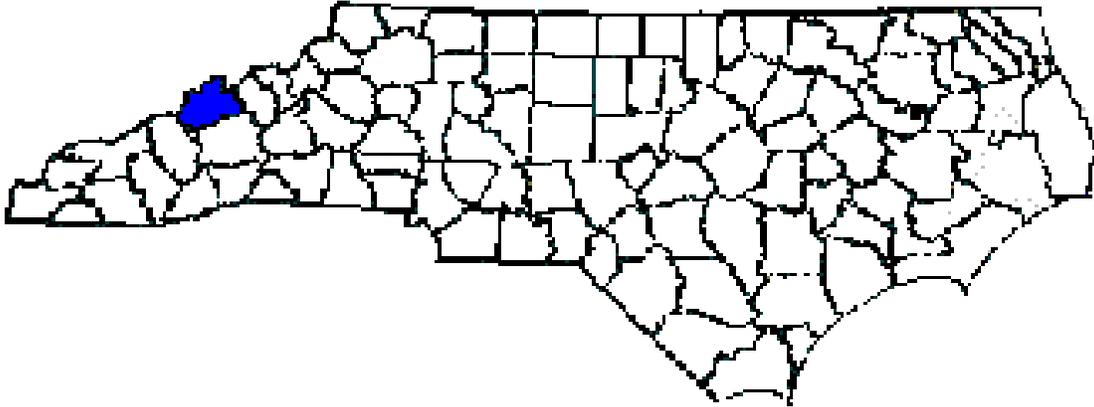


ANNUAL REPORT FOR 2015



**Middle Fork Creek Site E Mitigation Site
Madison County
TIP No. R-2518A
COE Action ID: SAW-2007-2197-357/300
DWR #: 20071134**



Prepared By:
Natural Environment Section & Roadside Environmental Unit
North Carolina Department of Transportation
November 2015

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during the Year 2015 at the Middle Fork Creek Site E Mitigation Site in Madison County. The North Carolina Department of Transportation (NCDOT) completed this project in November 2008 and water was turned in May 2009. This report provides the monitoring results for the sixth formal year of monitoring (Year 2015). The Year 2015 monitoring period was the sixth of five scheduled years of monitoring on the Middle Fork Creek Site E Mitigation Site (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring at the Middle Fork Creek Site E, it has met the required monitoring protocols for the sixth formal year of monitoring on the stream and for the fourth formal year of monitoring on the planted vegetation. Stream repairs completed in June 2014 at Site E included constructing j-hooks, geolifts, rock vanes, grading work and removing some structures to stabilize the stream (see repair plans on pages 9 & 10). The streambank and buffer area were originally planted in March 2012 with live stakes and bareroot seedlings. The site was supplementally planted in March 2015 after stream repairs were completed. The planted vegetation is surviving at this time.

NCDOT will continue stream and vegetation monitoring at the Middle Fork Creek Site E Mitigation Site in 2016.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2015 at the Middle Fork Creek Site E Mitigation Site. Site E is located on US 19 in Madison County at Sta. 33+80 Rt. and Sta. 33+80 to 38+00 Lt. -L- (Figure 1). The Middle Fork Creek Site E was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2518A in Madison County.

The mitigation site provided approximately 833 linear feet of stream restoration and 820 linear feet of stream preservation. Construction was completed during November 2008 and water was turned in May 2009 by the NCDOT. Stream restoration involved backfilling a portion of the existing channel so the roadway could be extended. A new floodplain and channel were excavated and several in-stream structures such as crossvanes and j-hooks were installed. The riparian buffer will also be planted.

1.2 Purpose

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2015 at the Middle Fork Creek Site E Mitigation Site. Hydrologic monitoring was not required for this site.

1.3 Project History

November 2008	Construction Completed
May 2009	Water Turned Into Stream
March 2009	Site Planted (Type I only)
October 2009	As-Built Survey Completed
November 2010	Stream Channel Monitoring (Year 1)
November 2011	Stream Channel Monitoring (Year 2)
March 2012	Site Planted (Type I and II)
September 2012	Vegetation Monitoring (Year 1)
November 2012	Stream Channel Monitoring (Year 3)
February 2013	Live Staked Eroded Banks
March 2013	Bankfull Monitoring Gauge Installed
August 2013	Vegetation Monitoring (Year 2)
November 2013	Stream Channel Monitoring (Year 4)
May 2014	Small Patches of Japanese Knotweed Sprayed
June 2014	Stream Repairs
July 2014	Small Patches of Japanese Knotweed Sprayed
August 2014	Vegetation Monitoring (Year 3)
November 2014	Stream Channel Monitoring (Year 5)
March 2015	Supplemental Planting
July 2015	Vegetation Monitoring (Year 4)
July 2015	Small Patch of Japanese Knotweed Sprayed
November 2015	Stream Channel Monitoring (Year 6)

1.4 Debit Ledger

The entire Middle Fork Creek Site E stream mitigation site was used for the R-2518A project to compensate for unavoidable stream impacts.

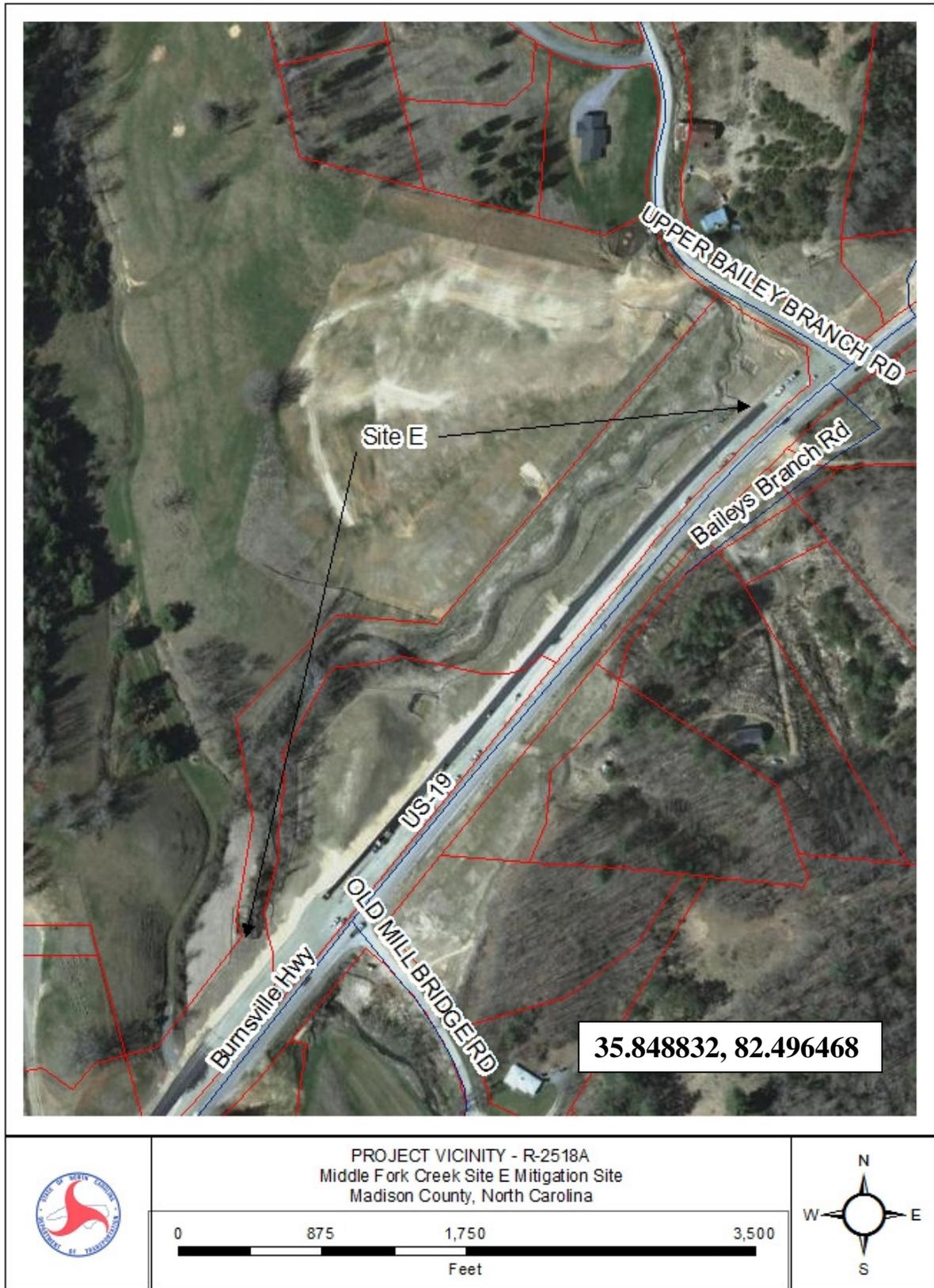


Figure 1. Vicinity Map

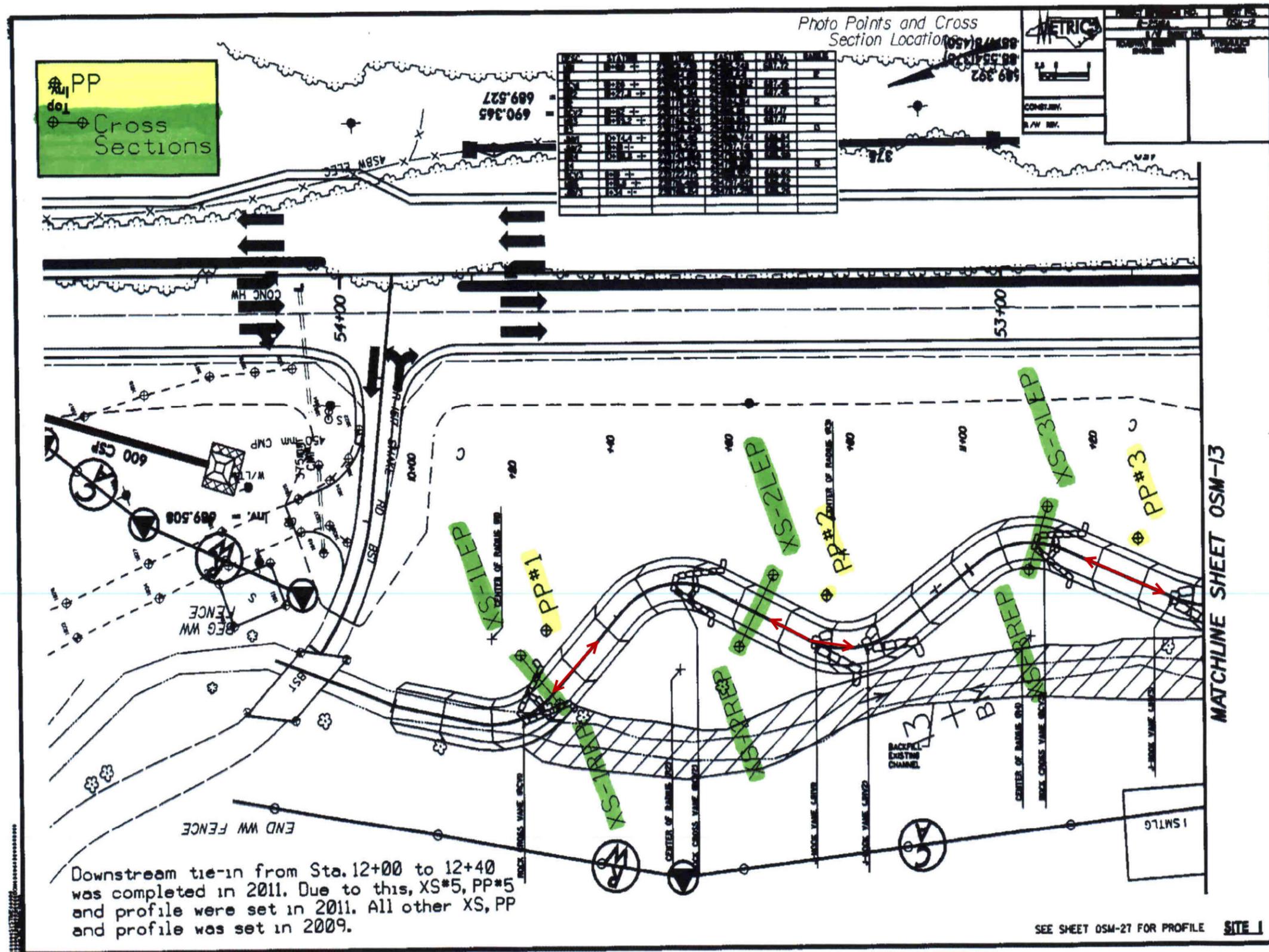


Figure 2. Site E Map



PROJECT REFERENCE NO.	SHEET NO.
R-2518A	RF-7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

STREAMBANK REFORESTATION FOR SITE E & F

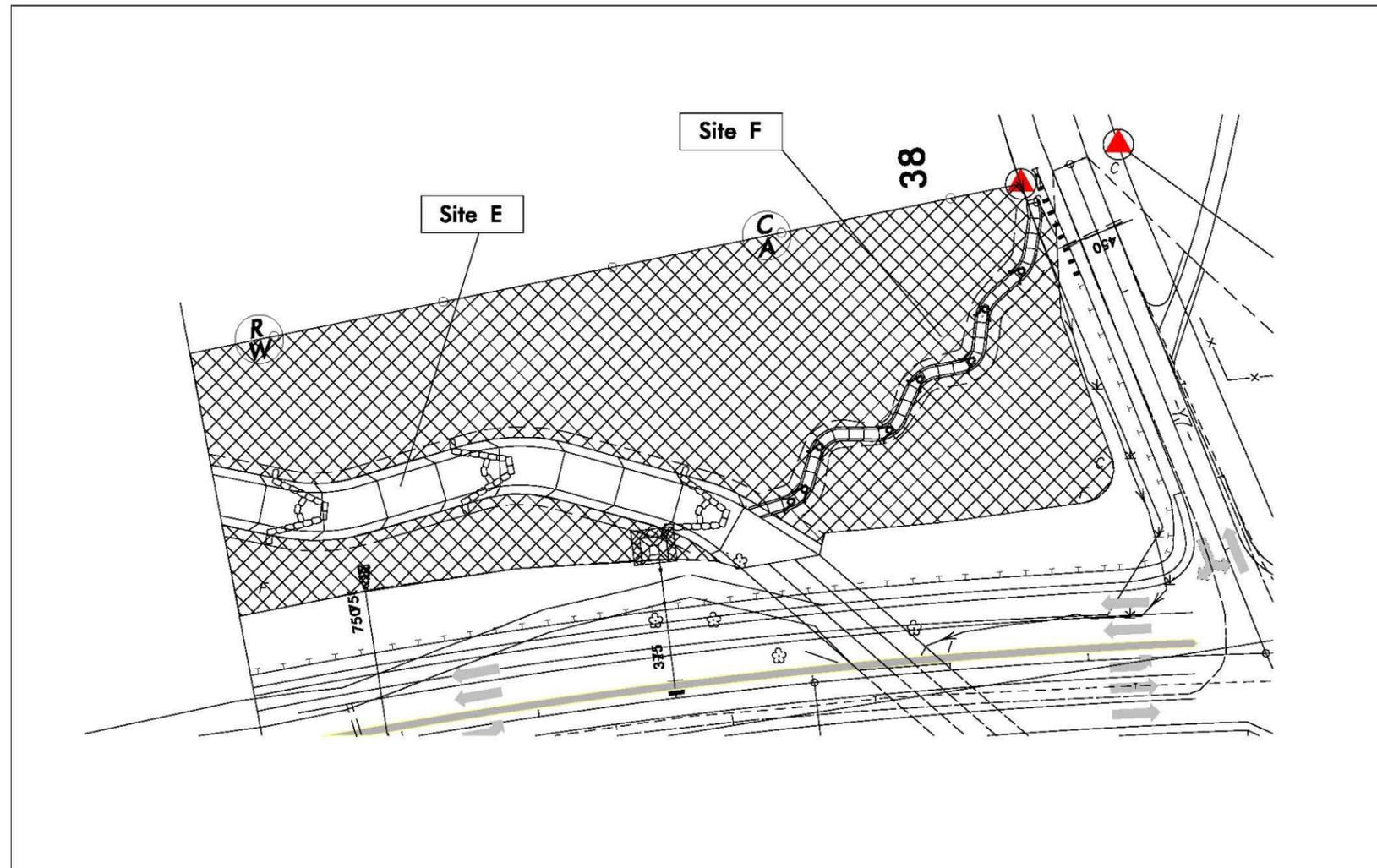


Figure 5. Site E Reforestation Map



PROJECT REFERENCE NO.	SHEET NO.
R-2518A	RF-8
R./W. SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

STREAMBANK REFORESTATION FOR SITE E (LOWER)

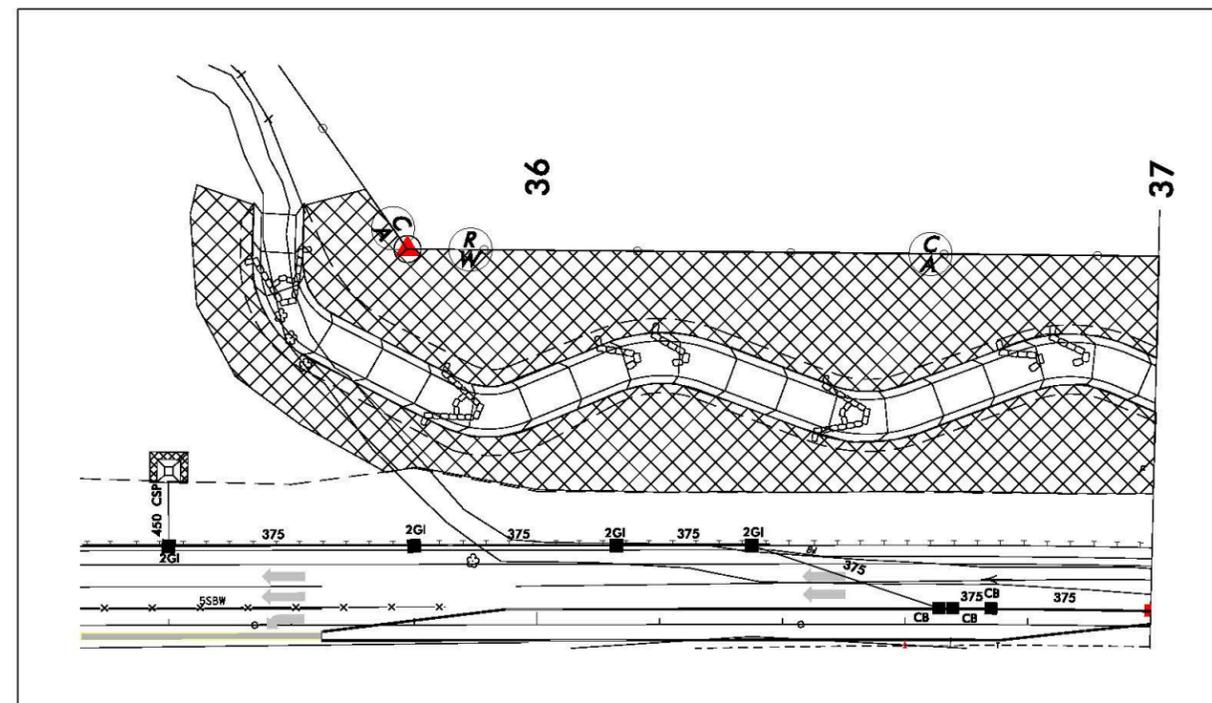
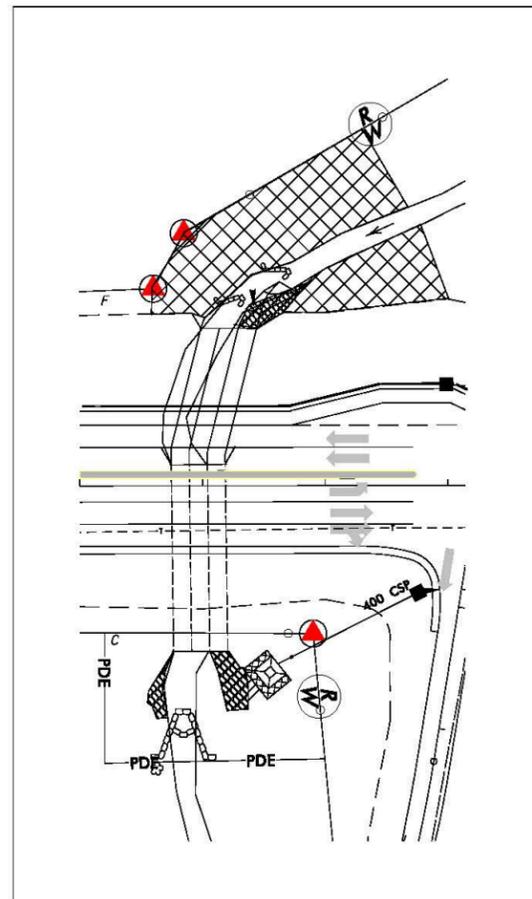


Figure 6. Site E Reforestation Map

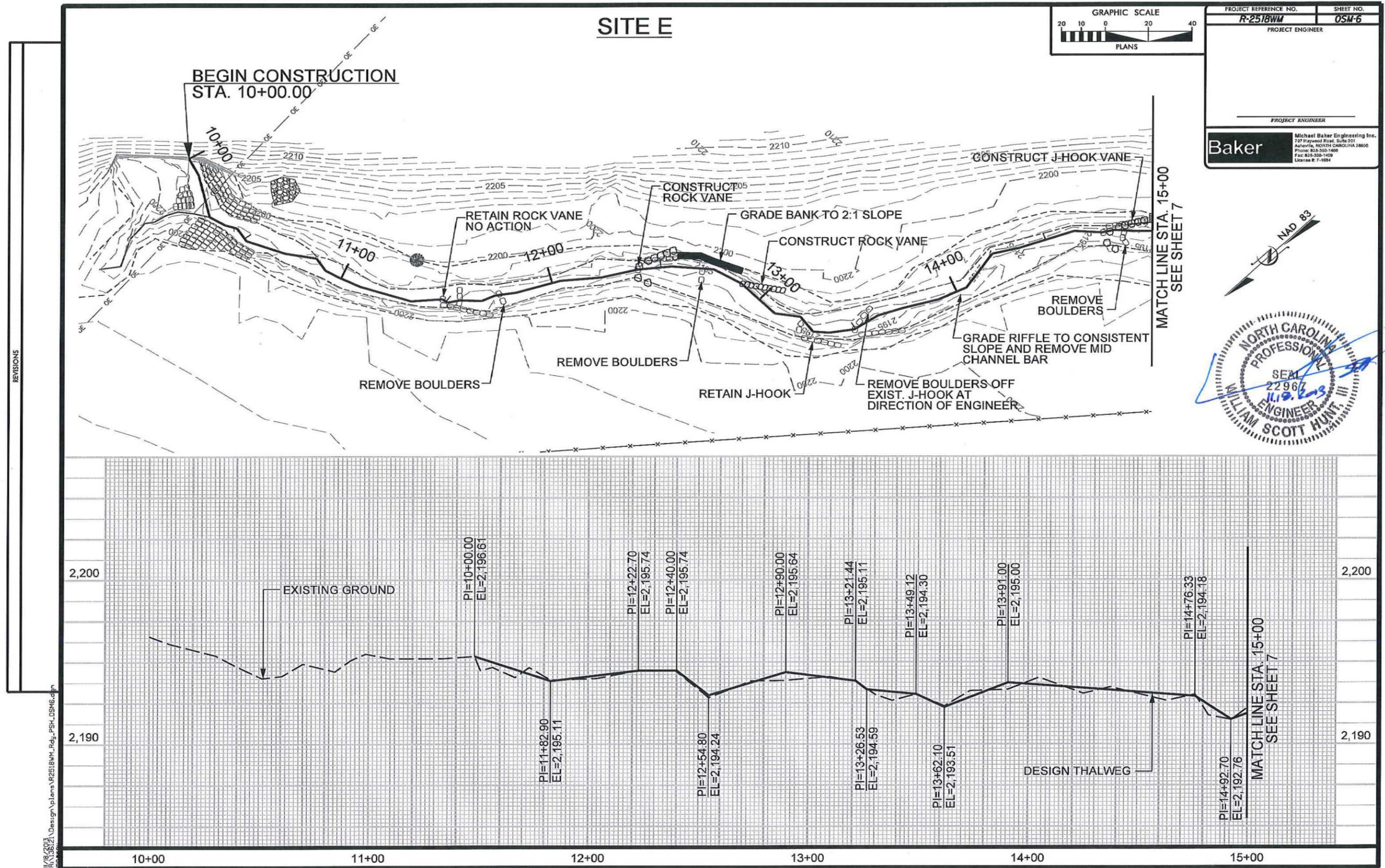


Figure 7. Site E Repair Plans

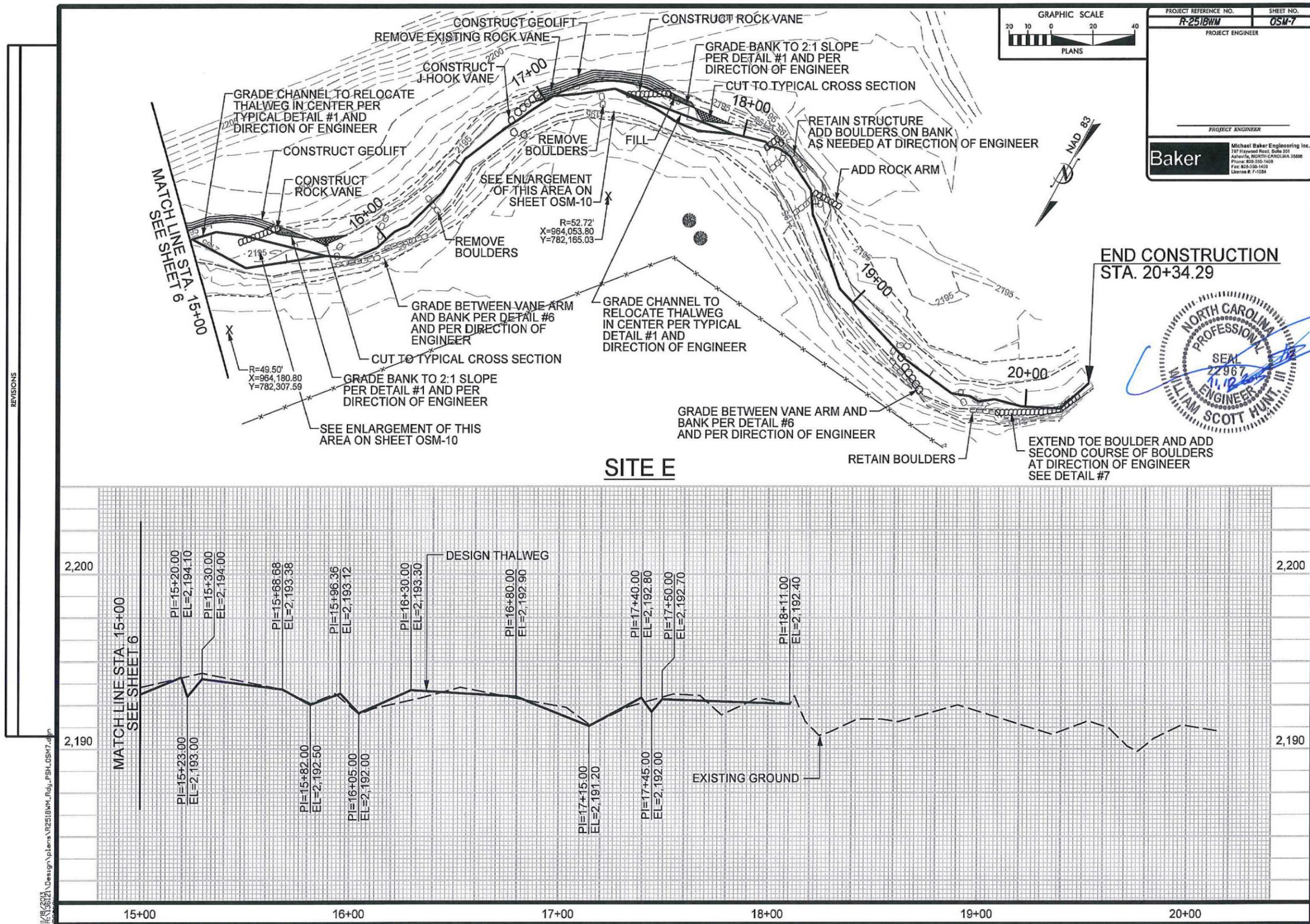


Figure 8. Site E Repair Plans

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The permittee shall monitor the restoration and enhancement mitigation sites following the Level 1 protocols outlined in the "Stream Mitigation Guidelines," dated April 2003 with the following exceptions:

1. Pebble counts shall not be conducted.
2. Two cross sections shall be conducted for streams less than 500 linear feet and five (5) cross sections shall be conducted for streams greater than 500 linear feet.
3. Riparian success shall be by visual inspection of plant survival. Photos will be taken and comments noted on plant survival.

The permittee shall monitor the preservation sites by visual inspection. Photos will be taken and comments noted on plant survival. The monitoring shall be conducted annually for a minimum of five (5) years after final planting. The monitoring results shall be submitted to DWR in a final report within sixty (60) days after completing monitoring. After 5 years the NCDOT shall contact the DWR to schedule a site visit to "close out" the mitigation site.

2.2 Stream Description

2.2.1 Post-Construction Conditions

The restoration of the Middle Fork Creek Site E Mitigation Site involved backfilling a portion of the existing channel so the roadway could be extended. A new floodplain and channel were excavated and several in-stream structures such as cross vanes and j-hooks were installed. The riparian buffer will also be planted.

2.2.2 Monitoring Conditions

The objective of the Middle Fork Creek Site E stream restoration was to restore a B4c stream as identified in Rosgen's Applied River Morphology. A total of five cross sections (three in a riffle and two in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1 (Site E).

Table 1. Abbreviated Morphological Summary (Middle Fork Creek Site E)

Variable	Proposed	Cross-Section #1 (Riffle)	Cross-Section #3 (Riffle)	Cross-Section #5 (Riffle)	Min – Max Values (Riffle Sections only)
		2015	2015	2015	2015
Drainage Area (mi ²)	10.4	10.4	10.4	10.4	10.4
Bankfull Cross Sectional Area (ft ²)	61.9	46.92	35.83	35.27	35.27 – 46.92
Maximum Bankfull Depth (ft.)	2.7-3.4	3.64	2.72	2.8	2.72 – 3.64
Width of the Floodprone Area (ft.)	46	45	51.12	36	36 – 51.12
Bankfull Mean Depth (ft)	2.27	1.76	1.05	1.52	1.05 – 1.76
Width/Depth Ratio	12	15.15	32.48	15.22	15.15 – 32.48
Entrenchment Ratio	1.7	1.69	1.5	1.56	1.5 – 1.69
Bankfull Width (ft.)	27.3	26.67	34.1	23.14	23.14 – 34.1

* Riffle values are used for classification purposes, pool values are shown in Appendix A.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of five cross sections and the longitudinal profile of the Middle Fork Creek Site E established by NCDOT after construction. The length of the profile along the Middle Fork Creek Site E was approximately 900 linear feet. Five cross sections were established during the as-built monitoring year. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The location of the cross sections and longitudinal profile are shown in Appendix A.

Middle Fork Creek Site E Cross-Sections:

- ◆ Cross-Section #1: Middle Fork Creek Site E, Station 102+00, midpoint of riffle
- ◆ Cross-Section #2: Middle Fork Creek Site E, Station 316+00, midpoint of pool
- ◆ Cross-Section #3: Middle Fork Creek Site E, Station 500+00, midpoint of riffle
- ◆ Cross-Section #4: Middle Fork Creek Site E, Station 805+00, midpoint of pool
- ◆ Cross-Section #5: Middle Fork Creek Site E, Station 853+00, midpoint of riffle

Based on comparisons of the As-Built to the monitoring data, all of the cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment; however, this information should remain similar in appearance. The longitudinal profile showed that the channel bed was stable for the 2015 monitoring evaluation. Stream repairs completed in June 2014 at Site E included constructing j-hooks, geolifts, rock vanes, grading work and removing some structures to stabilize the stream (see repair plans on pages 9 & 10). Pebble counts were not required per the permit conditions and therefore were not completed. Multiple bankfull events were documented by a surface water gauge at Site E during the 2013 and 2014 monitoring years.

3.0 VEGETATION: MIDDLE FORK CREEK SITE E

3.1 Description of Species

The following tree species were planted on the streambank:

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

The following tree species were planted in the buffer area:

Liriodendron tulipifera, Yellow Poplar

Platanus occidentalis, Sycamore

Fraxinus pennsylvanica, Green Ash

Quercus alba, White Oak

3.2 Results of Vegetation Monitoring

Streambank & Buffer Vegetation: The streambank reforestation was completed in March 2012. A supplemental planting took place in March 2015. The Year 4 vegetation monitoring evaluation noted: Type I: Black Willow, Silky Dogwood, and Type II: Sycamore, Green Ash, Tulip Poplar and White Oak were surviving at the time of the monitoring evaluation. A small area of Japanese Knotweed was sprayed in July 2015 around Cross Section #5.

3.3 Conclusions

NCDOT will continue to monitor the planted vegetation in 2016.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The Middle Fork Creek Site E Mitigation Site has met the required monitoring protocols for the sixth formal year of monitoring on the stream and for the fourth formal year of monitoring on the planted vegetation.

NCDOT will continue monitoring the Middle Fork Creek Site E Mitigation Site in 2016.

5.0 REFERENCES

Stream Mitigation Plan, US Highway 19, R-2518A On-Site Mitigation
Madison County, North Carolina, August 2006.

Design Plans for R-2518A, US 19 from I-26 to 0.8 KM east of the Yancey Co.
Line, Stream Mitigation (Preservation, Enhancement, and Restoration),
HSMM.

North Carolina Department of Transportation (NCDOT), April 29, 2008. 404 and
401 Individual Permits for R-2518A and R-2518B (ACOE Permit No. 2007-
2197-357/300 and DWR Project No. 20071134, Individual Certification No.
3706).

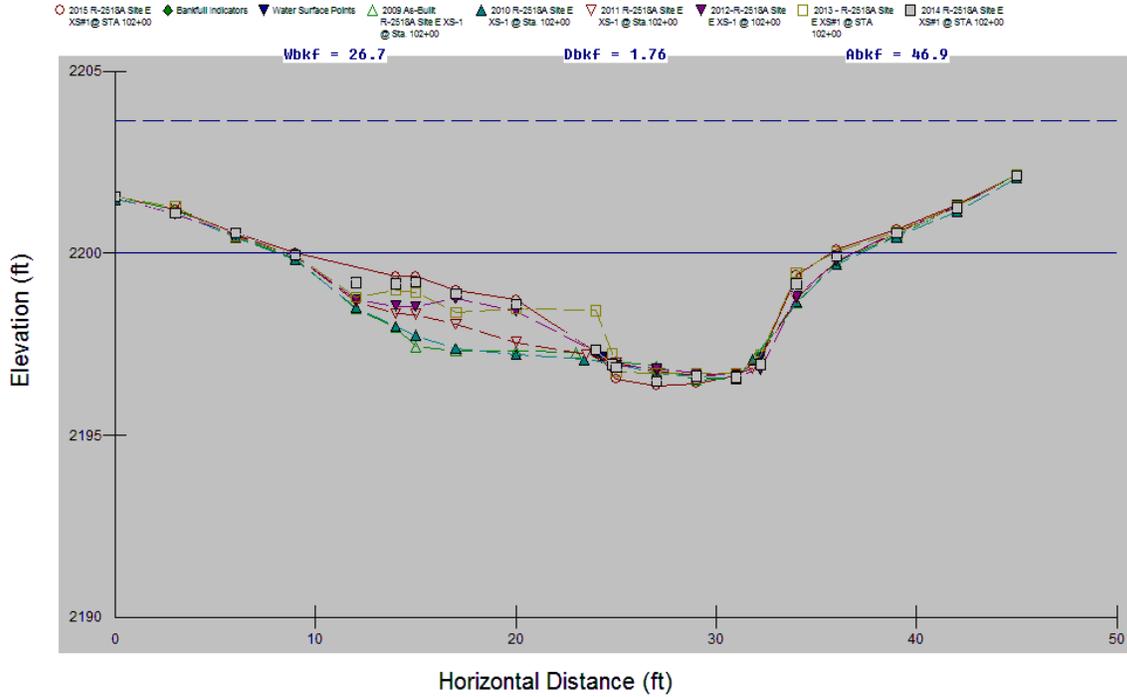
Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa
Springs, Colorado.

US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines.
Prepared with cooperation from the US Environmental Protection Agency,
NC Wildlife Resources Commission, and the NC Division of Water
Resources.

APPENDIX A

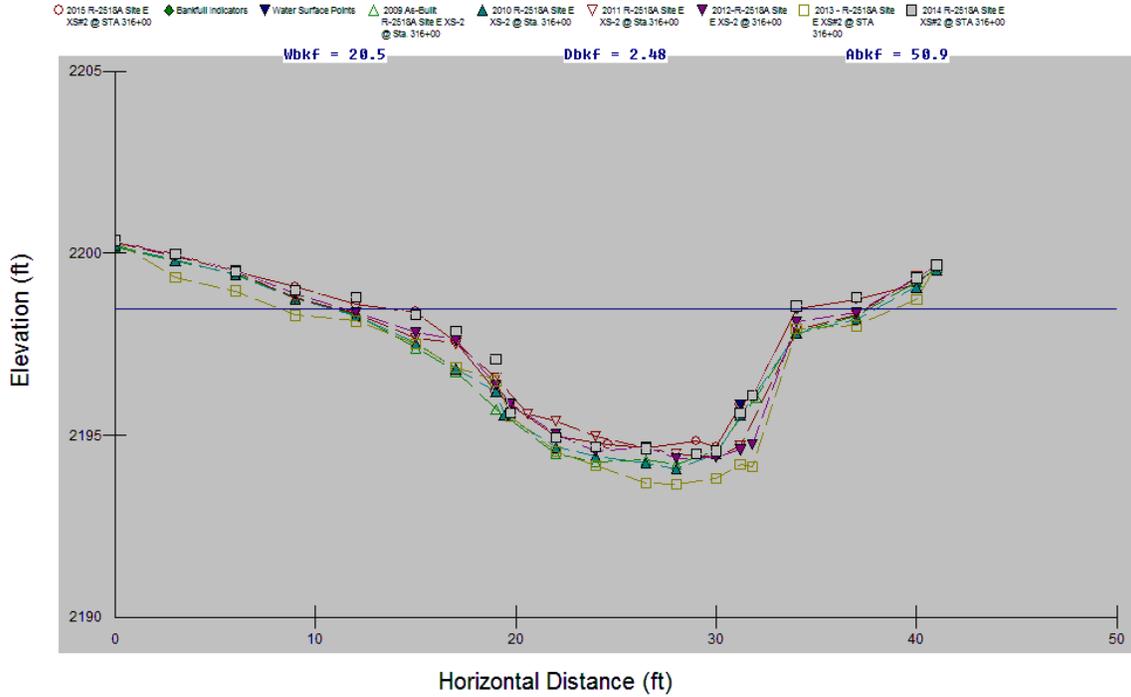
CROSS SECTIONS AND LONGITUDINAL PROFILE

R-2518A Site E XS#1 @ STA 102+00



Site E: Cross-Section #1 (Riffle) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft²)	59.32	56.44	50.89	46.83	47.83	46.92
Maximum Bankfull Depth (ft.)	3.26	3.28	3.28	3.26	3.47	3.64
Width of the Floodprone Area (ft.)	45	45	45	45	45	45
Bankfull Mean Depth (ft.)	2.16	2.06	1.86	1.76	1.76	1.76
Width/Depth Ratio	12.74	13.32	14.74	15.15	15.47	15.15
Entrenchment Ratio	1.64	1.64	1.64	1.69	1.65	1.69
Bankfull Width (ft.)	27.51	27.43	27.42	26.67	27.23	26.67

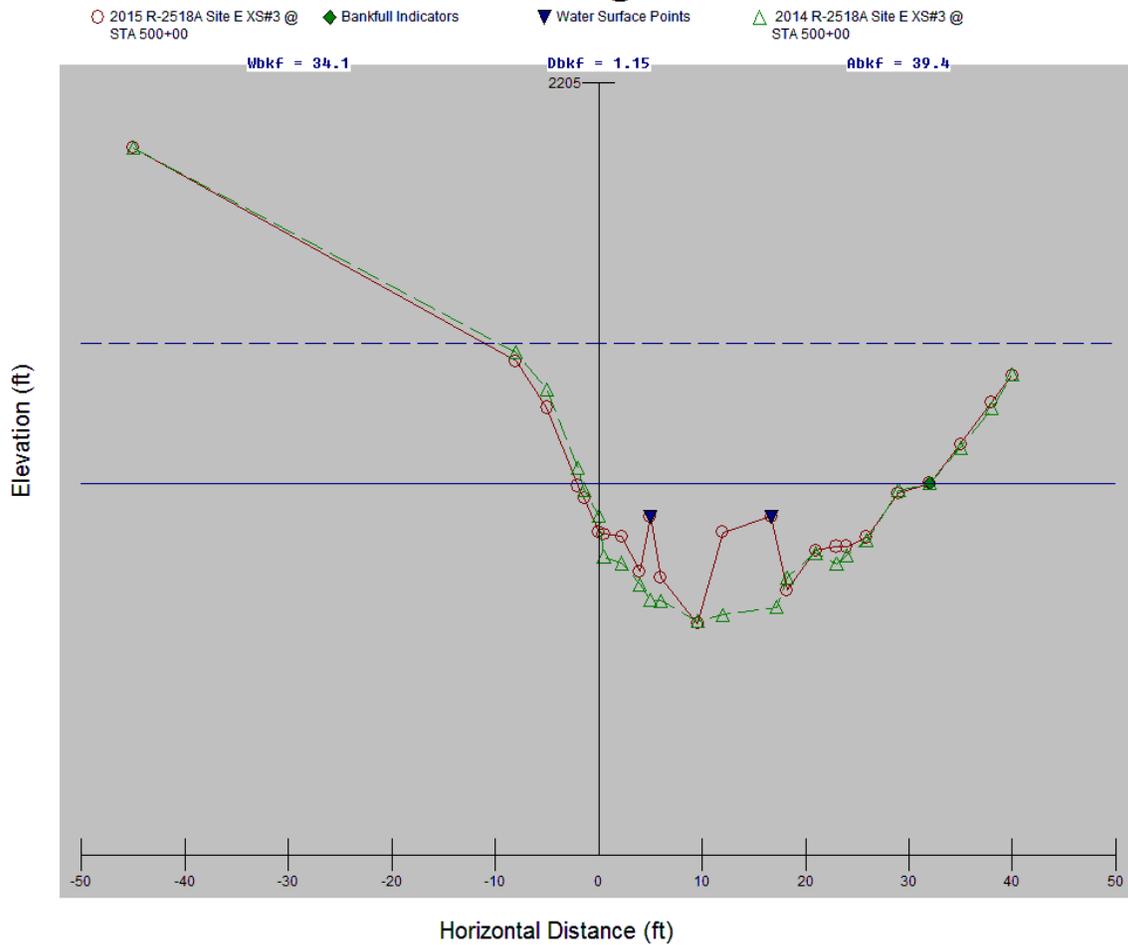
R-2518A Site E XS#2 @ STA 316+00



Site E: Cross-Section #2 (Pool) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft²)	45.83	42.38	49.01	55.21	51.97	50.87
Maximum Bankfull Depth (ft.)	3.72	3.52	3.74	4.27	4.06	3.85
Bankfull Mean Depth (ft.)	2.28	2.11	2.38	2.63	2.54	2.48
Bankfull Width (ft.)	20.07	20.07	20.55	20.97	20.47	20.5

*According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

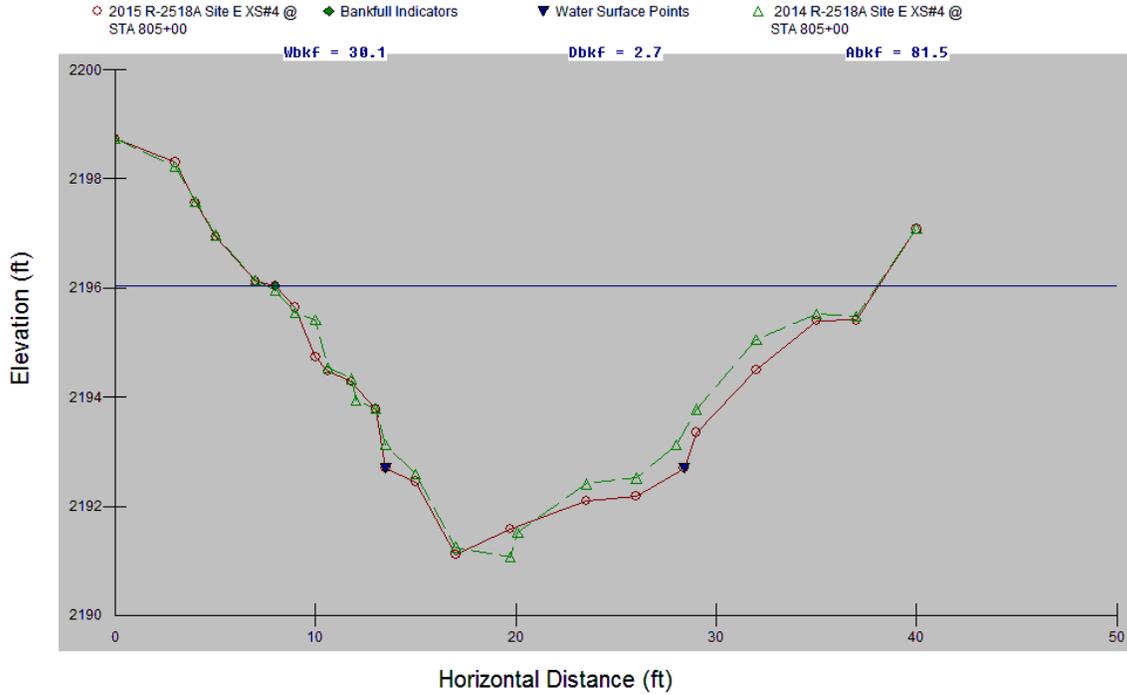
R-2518A Site E XS#3 @ STA 500+00



Site E: Cross-Section #3 (Riffle) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	62.4	63.57	62.14	61.27	54.7	35.83
Maximum Bankfull Depth (ft.)	3.59	3.53	3.89	2.76	2.68	2.72
Width of the Floodprone Area (ft.)	40	40	40	45.8	49.3	51.12
Bankfull Mean Depth (ft.)	2.22	2.13	2.2	1.83	1.63	1.05
Width/Depth Ratio	12.64	14.03	12.86	18.32	20.6	32.48
Entrenchment Ratio	1.43	1.34	1.41	1.37	1.47	1.5
Bankfull Width (ft.)	28.06	29.89	28.3	33.52	33.57	34.1

*The left end pin at Cross Section #3 had to be reset due to stream repairs completed in June 2014, so therefore, the 2014 and 2015 were not overlaid with the previous monitoring years.

R-2518A Site E XS#4 @ STA 805+00

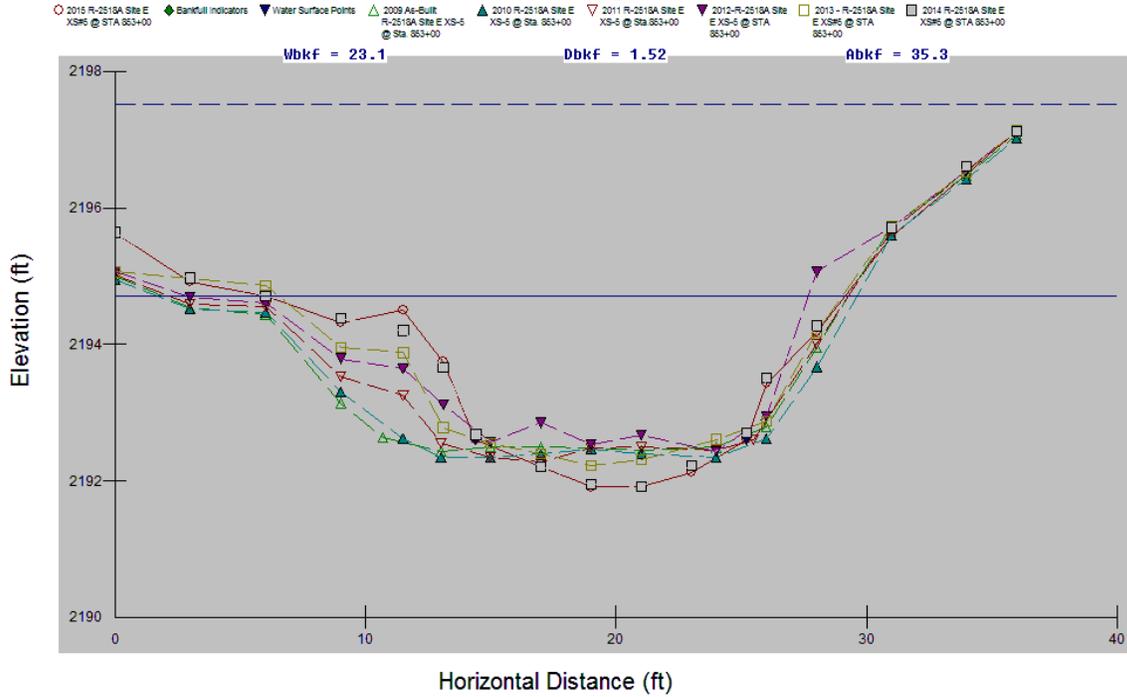


Site E: Cross-Section #4 (Pool) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	69.95	70.4	62.52	46.96	73.26	81.5
Maximum Bankfull Depth (ft.)	4.24	4.53	4.58	3.5	4.89	4.92
Bankfull Mean Depth (ft.)	2.37	2.43	2.12	2.23	2.45	2.7
Bankfull Width (ft.)	29.53	28.92	29.45	21.1	29.89	30.13

*According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

*Cross Section #4 had to be reset after the stream repairs were completed in June 2014, so therefore, the 2014 and 2015 monitoring data were not overlaid with the previous monitoring years.

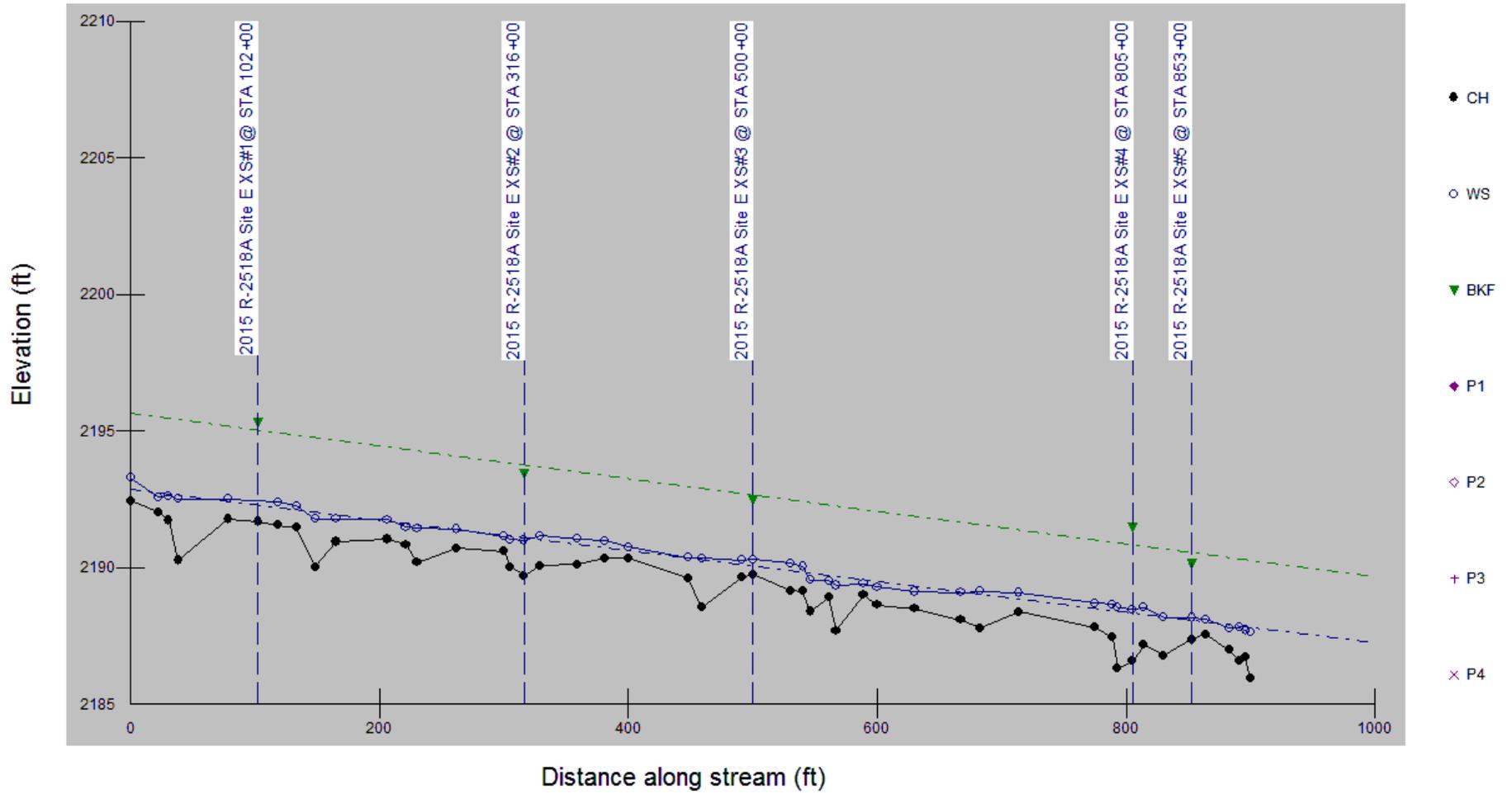
R-2518A Site E XS#5 @ STA 853+00



Site E: Cross-Section #5 (Riffle) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	38.49	36.94	31.55	39.91	34.85	35.27
Maximum Bankfull Depth (ft.)	2.13	2.28	2.17	2.63	2.79	2.8
Width of the Floodprone Area (ft.)	34.6	35.05	34.77	36	36	36
Bankfull Mean Depth (ft.)	1.66	1.61	1.46	1.71	1.52	1.52
Width/Depth Ratio	14	14.28	14.77	13.63	15.08	15.22
Entrenchment Ratio	1.49	1.52	1.61	1.54	1.57	1.56
Bankfull Width (ft.)	23.24	22.99	21.56	23.31	22.92	23.14

*The left end pin at Cross Section #5 had to be reset due to stream repairs completed in June 2014.

2015 R-2518A Site E Profile



APPENDIX B
SITE PHOTOGRAPHS

Middle Fork Creek Site E



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)



Photo Point #3 (Downstream)

November 2015

Middle Fork Creek Site E



Photo Point #4 (Upstream)



Photo Point #4 (Downstream)



Photo Point #5 (Upstream)



Photo Point #5 (Downstream)

November 2015

Middle Fork Creek Site E



Vegetation Overview Photo (Looking Upstream from US 19)



Vegetation Overview Photo (Looking Downstream from US 19)

July 2015

Middle Fork Creek Site E



Vegetation Overview Photo (Right Buffer Looking Downstream from Upper Bailey Branch Rd.)

July 2015