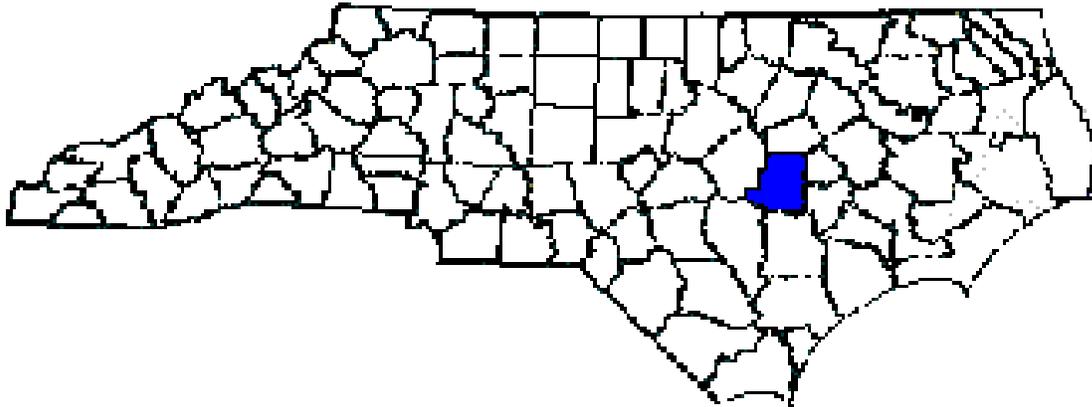


ANNUAL REPORT FOR 2014



**Unnamed Tributary to Smith Mill Run
Wayne County
TIP No. R-2554BA – Permitted Site 4
COE Action ID: SAW-200-00252
DWQ #: 20080570**



Prepared By:
Roadside Environmental Unit & Natural Environment Section
North Carolina Department of Transportation
August 2014

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2014 at the UT to Smith Mill Run Mitigation Site in Wayne County. Construction was completed in 2010 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the fifth formal year of monitoring (Year 2014). The Year 2014 monitoring period is the fifth of five scheduled years for monitoring on UT to Smith Mill Run (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring along UT to Smith Mill Run, the site has met the required monitoring protocols for the fifth formal year of monitoring. Based on comparing the as-built data to the monitoring data, the channel is stable at this time. A supplemental planting was completed at UT to Smith Mill Run in February 2012. The streambank and buffer are meeting the planted vegetation success criteria for the fifth year of monitoring.

The longitudinal profile survey was not conducted along the stream at the UT to Smith Mill Run Mitigation Site in 2014 due to extensive vegetation growth along the channel. The heavy vegetation growth made it impossible to survey the channel without cutting down many of the desired species along the channel. NCDOT proposed to discontinue profile monitoring at the 2012 Annual Monitoring Meeting but it was agreed that a visual inspection of the channel stability throughout the reach and photo documentation at the permanent photo point locations would be completed. All other monitoring activities were to be continued throughout the five year monitoring period.

NCDOT proposes to discontinue stream and vegetation monitoring at the UT to Smith Mill Run Mitigation Site.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2014 at the UT to Smith Mill Run Mitigation Site. The site is located adjacent to US 70 (Goldsboro Bypass) just south of SR 1313 Belfast Road in Goldsboro, NC (Figure 1). UT to Smith Mill Run Mitigation Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2554BA in Wayne County.

The mitigation project covers approximately 1,082 linear feet of stream relocation. Construction was completed in January 2010 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved the installation of rock cross vanes, rock vanes, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

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 2014 at the UT to Smith Mill Run Mitigation Site. Hydrologic monitoring was not required for the site.

1.3 Project History

January 2010	Construction Completed
September 2010	Vegetation Monitoring (Year 1)
October 2010	Stream Channel Monitoring (Year 1)
January 2011	Replanted Site
August 2011	Vegetation Monitoring (Year 2)
November 2011	Stream Channel Monitoring (Year 2)
February 2012	Supplemental Planting
August 2012	Vegetation Monitoring (Year 3)
December 2012	Stream Channel Monitoring (Year 3)
July 2013	Vegetation and Stream Channel Monitoring (Year 4)
July 2014	Vegetation and Stream Channel Monitoring (Year 5)

1.4 Debit Ledger

The entire UT to Smith Mill Run stream mitigation site was used for the R-2554BA project to compensate for unavoidable stream impacts.



Figure 1. Site Location Map

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The stream mitigation site shall be monitored annually for five years or until success criteria are satisfied. Monitoring protocols shall follow the Monitoring Level I outlined in the Stream Mitigation Guidelines, April 2003. NCDOT will evaluate the success of the stream relocation project based on guidance provided by the Stream Mitigation Guidelines disseminated by the United States Army Corps of Engineers-Wilmington District. The survey of channel dimension will consist of permanent cross sections placed at approximately six cross sections (three riffles and three pools). Annual photographs showing both banks and upstream and downstream views will be taken from permanent, mapped photo points. The survey of the longitudinal profile will represent distinct areas of the stream and will cover a cumulative total of 1,041 linear feet of channel. The entire restored length of stream will be investigated for channel stability and in-stream structure functionality. Any evidence of channel instability will be identified, mapped and photographed.

Vegetation Success

For the onsite buffer mitigation sites, the permittee shall monitor the sites for five years. An annual report shall be submitted to the DWQ for a period of 5 years showing monitoring results, survival rate, success of tree and vegetation establishment, and that diffuse flow through the riparian buffer has been maintained. The first annual report shall be submitted within one year of the final planting. Failure to achieve a buffer density of 320 trees per acre after 5 years will require the annual report to provide appropriate remedial actions to be implemented and a schedule for implementation. Approval of the final annual report and a formal "close-out" of the mitigation site by the DWQ is required.

The success of vegetation plantings will be measured through stem counts. Permanent quadrants will be used to sample the riparian buffer. Survival of the live stakes will be determined by visual observation throughout the 5 year monitoring period.

Bareroot vegetation will be evaluated using 2 staked survival plots. Plots will be 50 ft. by 50 ft. or 100 ft. by 25 ft. and all flagged stems will be counted in those plots. Success will be defined as 320 stems per acre after 5 years. All vegetation monitoring will be conducted during the growing season.

2.2 Stream Description

2.2.1 Post-Construction Conditions

The mitigation project covers approximately 1,082 linear feet of stream relocation. Construction was completed in January 2010 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved the installation of rock cross vanes, rock vanes, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

2.2.2 Monitoring Conditions

The objective of the UT to Smith Mill Run Mitigation Site relocation was to build a C5 stream type as identified in the Rosgen's Applied River Morphology. A total of six cross sections (three in a riffle, three in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology in Table 1.

Table 1. Abbreviated Morphological Summary (Upper and Lower Channel of the UT to Smith Mill Run)							
Variable	Proposed Upper Reach	Proposed Lower Reach	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #4 (Riffle)	Cross Section #6 (Riffle)	Min. - Max Values (Riffle Sections Only)
			2014	2014	2014	2014	2014
Drainage Area (sq. mi)	0.084	0.15	0.084	0.084	0.15	0.15	0.15 - 0.084
Bankfull Width (ft)	6.0	8.0	9.78	9.18	11	14.46	9.18 – 14.46
Bankfull Mean Depth (ft)	0.5	0.7	0.34	0.35	0.58	0.47	0.34 – 0.58
Width/Depth Ratio	12.0	11.4	28.76	26.23	18.97	30.77	18.97 – 30.77
Bankfull Cross Sectional Area (ft ²)	3	5.6	3.29	3.19	6.37	6.84	3.19 – 6.84
Maximum Bankfull Depth (ft)	0.65	1.0	0.61	0.81	1.16	1.5	0.61 – 1.5
Floodprone Area (ft)	89-101	62-95	41.27	55	26	41	26 – 55
Entrenchment Ratio	14.8-16.8	7.9-11.9	4.22	5.99	2.36	2.84	2.36 – 5.99

*Drainage Area, Floodprone Width, and Slope are averaged values only.

*Riffle values are used for classification purposes.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of six cross sections and the longitudinal profile of UT to Smith Mill Run Mitigation Site established by the NCDOT after construction. The length of the profile along Smith Mill Run was approximately 1,041 linear feet (Main Channel: 900 lf. and Tributary: 141 lf.). Six cross sections were established during the as-built. 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.

- ◆ Cross Section #1. UT to Smith Mill Run, Station 166+00 linear feet, midpoint of riffle
- ◆ Cross Section #2. UT to Smith Mill Run, Station 251+00 linear feet, midpoint of pool
- ◆ Cross Section #3. UT to Smith Mill Run, Station 329+00 linear feet, midpoint of riffle
- ◆ Cross Section #4. UT to Smith Mill Run, Station 426+50 linear feet, midpoint of pool (main channel) and Station 64+00 linear feet, midpoint of riffle (tributary)
- ◆ Cross Section #5 UT to Smith Mill Run, Station 593+50 linear feet, midpoint of pool
- ◆ Cross Section #6 UT to Smith Mill Run, Station 805+00 linear feet, midpoint of riffle

Based on comparisons of the as-built to the monitoring data, all six 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 survey was not conducted along the stream at the UT to Smith Mill Run Mitigation Site in 2014 due to extensive vegetation growth along the channel. The heavy vegetation growth made it impossible to survey the channel without cutting down many of the desired species along the channel. NCDOT proposed to discontinue profile monitoring at the 2012 Annual Monitoring Meeting but it was agreed that a visual inspection of the channel stability throughout the reach and photo documentation at the permanent photo point locations would be completed. All other monitoring activities will continue to be completed throughout the five year monitoring period.

A visual inspection of the channel and photos taken from photo points 1 through 6 showed that the channel bed is stable throughout the stream relocation at this time. Two small beaver dams were noted up and downstream of Cross Section #6. USDA will be contacted to remove the beavers and dams.

2.4 Results of Stream and Buffer Vegetation

2.4.1 Description of Species

The following live stake 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, Tulip Poplar

Platanus occidentalis, American Sycamore

Juglans nigra, Black Walnut

Betula nigra, River Birch

Fraxinus pennsylvanica, Green Ash

2.4.2 Results of Vegetation Monitoring

Buffer Vegetation: One 50 ft. x 50 ft. vegetation plot and one 100 ft. x 25 ft. vegetation plot were set to determine the trees per acre in the buffer area.

Table 2. Vegetation Monitoring Results

Plot #	Tulip Poplar	American Sycamore	Black Walnut	River Birch	Green Ash	Total (Year 5)	Total (at planting)	Density (Trees/Acre)
1	3	24		2	15	44	64	468
2	3	12		18	2	35	40	595
Year 5 Average Density								531
Year 4 Average Density								648
Year 3 Average Density								639
Year 2 Average Density								442
Year 1 Average Density								319

Site Notes: The black willow and silky dogwood live stakes were surviving along the streambank. Other vegetation noted included cattail, baccharis, sweetgum, lespedeza, soft rush, pine, and various grasses.

2.4.3 Conclusions

There were two vegetation monitoring plots established throughout the buffer area. The 2014 vegetation monitoring of the site revealed an average tree density of 531 trees per acre. This average is above the minimum success criteria of 320 trees per acre after year five monitoring. NCDOT proposes to discontinue monitoring the vegetation at the UT to Smith Mill Run Mitigation Site.

3.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The UT to Smith Mill Run Mitigation Site has met the required monitoring protocols for the fifth formal year of monitoring. The channel and structures throughout the stream are stable at this time. The streambank and buffer are meeting the planted vegetation success criteria for the fifth year of monitoring.

NCDOT proposes to discontinue stream and vegetation monitoring at the UT to Smith Mill Run Mitigation Site.

4.0 REFERENCES

Natural Channel Design for UT to Smith Mill Run (Permit Site 4); Wayne County, NC, Rev. October 10, 2007.

As-Built Report for Stream Restoration on R-2554BA Permit Site 4, Wayne County, NC, February 26, 2010.

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

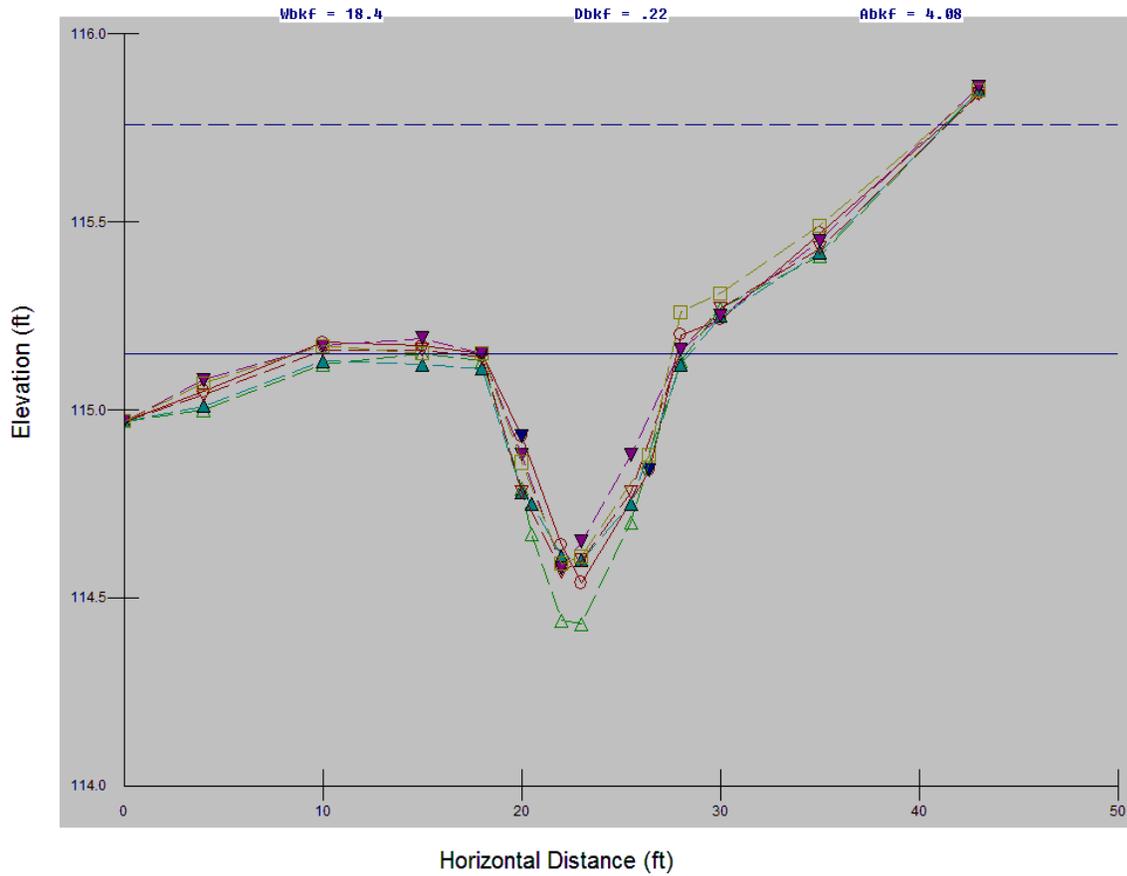
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

APPENDIX A

CROSS SECTION COMPARISONS

R-2554BA Site 4 XS-1 @ Sta. 166+00

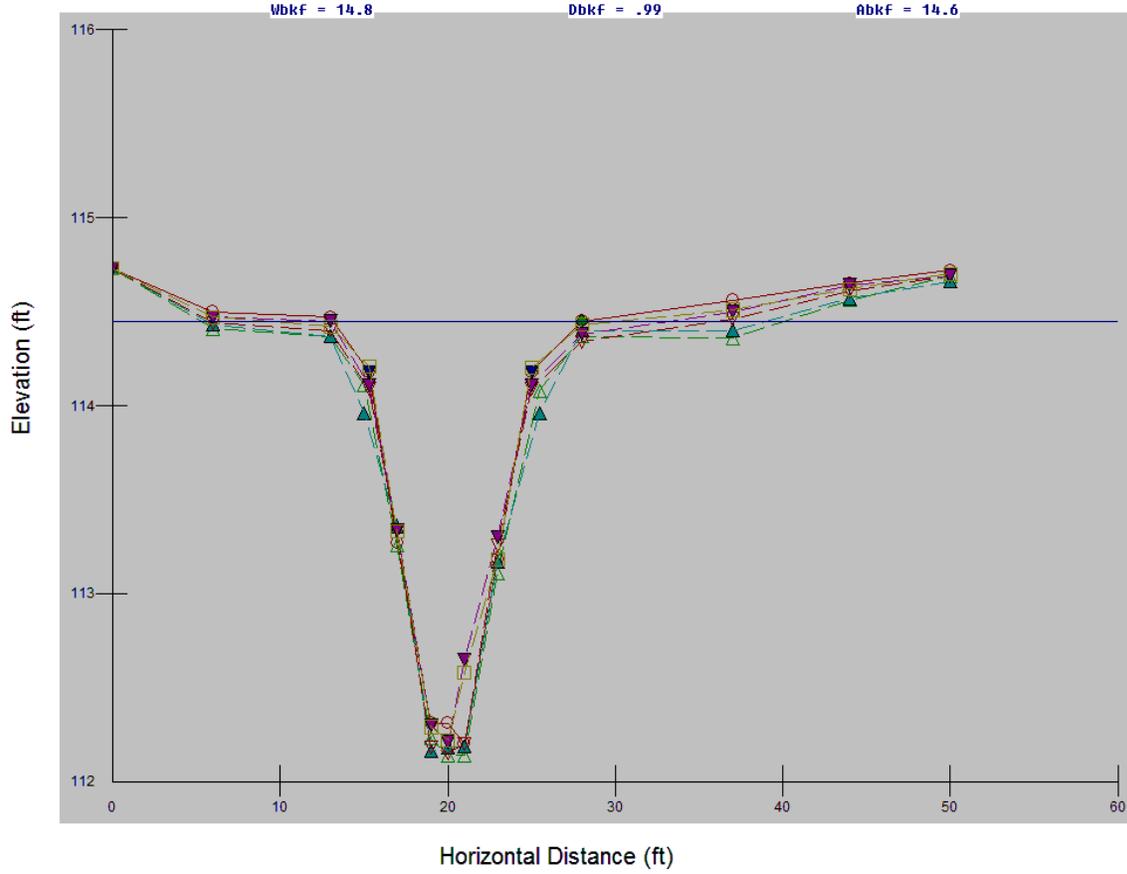
○ 2014 XS-1 @ Sta. 166+00
 ◆ Bankfull Indicators
 ▼ Water Surface Points
 △ As-Built XS-1 @ Sta. 166+00
 ▲ 2010 XS-1 @ Sta. 166+00
 ▽ 2011 XS-1 @ Sta. 166+00
 ▼ 2012 XS-1 @ Sta. 166+00
 □ 2013 XS-1 @ Sta. 166+00



Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	9.93	9.87	9.91	9.54	9.78
Bankfull Mean Depth (ft)	0.32	0.34	0.30	0.34	0.34
Width/Depth Ratio	31.03	29.03	33.03	28.06	28.76
Bankfull Cross Sectional Area (ft ²)	3.18	3.4	2.93	3.22	3.29
Maximum Bankfull Depth (ft)	0.51	0.57	0.57	0.56	0.61
Width of the Floodprone Area (ft)	43	40.46	40.27	39.89	41.27
Entrenchment Ratio	3.9	4.1	4.06	4.18	4.22

R-2554BA Site 4 XS-2 @ Sta. 251+00

○ 2014 XS-2 @ Sta. 251+00
 ◆ Bankfull Indicators
 ▼ Water Surface Points
 △ As-Built XS-2 @ Sta. 251+00
 ▲ 2010 XS-2 @ Sta. 251+00
 ▽ 2011 XS-2 @ Sta. 251+00
 ▼ 2012 XS-2 @ Sta. 251+00
 □ 2013 XS-2 @ Sta. 251+00

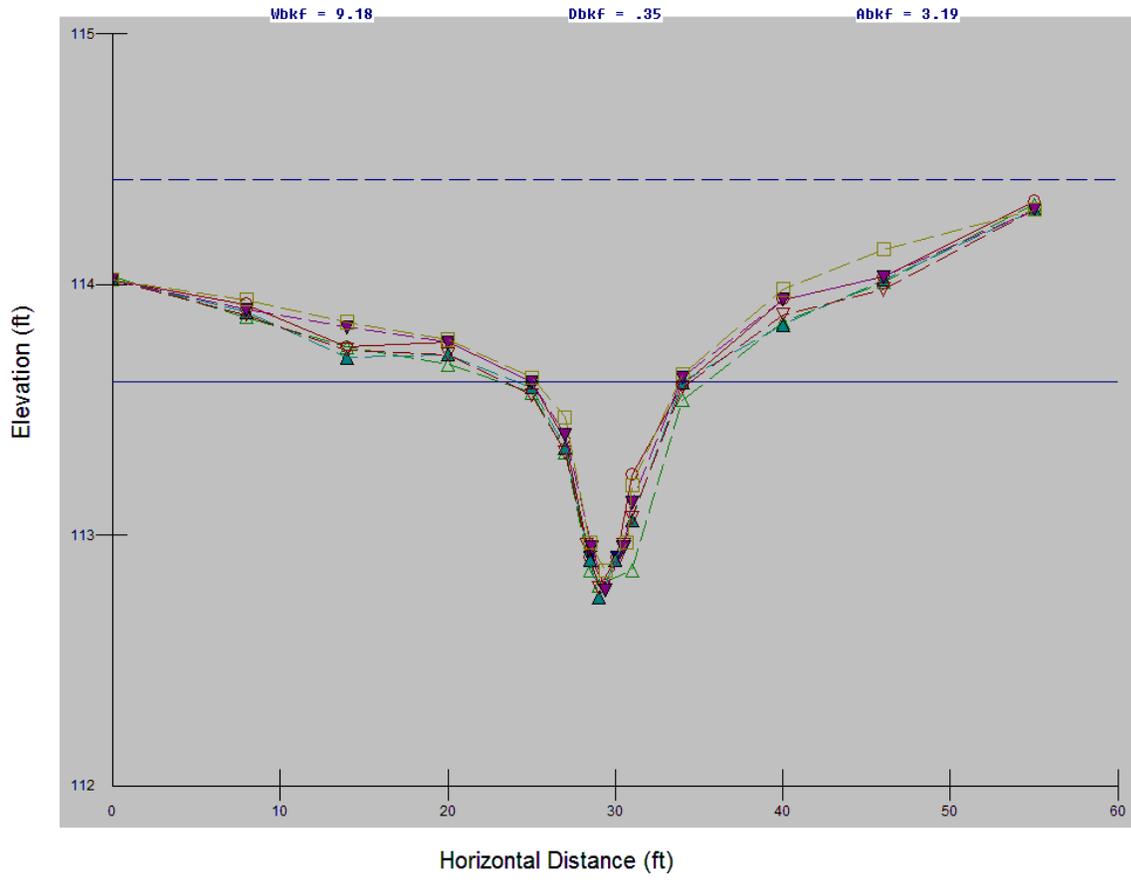


Cross-Section #2 (Pool) Abbreviated Morphological Summary*					
	2010	2011	2012	2013	2014
Bankfull Cross Sectional Area (ft ²)	15.81	13.74	13.12	13.76	14.64
Maximum Bankfull Depth (ft)	2.24	2.19	2.17	2.21	2.25
Bankfull Mean Depth (ft)	0.85	0.94	0.9	0.84	0.99
Bankfull Width (ft)	18.5	14.55	14.53	16.4	14.84

* 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-2554BA Site 4 XS-3 @ Sta 329+00

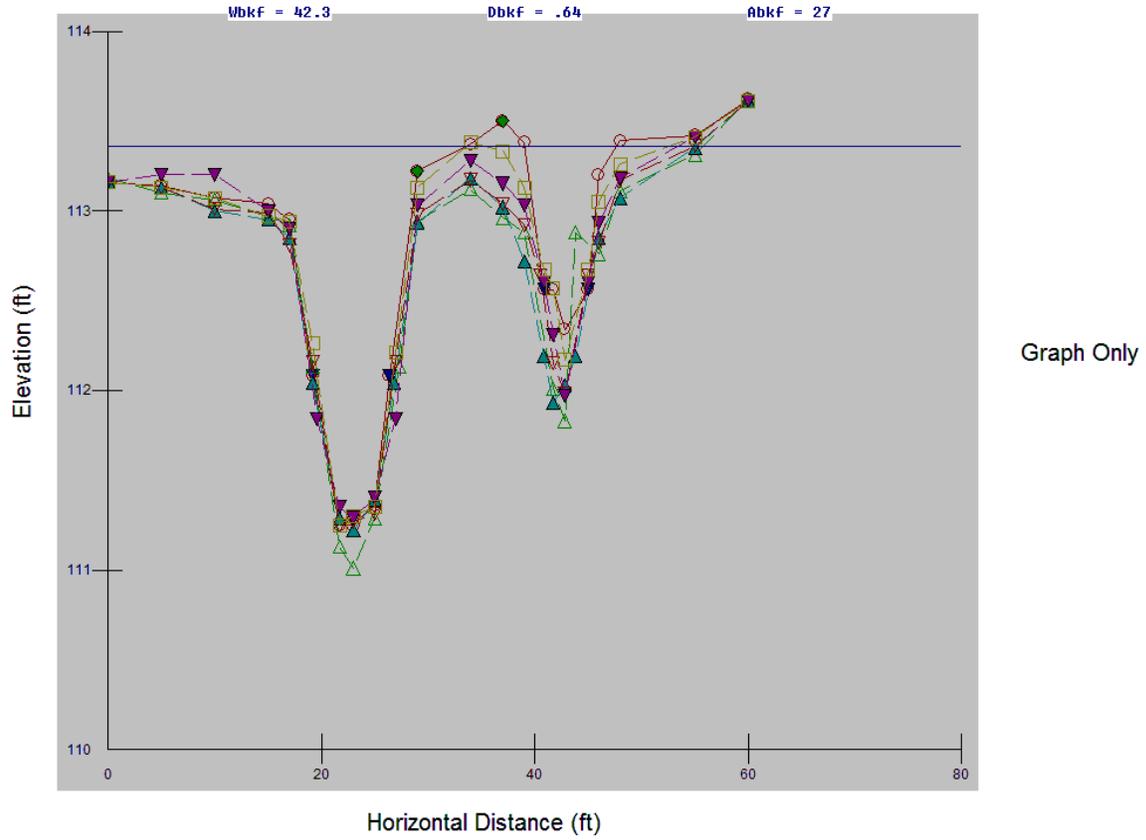
○ 2014 XS-3 @ Sta. 329+00
 ◆ Bankfull Indicators
 ▼ Water Surface Points
 △ As-Built XS-3 @ Sta. 329+00
 ▲ 2010 XS-3 @ Sta. 329+00
 ▽ 2011 XS-3 @ Sta. 329+00
 ▼ 2012 XS-3 @ Sta. 329+00
 □ 2013 XS-3 @ Sta. 329+00



Cross-Section #3 (Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	8.89	8.83	8.88	8.93	9.18
Bankfull Mean Depth (ft)	0.39	0.37	0.37	0.35	0.35
Width/Depth Ratio	22.79	23.86	24	25.51	26.23
Bankfull Cross Sectional Area (ft ²)	3.46	3.24	3.3	3.14	3.19
Maximum Bankfull Depth (ft)	0.84	0.77	0.83	0.77	0.81
Width of the Floodprone Area (ft)	55	55	55	55	55
Entrenchment Ratio	6.19	6.23	6.19	6.16	5.99

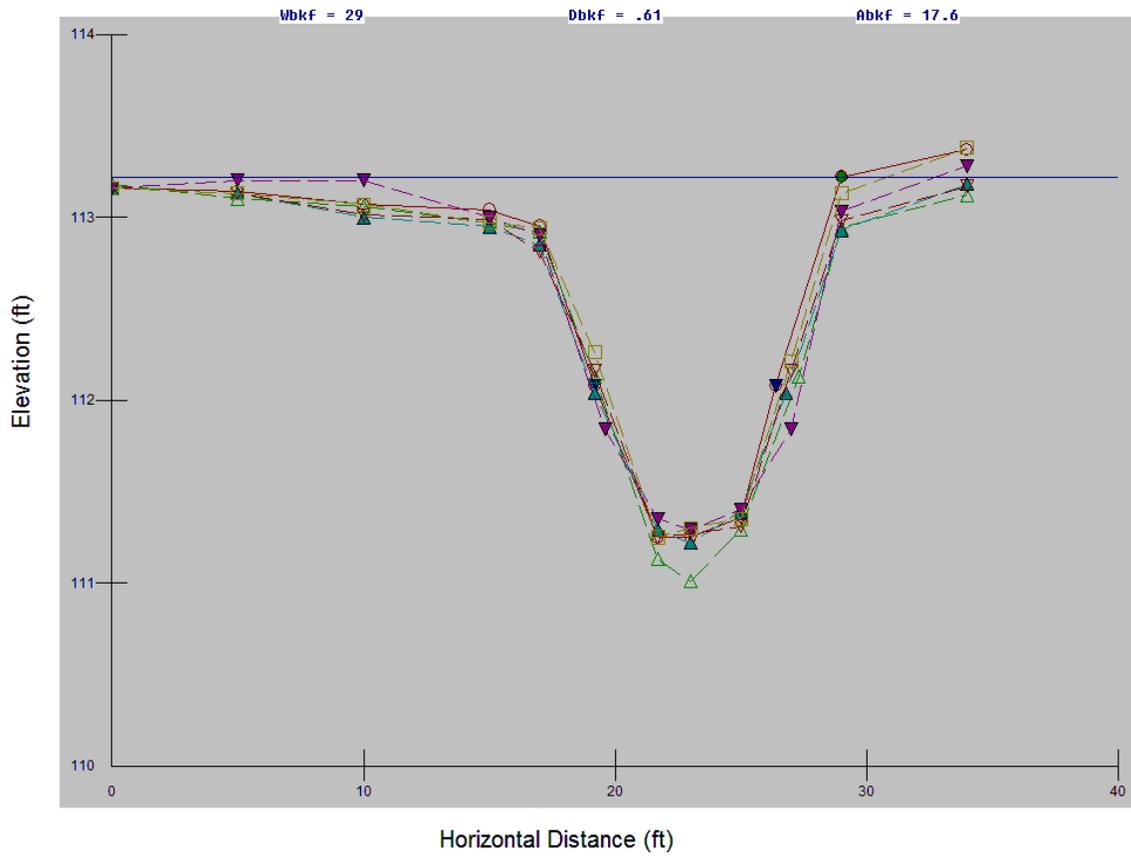
R-2554BA Site 4 XS-4 Pool @ Sta. 426+50 (Main) and Riffle @ Sta. 64+00 (Trib.)

- 2014 XS-4
- ◆ Bankfull Indicators
- ▼ Water Surface Points
- △ As-Built XS-4
- ▲ 2010 XS-4
- ▽ 2011 XS-4
- ▼ 2012 XS-4
- 2013 XS-4



R-2554BA Site 4 Pool XS-4 @Sta. 426+50 on Main Channel

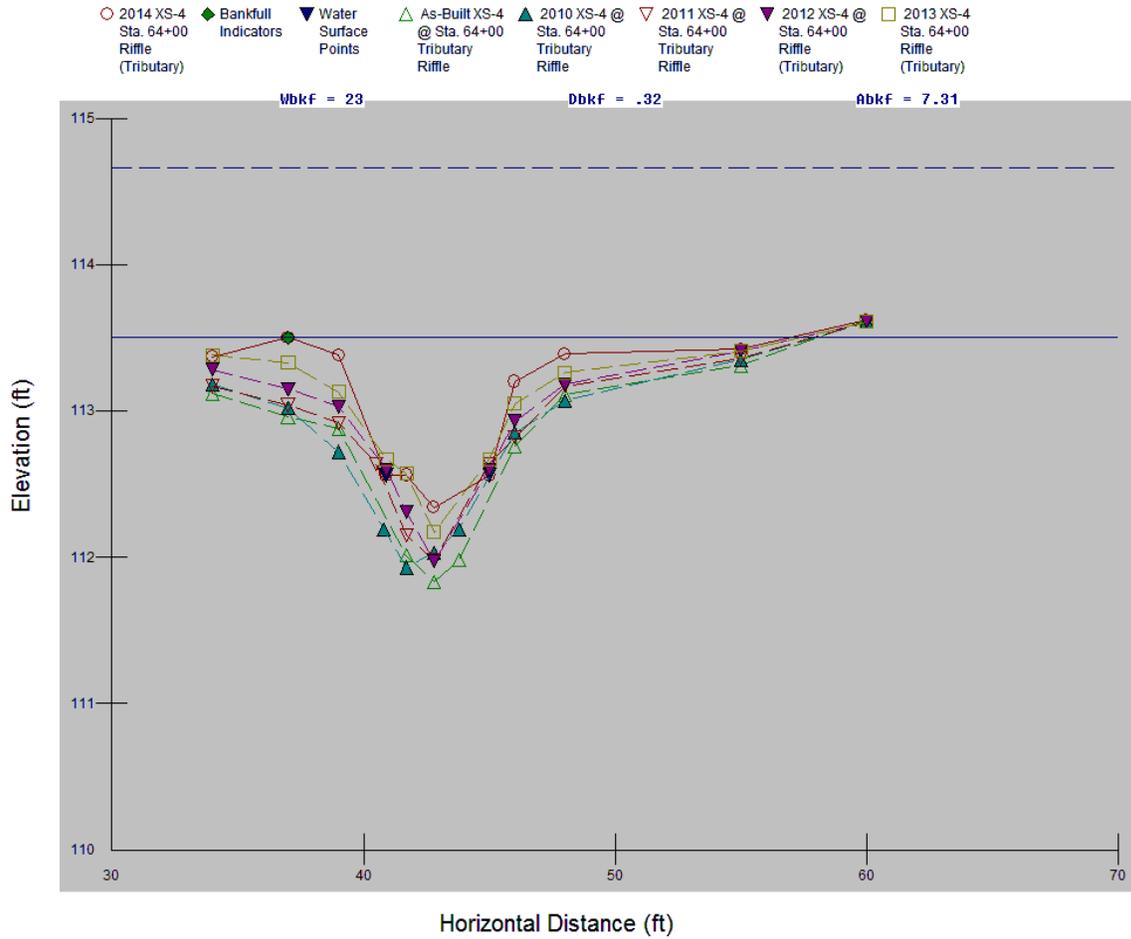
- 2014 XS-4 Sta. 426+50 Pool (Main Channel)
- ◆ Bankfull Indicators
- ▼ Water Surface Points
- △ As-Built XS-4 @ Sta. 426+50 Pool Main
- ▲ 2010 XS-4 @ Sta. 426+50 Pool Main
- ▽ 2011 XS-4 @ Sta. 426+50 Pool Main
- ▼ 2012 XS-4 @ Sta. 426+50 Pool (Main Channel)
- 2013 XS-4 @ Sta. 426+50 Pool (Main Channel)



Cross-Section #4 (Main Pool) Abbreviated Morphological Summary*					
	2010	2011	2012	2013	2014
Bankfull Cross Sectional Area (ft ²)	12.89	13.36	14.5	15.14	15.41
Maximum Bankfull Depth (ft)	1.71	1.73	1.74	1.88	1.97
Bankfull Mean Depth (ft)	0.95	0.96	0.98	0.8	1.28
Bankfull Width (ft)	13.6	13.89	14.75	19	12

* 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.

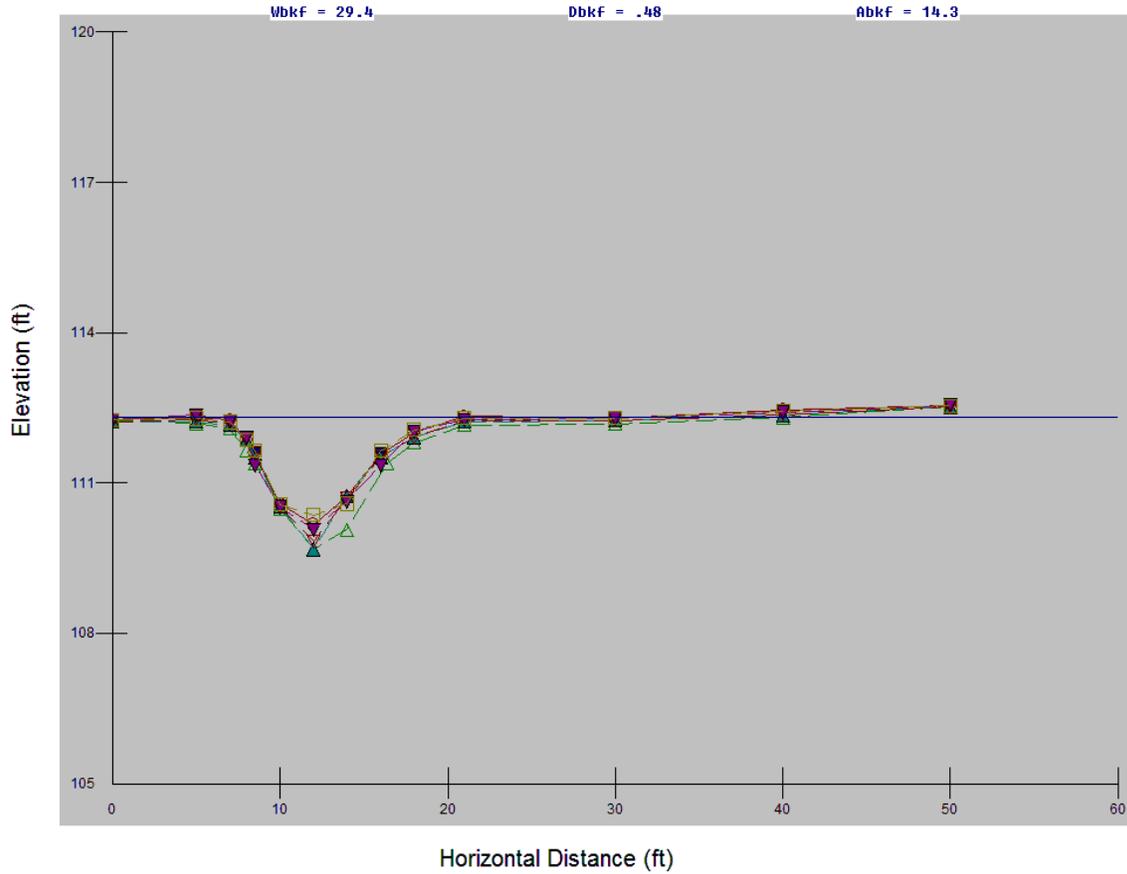
R-2554BA Site 4 Riffle XS-4 @ Sta. 64+00 (Tributary)



Cross-Section #4 (Tributary Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	10.55	10.26	10.76	14.27	11
Bankfull Mean Depth (ft)	0.52	0.43	0.46	0.39	0.58
Width/Depth Ratio	20.29	23.86	23.39	36.59	18.97
Bankfull Cross Sectional Area (ft ²)	5.47	4.41	4.91	5.58	6.37
Maximum Bankfull Depth (ft)	1.09	1.06	1.18	1.16	1.16
Width of the Floodprone Area (ft)	26	26	26	26	26
Entrenchment Ratio	2.47	2.53	2.42	1.82	2.36

R-2554BA Site 4 XS-5 @ Sta 593+50

○ 2014 XS-5 @ Sta. 593+50
 ◆ Bankfull Indicators
 ▼ Water Surface Points
 △ As-Built XS-5 @ Sta. 593+50
 ▲ 2010 XS-5 @ Sta. 593+50
 ▽ 2011 XS-5 @ Sta. 593+50
 ▼ 2012 XS-5 @ Sta. 593+50
 □ 2013 XS-5 @ Sta. 593+50

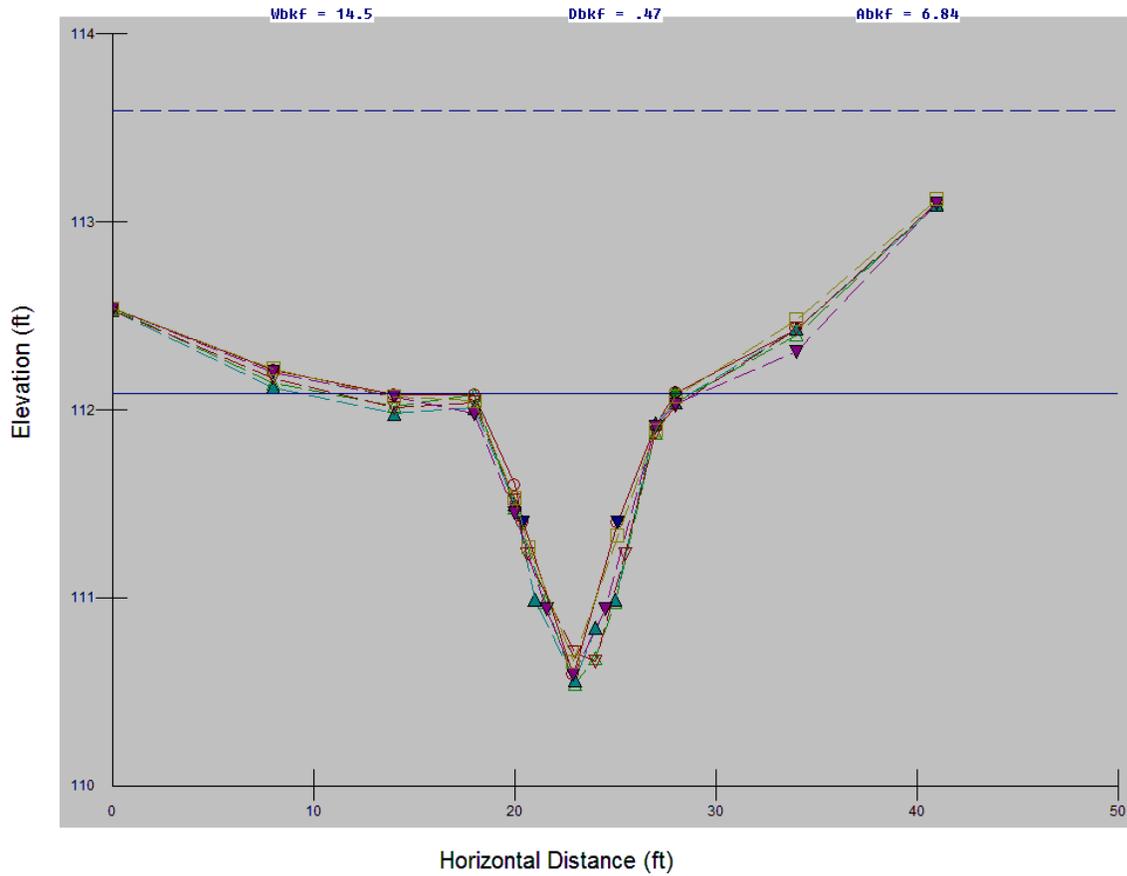


Cross-Section #5 (Pool) Abbreviated Morphological Summary*					
	2010	2011	2012	2013	2014
Bankfull Cross Sectional Area (ft ²)	14.34	14.6	14.27	13.37	13.99
Maximum Bankfull Depth (ft)	2.55	2.43	2.19	1.94	2.15
Bankfull Mean Depth (ft)	0.9	0.91	0.99	0.84	0.88
Bankfull Width (ft)	16	16	14.36	16	15.91

* 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-2554BA Site 4 XS-6 @ Sta. 805+00

○ 2014 XS-6 @ Sta. 805+00
 ◆ Bankfull Indicators
 ▼ Water Surface Points
 △ As-Built XS-6 @ Sta. 805+00
 ▲ 2010 XS-6 @ Sta. 805+00
 ▽ 2011 XS-6 @ Sta. 805+00
 ▼ 2012 XS-6 @ Sta. 805+00
 □ 2013 XS-6 @ Sta. 805+00



Cross-Section #6 (Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	9.73	9.92	12.22	14	14.46
Bankfull Mean Depth (ft)	0.75	0.72	0.59	0.49	0.47
Width/Depth Ratio	12.97	13.78	20.71	28.57	30.77
Bankfull Cross Sectional Area (ft ²)	7.28	7.1	7.26	6.83	6.84
Maximum Bankfull Depth (ft)	1.45	1.36	1.44	1.41	1.5
Width of the Floodprone Area (ft)	41	41	41	41	41
Entrenchment Ratio	4.21	4.13	3.35	2.93	2.84

APPENDIX B

SITE PHOTOGRAPHS,

CROSS SECTION, VEGETATION PLOT, AND

PHOTO POINT LOCATIONS

AND

STREAMBANK REFORESTATION PLAN

UT to Smith Mill Run



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)



Photo Point #3 (Downstream)

July 2014

UT to Smith Mill Run



Photo Point #4 (Upstream on Main Channel)



Photo Point #4 (Downstream on Main Channel)



Photo Point #4 (Upstream on Tributary)



Photo Point #5 (Upstream)



Photo Point #5 (Downstream)

July 2014

UT to Smith Mill Run



Photo Point #6 (Upstream)



Photo Point #6 (Downstream)



Beaver dam upstream of Cross Section #6



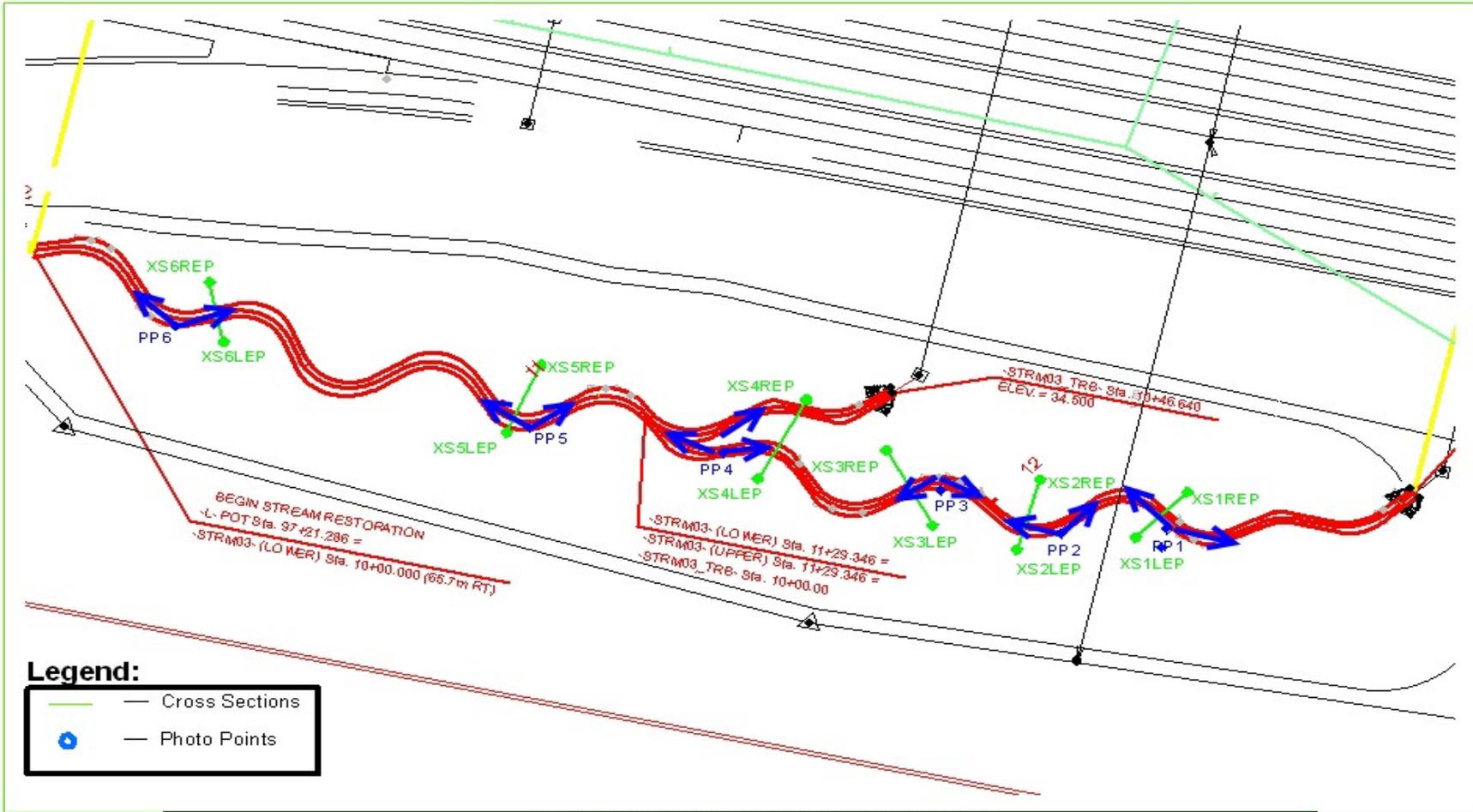
Beaver dam downstream of Cross Section #6



Overview Photo Looking Upstream
July 2014



Overview Photo Looking Downstream

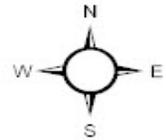
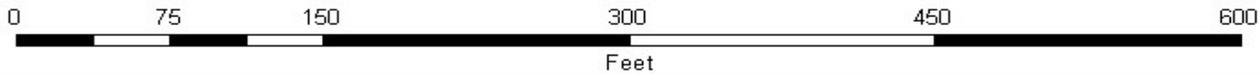


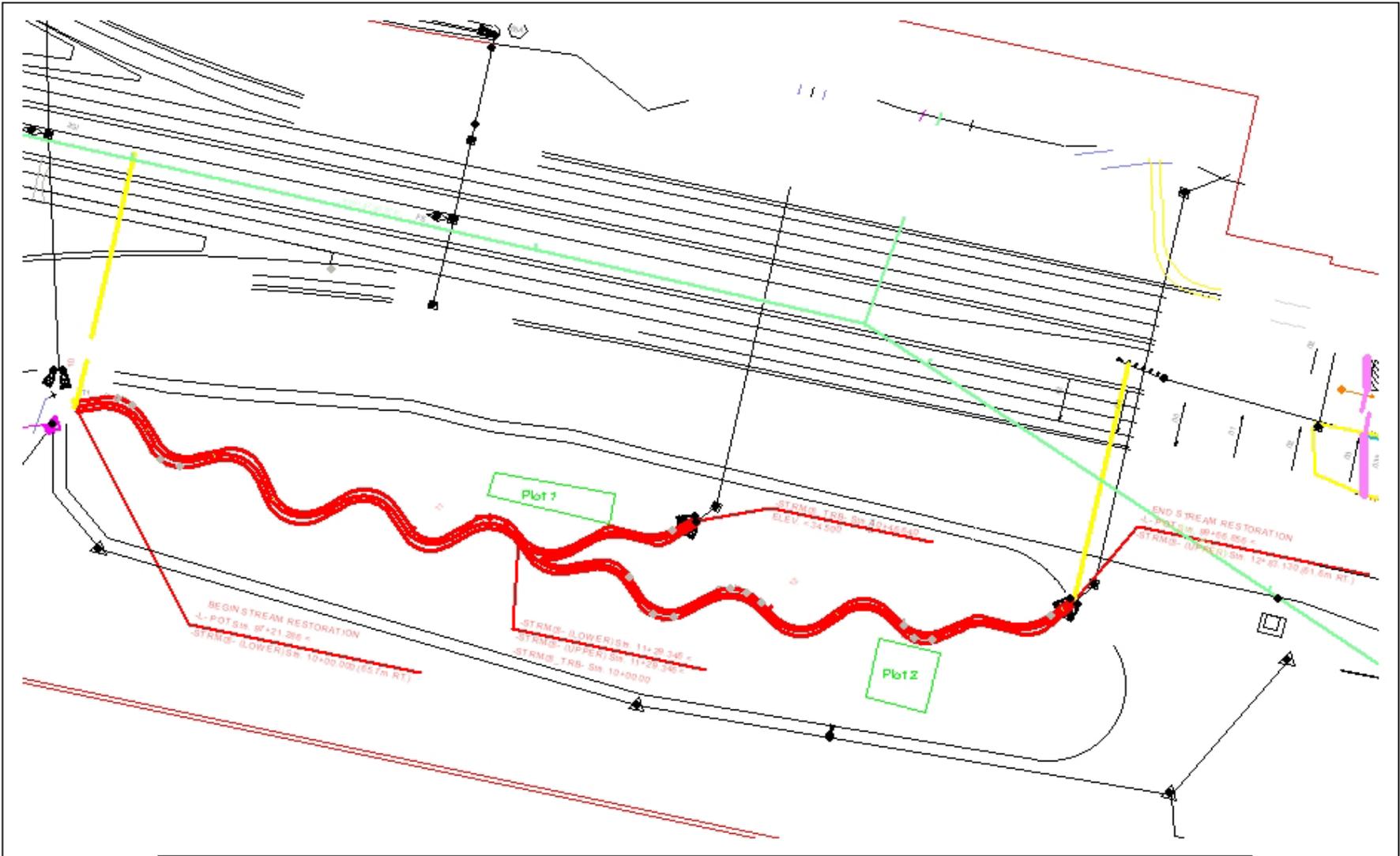
Legend:

- Cross Sections
- Photo Points

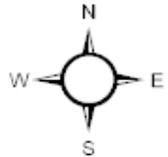
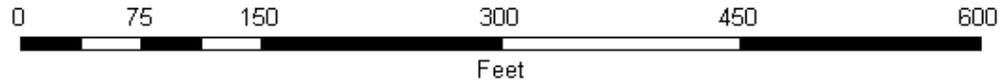


**Photo Point and Cross Section Locations
R-2554BA UT to Smith Mill Run
Wayne County, North Carolina**





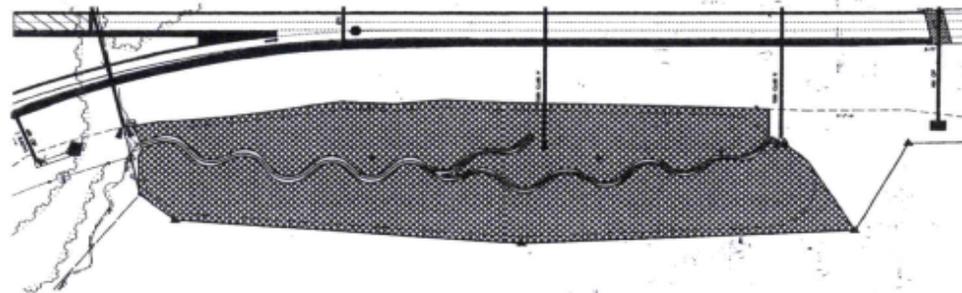
Vegetation Plot Locations
R-2554BA UT to Smith Mill Run
Wayne County, North Carolina





PROJECT REFERENCE NO. R-2554BA	SHEET NO. EC-40/CONSTR
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

1.5 HECTARE STREAMBANK REFORESTATION



SEE RF-2, RF-3 AND PROJECT SPECIAL PROVISIONS

Streambank Reforestation
R-2554BA UT to Smith Mill Run
Wayne County, North Carolina