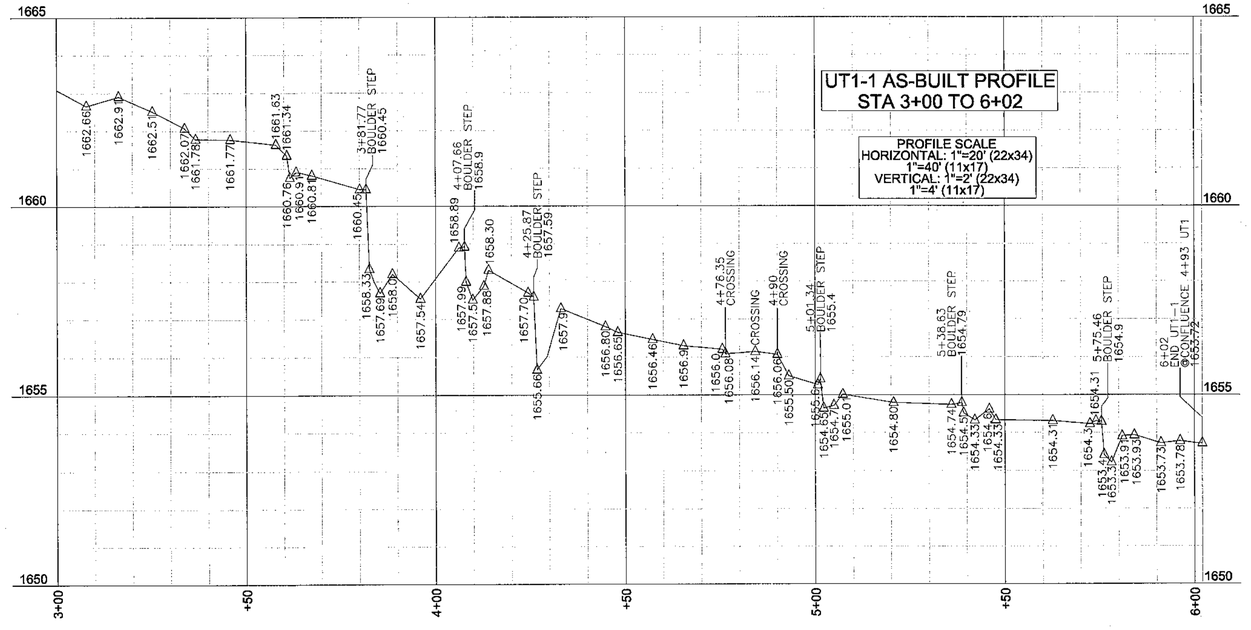

I, ELISABETH G. TURNER, AS A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF NORTH CAROLINA, HEREBY CERTIFY THAT THE DATA SHOWN ON THIS DRAWING, WAS OBTAINED UNDER MY SUPERVISION, IS AN ACCURATE AND COMPLETE REPRESENTATION OF WHAT WAS CONSTRUCTED IN THE FIELD, AND THAT THE PHYSICAL DIMENSIONS OR ELEVATIONS SHOWN THUS ARE AS-BUILT CONDITIONS EXCEPT WHERE OTHERWISE NOTED HEREON. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 2nd DAY OF AUGUST, 2013.

ELISABETH G. TURNER, P.L.S. #L-4440

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

REVISIONS, DATE, AND INITIAL:

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3201 Glenridge Drive, Raleigh, NC 27604 -- (919)875-1378
P-0702 -- Lturner921@att.net -- Dturner119@att.net
www.TURNERLANDSURVEYING.com

UT1-1 STA 0+00 TO 6+02 PROFILE

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS)
MITIGATION PROJECT

CHEROKEE COUNTY MURPHY NORTH CAROLINA

DATE:	04/24/13
SURVEYED BY:	DST/EGT
DRAWN BY:	DST/EGT
REVIEWED BY:	DST/EGT
PROJECT:	TLS-12-021
FILE:	UTMC-CONTRERAS _92766_TLS_AB_F
SCALE:	AS SHOWN

SHEET 10 of 14

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NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

NOTES:
1. SEE SHEET 1 FOR ALL NOTES.

LEGEND:
- THALWEG
- EX. THALWEG
- TOP OF BANK
- BANK TOE
- AS-BUILT LOD
- CE — CONSERVATION EASEMENT (BY OTHERS)
- POWER EASEMENT
- OW — OVERHEAD WIRE
- CONSTRUCTED RIFFLE
- STREAM CROSSING
- VERNAL POOL
- CONTROL PT./ BENCHMARK
- TRANSPLANT
- EX. TREE
- LOG VANE
- BOULDER STEP
- J-HOOK
- LOG SILL
- ROOTWAD
- x1653.85 STRUCTURE ELEV. AT BANK TIE IN
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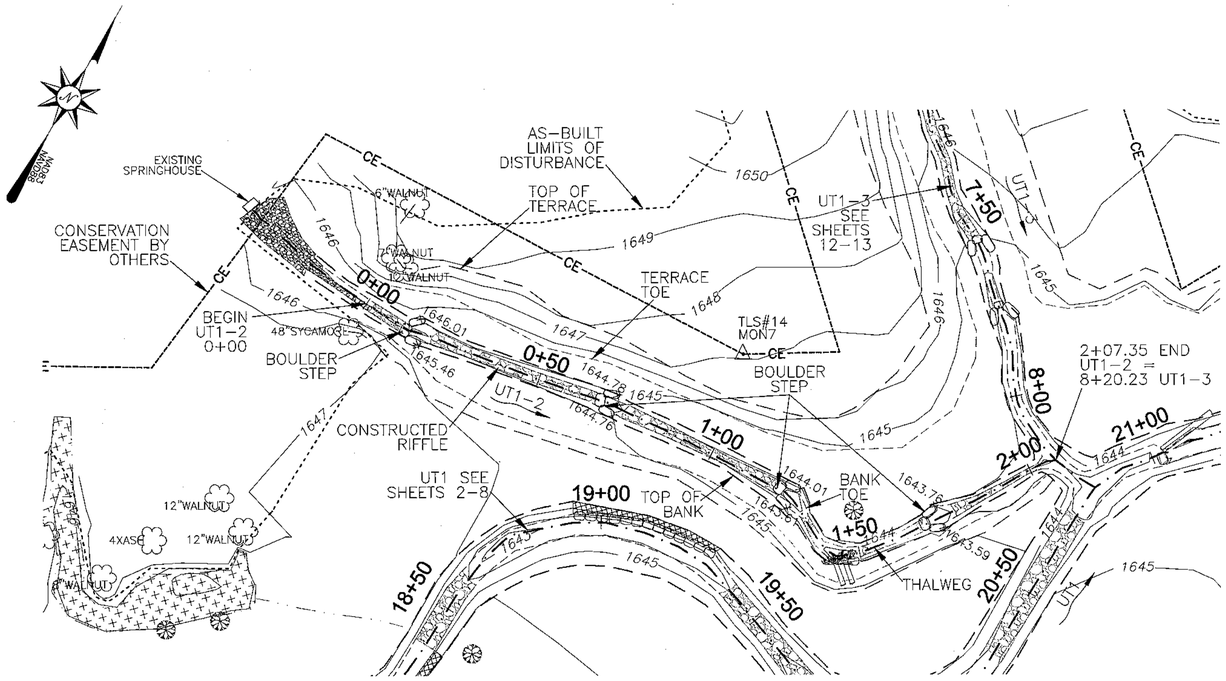
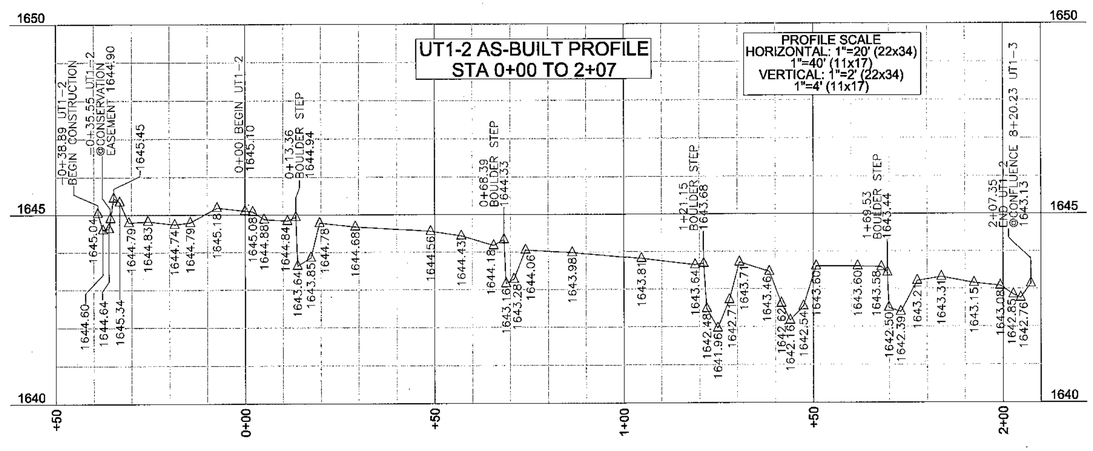
- COVER LOGS
- LUNKER BUNKER





AS-BUILT SURVEY BY:
TURNER LAND SURVEYING, PLLC
SURVEYED FEB-MAY 2013

20' 0' 20' 40'

SCALE: 1"=20' (22x34)
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CONTOUR INTERVAL = 1'

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UT1-2 STA 0+00 TO 2+07 PLAN & PROFILE

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS) MITIGATION PROJECT

CHEROKEE COUNTY — MURPHY — NORTH CAROLINA

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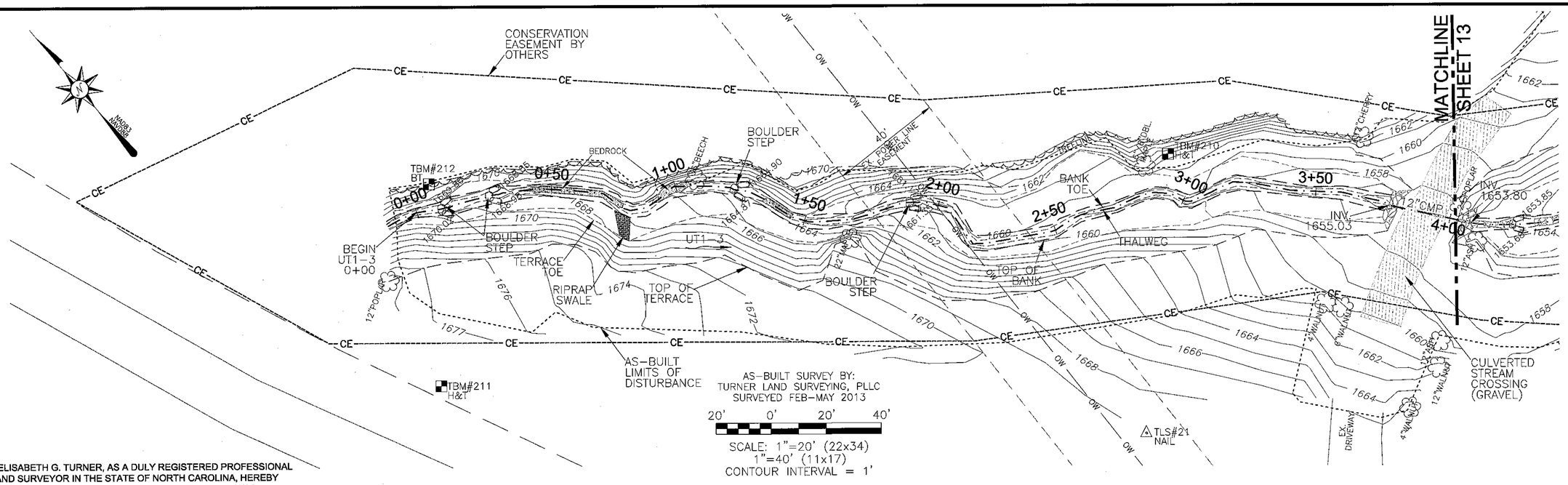
SCALE:	AS SHOWN

SHEET 11 of 14



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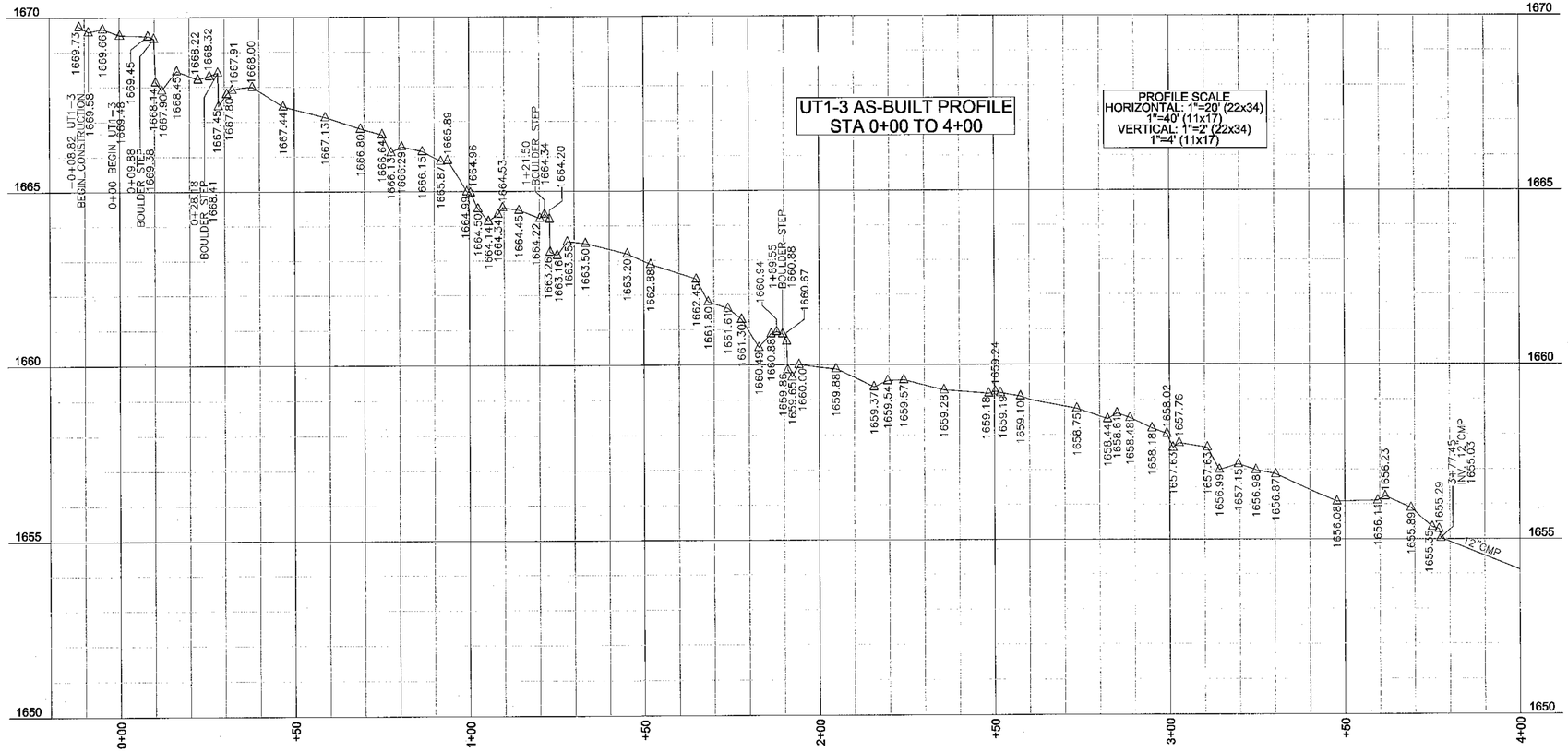

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UT1-3 STA 0+00 TO 4+00 PLAN & PROFILE

AS-BUILT SURVEY OF
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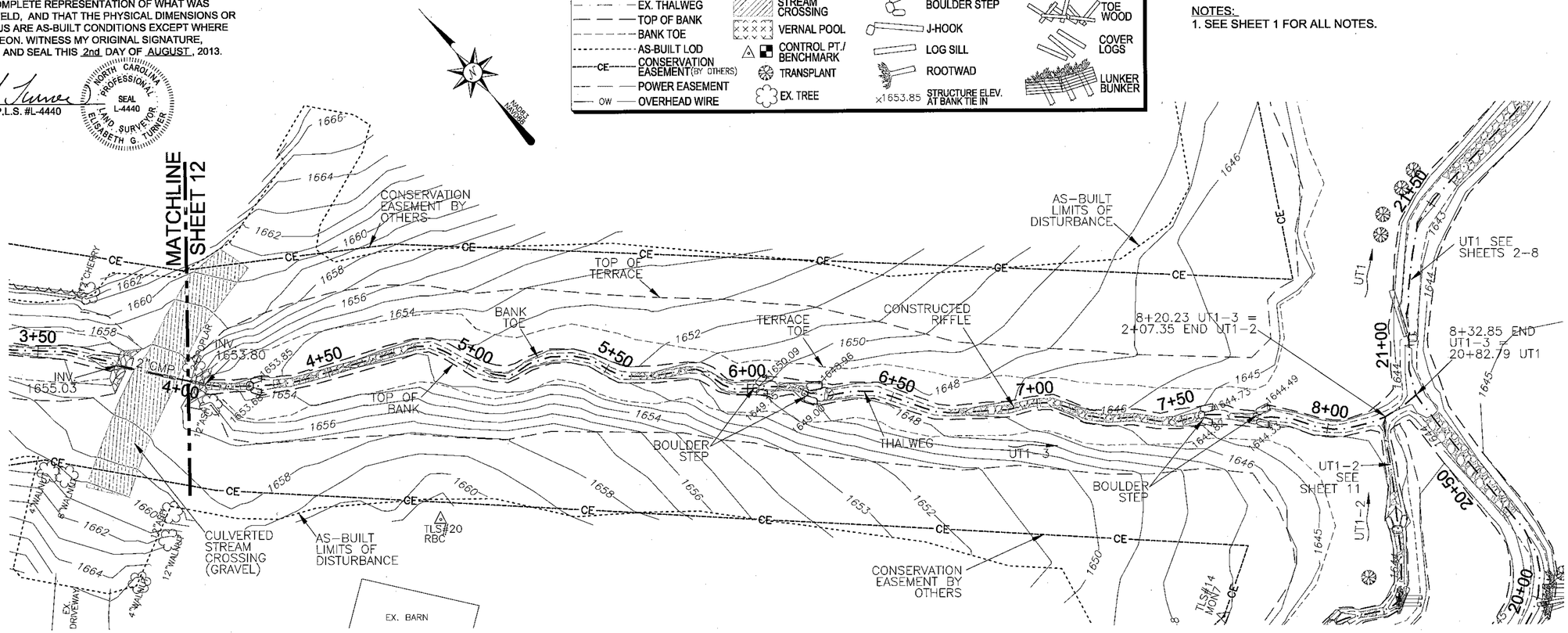

AS-BUILT SURVEY BY:
TURNER LAND SURVEYING, PLLC
SURVEYED FEB-MAY 2013

20' 0' 20' 40'

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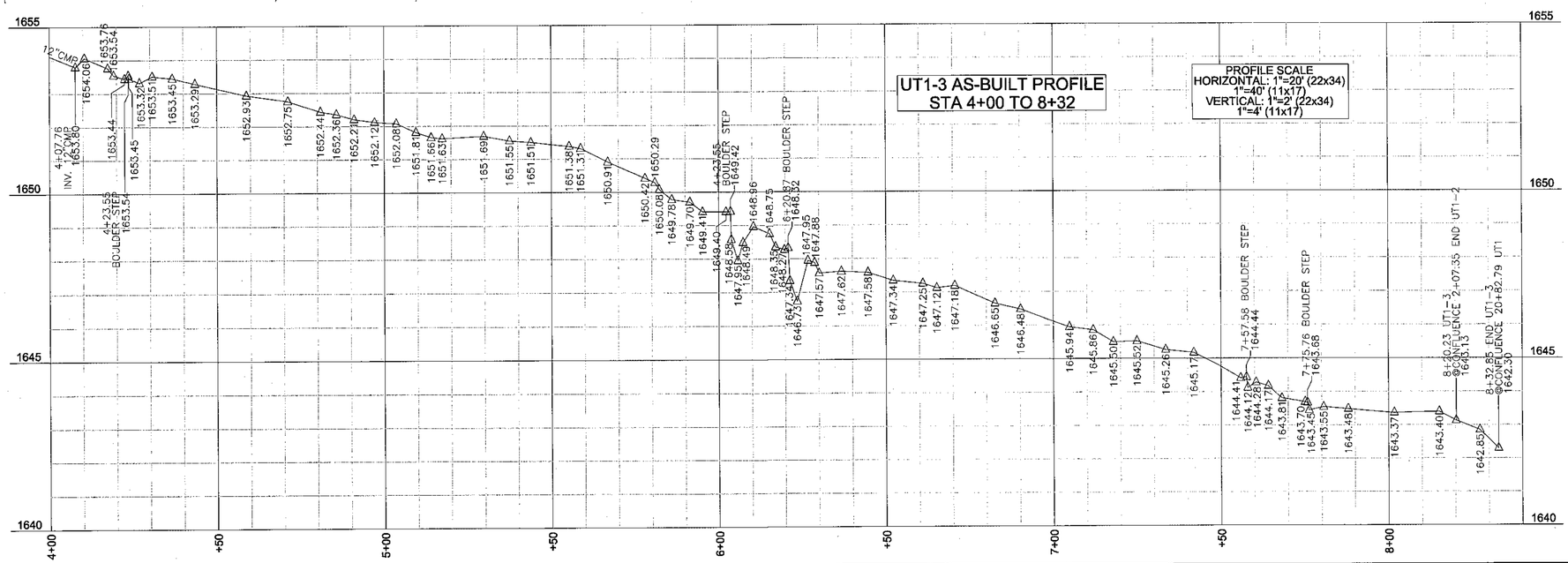

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REVISIONS, DATE, AND INITIAL:

UT1-3 STA 4+00 TO 8+32 PLAN & PROFILE

AS-BUILT SURVEY OF
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SHEET 13 of 14

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SURVEYED FEB-MAY 2013

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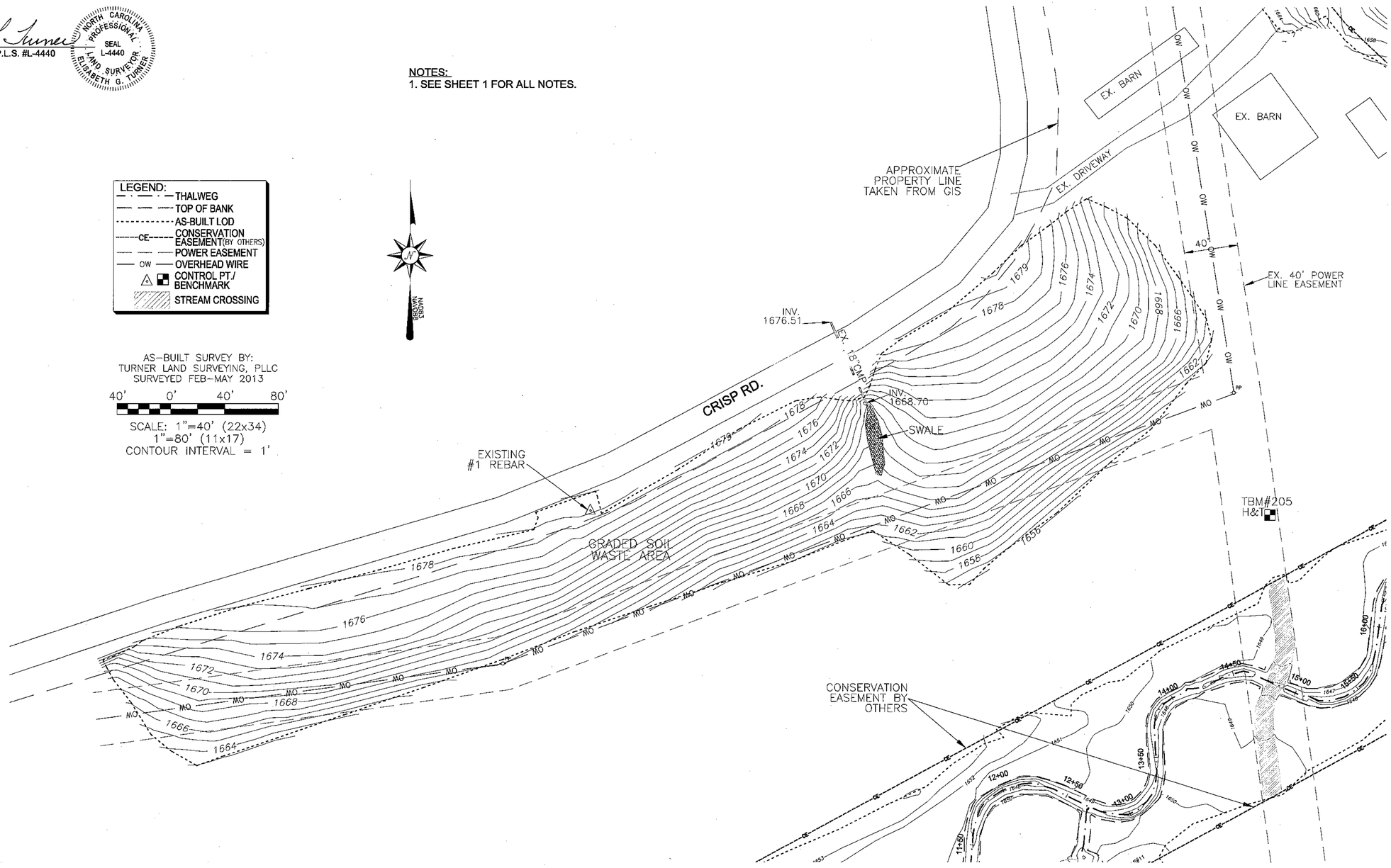

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GRADED SOIL WASTE AREA

AS-BUILT SURVEY OF
UT TO MARTINS CREEK (CONTRERAS)
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14 of 14