OAKLEY CROSSROADS (G)
STREAM & BUFFER RESTORATION

MONITORING REPORT (YEAR 5 OF 5)

Pitt County, North Carolina
SCO Project Number 050659701
DMS Project Number 273

Prepared for:
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Environmental Quality

Status of Plan: Final
Construction Completed: 2011
Data Collected: 2015
Submission Date: December 2015

Prepared by:

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Raleigh, NC 27606

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1.0 Project Summary

The Oakley Crossroads Restoration Site is located approximately four miles south of Robersonville, North Carolina in northern Pitt County. This project is located in the Coastal Plain physiographic region in the 03090020 Cataloging Unit of the Tar-Pamlico River basin. A 24.8-acre conservation easement was recorded on land historically farmed up to the ditch bank. This channelized third order perennial stream flows from west to east through the easement before discharging into Tranters Creek and further downstream, to the Tar River. This project stream, Tranters Creek, and Tar River are all nutrient sensitive waters (NCDWQ, 2004).

The overall goal of the Oakley restoration project is to improve water quality and wildlife habitat by restoring a stable stream and riparian buffer system to the project site. Specific project goals from the 2006 Restoration Plan include:

- Provide a stable stream channel
- Restore riparian buffers along stream channel
- Improve aquatic and terrestrial habitat along a tributary to Tranters Creek
- Establish a wildlife corridor between the Tranters Creek and Briery Swamp to the south
- Preserve site riverine wetlands
- Improve water quality by diverting an existing agricultural ditch from the stream channel into the Taylor pond

This project includes 3,789 linear feet of stream restoration and 329 linear feet of stream enhancement. Priority II stream restoration involves restoring riffle/pool sequences, the installation of structures, and floodplain grading to improve floodplain connectivity and provide diverse instream habitat. Enhancement II stream restoration includes native hardwood tree and shrub planting. Also, native riparian buffer planting occurred on over 18 acres of the site; and an additional 1.37 acres of wetland was preserved. Because this project was instituted prior to October 11, 2007 riparian buffer restoration credit up to 200 feet from the top of bank of all perennial and intermittent waterways within the conservation easement area is applicable using the grandfathered buffer rules. The project will result in 3,920.60 stream mitigation units (SMUs), 17.77 of buffer mitigation units (BMUs), and 0.27 wetland mitigation units (WMUs).

STREAMS: Success criteria developed in the Restoration Plan for stream includes photo documentation, ecological function, and channel stability measurements. The channel will be considered stable if there are little or insignificant changes from the as-built dimensions and longitudinal profile. Sections 1, 2, and 3 of the Oakley restoration project were observed generally to be in stable condition despite the three beaver dams observed in MY5. The beaver dams were dismantled as much as possible during the monitoring event to allow collection of usable survey data to assess the geomorphology of the stream. The largest beaver dam located at Station 14+00 could only be partially removed which distorted the water surface survey data collected upstream. As a whole, the channel's profile and cross-section adjusted only minimally from baseline conditions. In addition and as described in the Restoration Plan, pool/riffle spacing remained constant, pools did not aggrade nor did riffles degrade, indicating stream success.

The channel has good connection to its floodplain. Evidence of bankfull overflow was observed during the initial assessment in the spring of 2015 and again in November 2015. The dimension, pattern, and profile survey of Sections 1 and 2 for MY5 conditions are consistent with the design intent to reduce stream power and erosion potential.

VEGETATION: The Restoration Plan for this project defines success if at least 260 trees/acre are surviving at the end of five years for each planting zone. This project is generating both stream and riparian buffer mitigation assets. For riparian buffer success and in accordance with North Carolina Division of Water Quality Administrative Code 15A NCAC 02B.0295 (Mitigation Program for Requirements for Protection and Maintenance of Riparian Buffers) planted vegetation shall include a minimum of at least four native hardwood tree species or four native hardwood tree and native shrub species, where no one species is greater than 50% of established stems at a density to provide 260 trees per acre at maturity. Native volunteer species may be included to meet performance standards.

The Monitoring Year 5 [MY5] stem counts within each of the nine (9) vegetation monitoring plots are included in Tables 7 and 9 in Appendix C. All of the nine vegetation plots met MY5 success criteria, with an average of 3,728 stems/acre (planted and volunteers). The average number of plot planted trees was 621 stems/acre. All plots besides one (VP7) met success criteria when considering planted stems alone, which was one stem short (243 stem/acre). It should also be noted a supplemental planting of over 4,800 plants took place throughout the project area in November/December 2013. The downstream end of the project was replanted again in December 2014. Overall, the planted woody vegetation continues to have excellent vigor and exhibit little to no issues, becoming established among the common successional herbaceous species.

ADDITIONAL DISCUSSION: Evidence, mostly minor, of beavers and nutria continues within the project limits from 2011, 2012, 2013, and 2014. The project stream has remained stable and functional despite beaver activity throughout the monitoring period. During the MY5 stream survey, three beaver dams were observed at Stations 18+80, 19+45, and 24+20. These dams were not observed two months earlier during the vegetation monitoring, and have not been in place long enough to affect the stability or functionality of the stream. Beaver control measures (i.e., traps) were in place, indicating that APHIS is working to control beaver on site.

Livestakes affected by previous beaver activity are showing evidence of resprouting and should continue with excellent vigor. Areas throughout the stream have approximately 6-8 inches of fine sediment accumulation, as observed since MY3. A few relict nutria burrows were also observed from Station 4+40 to 10+00 and 21+50, but the livestakes are maintaining bank stability and these areas do not threaten the stability of the stream.

Of note, from approximately Station 0+00 to 5+00 the top of bank and thalweg have aggraded relative to previous years. This is evident in the top of bank point and thalweg data in the longitudinal profile and XS-1 graphs in Appendix D. The deposition is likely a result of floodplain hydraulics and beaver dam influence. High flow events from the surrounding watershed transport sediment through an entrenched channel and culvert upstream of the restoration. As the sediment laden water enters the project, the valley immediately widens and provides ample floodplain. This sharp transition between confined flows and unconfined flows is conducive to deposition on the floodplain. This transition to a lower energy system is further amplified by the frequent beaver activity at this location. The thalweg and top of bank data downstream from Station 5+00 begin to align with data from previous years and the only erosion noted is limited to small areas associated with beaver impacts. The lack of significant bed and pattern changes indicate the stream is adequately transporting sediment and functioning hydraulically.

Areas of aggradation were observed throughout the thalweg longitudinal profile during the MY4 survey. These areas of aggradation were not observed in the MY5 survey. This difference is attributed to a fine layer of organic material in the stream bed; this layer allows water to flow through and does not represent the actual thalweg elevation of the stream. During the MY5 survey the survey data was collected by

pushing through this organic material to the actual streambed, unlike the MY4 survey which allowed the tip of the survey pole to rest on the organic material which did not represent the true thalweg, giving the illusion of aggradation when looking at the longitudinal profile data in MY4.

Four structures (two log sills at Station 22+68 and 23+27, and two log vanes with rock j-hooks at Station 35+34 and 36+01) appear to be losing grade control when looking at the longitudinal profile. When visually assessed in the field during the survey, these areas were still holding grade and no instabilities were noted.

The water surface data was collected from the downstream end of the project to the beaver dam located at 18+80. Despite removing a large section of the dam and letting the water level drop for 45 minutes, the water surface was still significantly affected by the beaver dam as seen in the longitudinal profile. As a result, stream reach summary data in Table 11b could not be calculated from the partial water surface data collected.

Areas of *Murdannia keisak* (marsh dayflower), observed since 2011, are still present in and along the banks of stream throughout Section 1 but has reduced in size and extent. *Murdannia keisak* is now below the mapping threshold as it was only observed in small isolated areas between Station 0+50 and 1+50, between Station 3+50 and 7+00, near Station 21+50, and near Station 28+50. These areas of *Murdannia keisak* have likely been reduced as a result of the shading provided by livestakes and consistent bankfull events over the past year. *Callitriche heterophylla* (water starwort), a non-invasive species, was again observed in several areas along all three sections of the stream. This aquatic plant was also noted to be present in monitoring years 1, 2, and 3 as well as prior to the construction of the restoration project. Neither the marsh dayflower nor the water starwort currently threaten the stability of the restored stream. Areas of *Mikania scandens* (Climbing hempweed) were observed on planted stems in and around vegetation plots 6 and 7 and some isolated sections of livestakes along the stream banks. *Persicaria perfoliata* (Tearthumb) was also observed in dense colonies throughout the riparian area and on some sections of livestakes. These areas have been monitored since they were first observed in 2013 and the planted stems as a whole are maintaining vigor without a need for supplemental planting. Additionally, the streambanks on both left and right bank below the Briley culvert, between Station 38+25 and 39+00, exhibited dense herbaceous vegetation and livestakes were observed to be resprouting.

A visual assessment of the vegetative cover of brush mattresses along the entire stream exhibited greater than 80% vegetative cover and were thriving for MY5. Figure 2 in Appendix A has been updated to remove, the areas where brush mattresses had less than the required 80% vegetative cover that were observed in 2012.

The wetland preservation areas were also visually assessed during the 2015 annual monitoring events. No issues were observed in these areas and existing vegetation appears to be in good condition. The conservation easement has prevented encroachment from adjacent agricultural operations and these wetland preservation areas should continue to be adequately protected moving forward without the need for additional demarcations.

Summary information, data, and statistics related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

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2.0 Methodology

Channel stability and vegetation survival were monitored on the project site. Post-restoration monitoring was conducted for a minimum of five years or until the success criteria are met following the completion of construction to document project success. The Monitoring Year 5 survey was completed using survey grade GPS on November 17, 2015.

2.1 MORPHOLOGICAL PARAMETERS AND CHANNEL STABILITY

2.1.1 Dimension

Dimensional characteristics were monitored at 7 permanent cross-sections (4 riffles, 3 pools) along Section 1 and Section 2. Survey data included points measured at all breaks in slope including top of bank, bankfull, inner berm, edge of water, and thalweg. Dimensional characteristics were compared to baseline conditions. All monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type. Stream channel stability and geomorphic monitoring for Section 3 was documented visually. Natural variability is expected, however the system should not experience trends toward excessive increasing bank erosion, channel degradation, or channel aggradation.

2.1.2 Pattern and Profile

The entire longitudinal profile of Section 1 and Section 2 was surveyed. Stationing from the as-built survey was used. The longitudinal profiles should show that the bedform features are remaining stable. The pools should remain deep with flat water surface slopes, and the riffles should remain steeper and shallower than the pools.

2.1.3 Sediment Transport

As discussed in prior project documentation, additional sediment transport evaluations will not be undertaken during the five-year monitoring period. However, the dimension, pattern, and profile survey for MY5 conditions for Section 1 and Section 2 were analyzed to determine whether the current sediment competency and capacity is consistent with the design.

2.2 VEGETATION

The Carolina Vegetation Survey (CVS) Level 2 methodology was utilized to sample vegetation on September 16, 2015. Nine 100-square meter CVS plots have been established within the project area. In each plot, four plot corners have been permanently located with rebar. Volunteer plant species (Level 2) were recorded this year (Refer to Figure 2 in Appendix A). Species composition, density, and survival of the planted vegetation was monitored in all plots.

2.3 HYDROLOGY

2.3.1 Wetland

Neither wetland restoration nor enhancement credit is being sought for this project. Existing jurisdictional wetlands as depicted in Figure 2 in Appendix A are being preserved. The wetland preservation areas are visually assessed during each monitoring year.

2.3.2 Stream

One crest gauge has been installed onsite and is located near Cross-section 3. Each visit to the site included documentation of the highest stage for the monitoring interval and a reset of the device. Other indications of bankfull flow including the presence of debris lines, sediment, or flooding were also monitored, and their presence was recorded and documented photographically. Refer to Figure 2 in Appendix A for the location of the crest gauge.

3.0 References

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2008. CVS-DMS Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm)

NCDWQ. 2004. Tar-Pamlico River Basinwide Water Quality Plan. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, NC.

NCDMS. 2010. Procedural Guidance and Content Requirements for DMS Monitoring Reports. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 1.3, January 15, 2010.

NCDMS. 2008. Mitigation Plan Document – Format Data Requirements, and Content Guidelines. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 2.0, March 27, 2008.

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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, NCDEHNR, Raleigh, North Carolina.

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4.0 Appendices

Appendix A – Project Vicinity Map and Background Tables

Appendix B – Visual Assessment Data

Appendix C – Vegetation Plot Data

Appendix D – Stream Survey Data

Appendix E – Hydrologic Data

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Appendix A. Project Vicinity Map and Background Tables

Figure 1 – Vicinity Map and Directions
Table 1a.b. – Project Restoration Components
Table 2 – Project Activity and Reporting History
Table 3 – Project Contacts
Table 4 – Project Attribute

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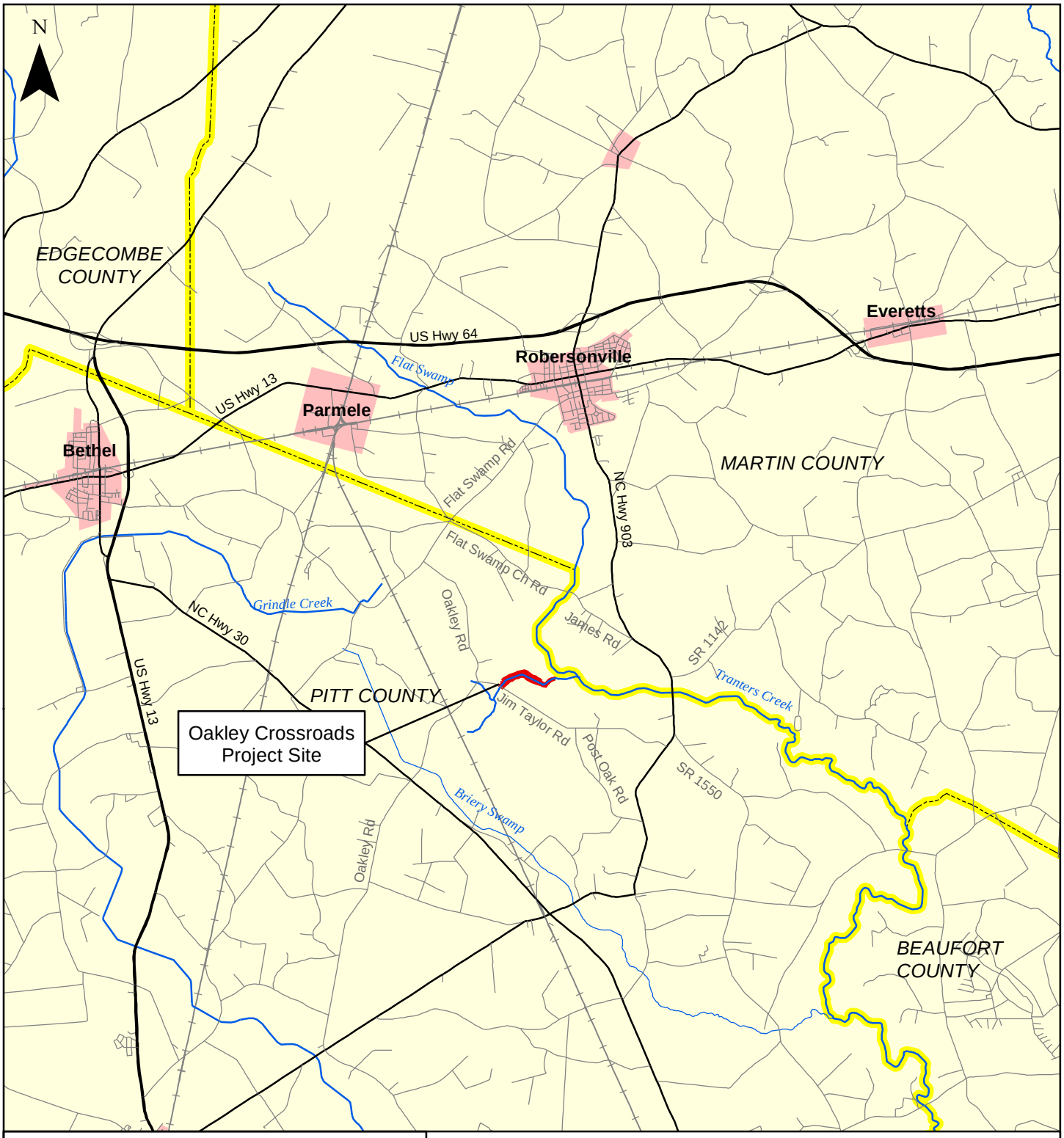

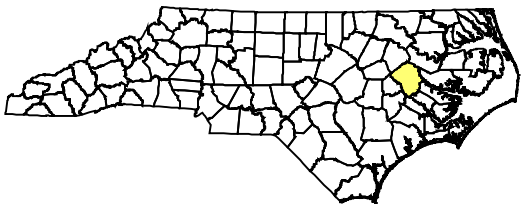

Legend

- Local Roads
- Major Roads
- Railroads
- Conservation Easement
- Streams
- Municipality
- County Boundary

Figure 1. Project Vicinity Map

Oakley Crossroads
Stream & Buffer Restoration
Pitt County, North Carolina

0 0.5 1 Miles

Stantec

NC Environmental Quality

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Table 1a. Project Components and Mitigation Credits									
Oakley Crossroads Stream and Buffer Restoration (EEP# 273)									
Project Component or Reach ID	**Existing Feet/Acres**	**Restoration Level**	**Approach**	**Footage or Acreage**	**Stationing/ Location**	**Mitigation Ratio**	**Mitigation Units**	**BMP Elements[1]**	**Comment**
Section 1	2,950	R	PII	3,789	00+00 to 37+98.64	1:1	3,789		Ten foot width of ford crossing removed from total length. Total restoration footage 3,789 LF.
Section 2	329	E	EII	329	~38+39 to ~41+68	2.5:1	131.6		Enhancement - log structures, brush mattresses and planting.
Riparian Buffer	n/a	R		774,084.2 sq ft	n/a	1:1	774,084.2		808,525 sq ft planted, 774,084.2 sq ft of which are eligible for mitigation credit0.2 acres (8712 sq ft) were removed from credit for non-diffuse flow from 2 ditches flowing into the project. Credit not counted for areas outside of the 200' buffer width.
Wetlands	1.37	P		1.37	n/a	5:1	0.27		

Table 1b. Component Summations							
Oakley Crossroads Stream and Buffer Restoration (EEP #273)							
Restoration	Stream	Riparian		Non-Ripar	Upland	Buffer	
Level	(lf)	Wetland (Ac)		(Ac)	(Ac)	(Ac)	BMP
		Riverine	Non-Riverine				
Restoration	3789					17.77	
Enhancement							
Enhancement I							
Enhancement II	329						
Creation							
Preservation		1.37					
HQ Preservation							
Totals (Feet/Acres)	**4118**	**1.37**				**17.77**	
MU Totals	**3,920.6**	**0.27**				**17.77**	

Non-Applicable

Table 2. Project Activity and Reporting History		
Oakley Crossroads Stream and Buffer Restoration (EEP# 273)		
Elapsed Time Since Grading Complete:	**66 months**	
Elapsed Time Since Original Planting Complete:	**66 months**	
Number of Reporting Years[1]:	**5**	
	Data Collection	**Completion or**
Activity or Deliverable	**Complete**	**Delivery**
Mitigation Plan	n/a	August 2006
Final Design – Construction Plans	n/a	June 2010
Construction (Grading complete)	n/a	May 2011
Seeding	n/a	May 2011
Planting	n/a	May 2011
As-built (Year 0 Monitoring – baseline)	June 2011	July 2011
Year 1 Monitoring	September 2011	November 2011
Replanting (bareroots)	n/a	January 2012
Year 2 Monitoring	October 2012	November 2012
Year 3 Monitoring	November 2013	Februrary 2014
Year 4 Monitoring	October 2014	November 2014
Year 5 Monitoring	November 2015	December 2015

1 = Equals the number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table	
Oakley Crossroads Stream and Buffer Restoration (EEP# 273)	
Designer	Stantec Consulting Services, Inc.
	801 Jones Franklin Rd, Ste 300, Raleigh, NC 27606
Primary project design POC	Nathan Jean (970) 449-8615
Construction Contractor	Ecosystems Grading Solutions, Inc.
	6642 Roper Hollow Rd., Morganton, NC 28655
Construction contractor POC	Bobby Koone (828) 584-3018
Survey Contractor	Turner Land Surveying
	3201 Glenridge Dr., Raleigh, NC 27604
Survey contractor POC	Elizabeth and David Turner (919) 875-1378
Planting Contractor	Bruton Natural Systems, Inc.
	P.O. Box 1197, Remont, NC 27830
Planting contractor POC	Charlie Bruton (919) 242-6555
Seeding Contractor	Ecosystems Grading Solutions, Inc.
	6642 Roper Hollow Rd., Morganton, NC 28655
Contractor point of contact	Bobby Koone (828) 584-3018
Seed Mix Sources	Green Resources
Nursery Stock Suppliers	Southeastern Native Plant Nursery
	South Carolina Super Tree Nursery
	Natives
Monitoring Performers	Stantec Consulting Services, Inc.
	801 Jones Franklin Rd, Ste 300, Raleigh, NC 27606
Stream Monitoring POC	Tim Taylor (980) 297-7669
Vegetation Monitoring POC	Amber Coleman (919)865-7399
Wetland Monitoring POC	n/a

Table 4. Project Baseline Information and Attributes			
Oakley Crossroads Stream and Buffer Restoration (EEP# 273)			
Project Information			
Project County	Pitt		
Project Area (acres)	26.6		
Project Coordinates (latitude and longitude)	35.76692, -77.269077		
Project Watershed Summary Information			
Physiographic Region	Coastal Plain		
River Basin	Tar-Pamlico		
USGS HUC for Project (14 digit)	0302010309002		
NCDWQ Sub-basin for Project	03-03-06		
Project Drainage Area (sq mi)	1.71		
Project Drainage Area % Impervious	<1%		
CGIA Landuse Classification	Cropland and Pasture		
Reach Summary Information			
Reach name	Section 1	Section 2	Section 3
Length of reach (linear feet)	3,799	40	289
Valley classification	VIII	VIII	VIII
Drainage area (acres)	1,014.5	1,014.7	1,092.3
NCDWQ stream identification score	41	40.5	40.5
NCDWQ classification	n/a	n/a	n/a
Morphological description (stream type)	E5	F5	F5
Evolutionary trend	E5	C5	C5
Underlying mapped soils	Bladen	Pantego	Pantego
Drainage class	Poorly drained	Very poorly drained	Very poorly drained
Soil hydric status	Yes	Yes	Yes
Slope	0-2%	0-1%	0-1%
FEMA classification	Zone X	Zone X	Zone X
Native vegetation community	Riverine bottomland hardwood and mesic mixed hardwood forest		
Percent composition of exotic invasive vegetation	0%	0%	10%
Wetland Summary Information			
n/a - wetland preservation only			
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	USACE 404 permit
Waters of the United States - Section 401	Yes	Yes	NCDWQ 401 permit
Endangered Species Act	No	n/a	n/a
Historic Preservation Act	No	n/a	n/a
Coastal Zone Management Act (CZMA)/Coastal Aream Management Act (CAMA)	No	n/a	n/a
FEMA Floodplain Compliance	No	n/a	n/a

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Appendix B. Visual Assessment

Figure 2 – Asset Map (1 Sheet)
Figure 2a and b – Current Condition Plan View (2 Sheets)
Table 5 – Visual Stream Morphology Stability Assessment
Table 6 – Vegetation Condition Assessment
Photos – Stream Stations (S1-S9)
Photos – Vegetation Plots (V1-V18)

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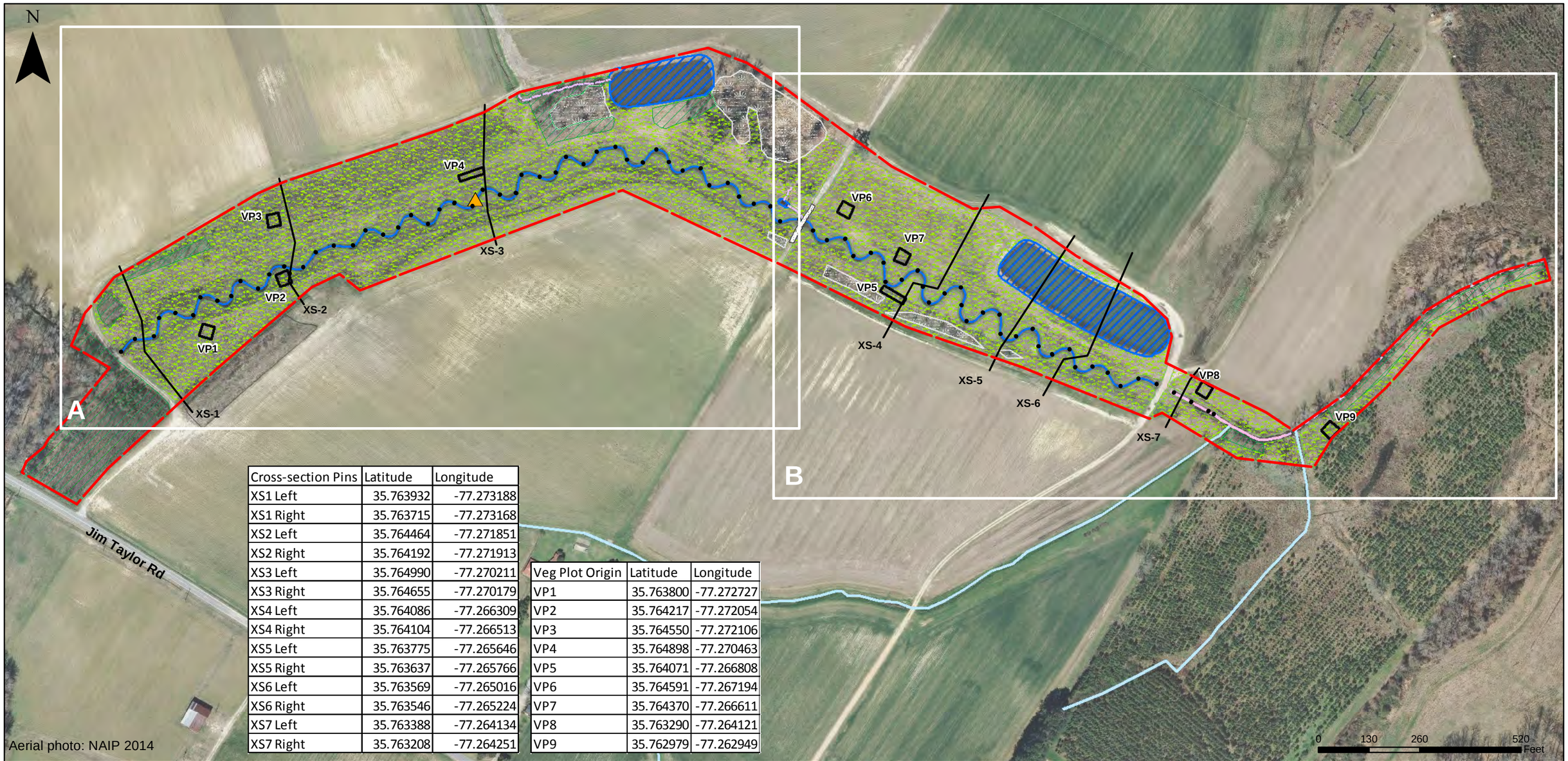


Cross-section Pins	Latitude	Longitude
XS1 Left	35.763932	-77.273188
XS1 Right	35.763715	-77.273168
XS2 Left	35.764464	-77.271851
XS2 Right	35.764192	-77.271913
XS3 Left	35.764990	-77.270211
XS3 Right	35.764655	-77.270179
XS4 Left	35.764086	-77.266309
XS4 Right	35.764104	-77.266513
XS5 Left	35.763775	-77.265646
XS5 Right	35.763637	-77.265766
XS6 Left	35.763569	-77.265016
XS6 Right	35.763546	-77.265224
XS7 Left	35.763388	-77.264134
XS7 Right	35.763208	-77.264251

Veg Plot Origin	Latitude	Longitude
VP1	35.763800	-77.272727
VP2	35.764217	-77.272054
VP3	35.764550	-77.272106
VP4	35.764898	-77.270463
VP5	35.764071	-77.266808
VP6	35.764591	-77.267194
VP7	35.764370	-77.266611
VP8	35.763290	-77.264121
VP9	35.762979	-77.262949

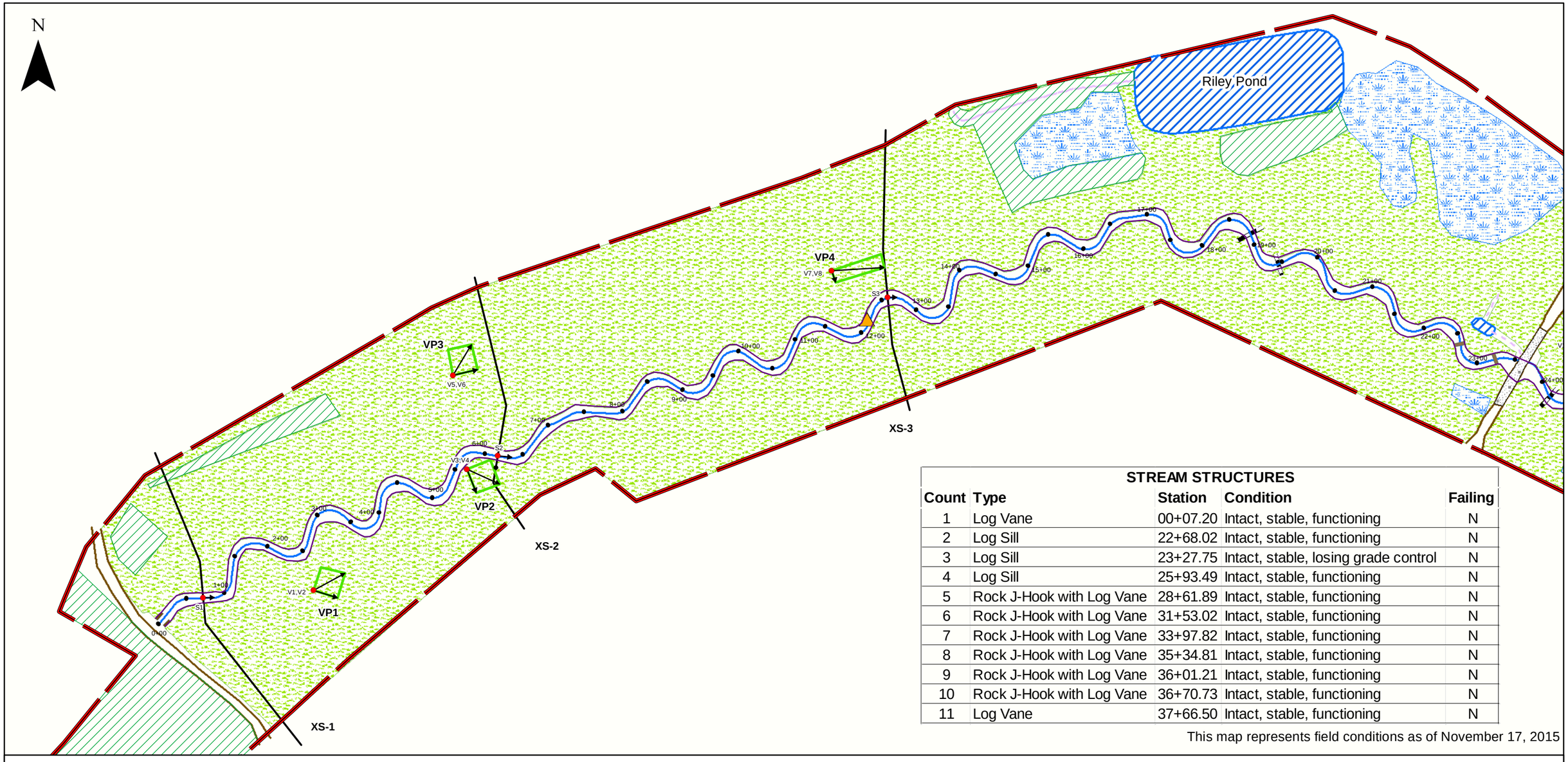
Figure 2. Project Status Map MY5

Oakley Crossroads Stream and Buffer Restoration Project
EEP #: 273
Pitt County, North Carolina
December 2015

- Crest gage
- Vegetation monitoring plots (VP 1-9)
- Stream cross-section surveys (XS 1-7)
- Ford crossing
- Conservation easement
- Existing Trees
- Ponds
- Other on-site hydrography
- Non-buffered waterways (Buffer credit area reduced by 0.1 ac for each waterway)

Mitigation Components

- Riparian Buffer Restoration (774,084.2 sqft)
- Section 1 Stream Restoration Centerline (3,789 ft)
- Section 2 Stream Enhacement II (329 ft)
- Wetland Preservation (1.37 ac)



STREAM STRUCTURES

Count	Type	Station	Condition	Failing
1	Log Vane	00+07.20	Intact, stable, functioning	N
2	Log Sill	22+68.02	Intact, stable, functioning	N
3	Log Sill	23+27.75	Intact, stable, losing grade control	N
4	Log Sill	25+93.49	Intact, stable, functioning	N
5	Rock J-Hook with Log Vane	28+61.89	Intact, stable, functioning	N
6	Rock J-Hook with Log Vane	31+53.02	Intact, stable, functioning	N
7	Rock J-Hook with Log Vane	33+97.82	Intact, stable, functioning	N
8	Rock J-Hook with Log Vane	35+34.81	Intact, stable, functioning	N
9	Rock J-Hook with Log Vane	36+01.21	Intact, stable, functioning	N
10	Rock J-Hook with Log Vane	36+70.73	Intact, stable, functioning	N
11	Log Vane	37+66.50	Intact, stable, functioning	N

This map represents field conditions as of November 17, 2015

Figure 2a. Current Condition Plan View MY5

Oakley Crossroads Stream and Buffer Restoration Project
EEP #: 273
Pitt County, North Carolina
December 2015

Photo points (Veg=V, Stream=S)
Stream cross-section surveys (XS 1-7)
Farm paths
Ford crossing
Conservation easement

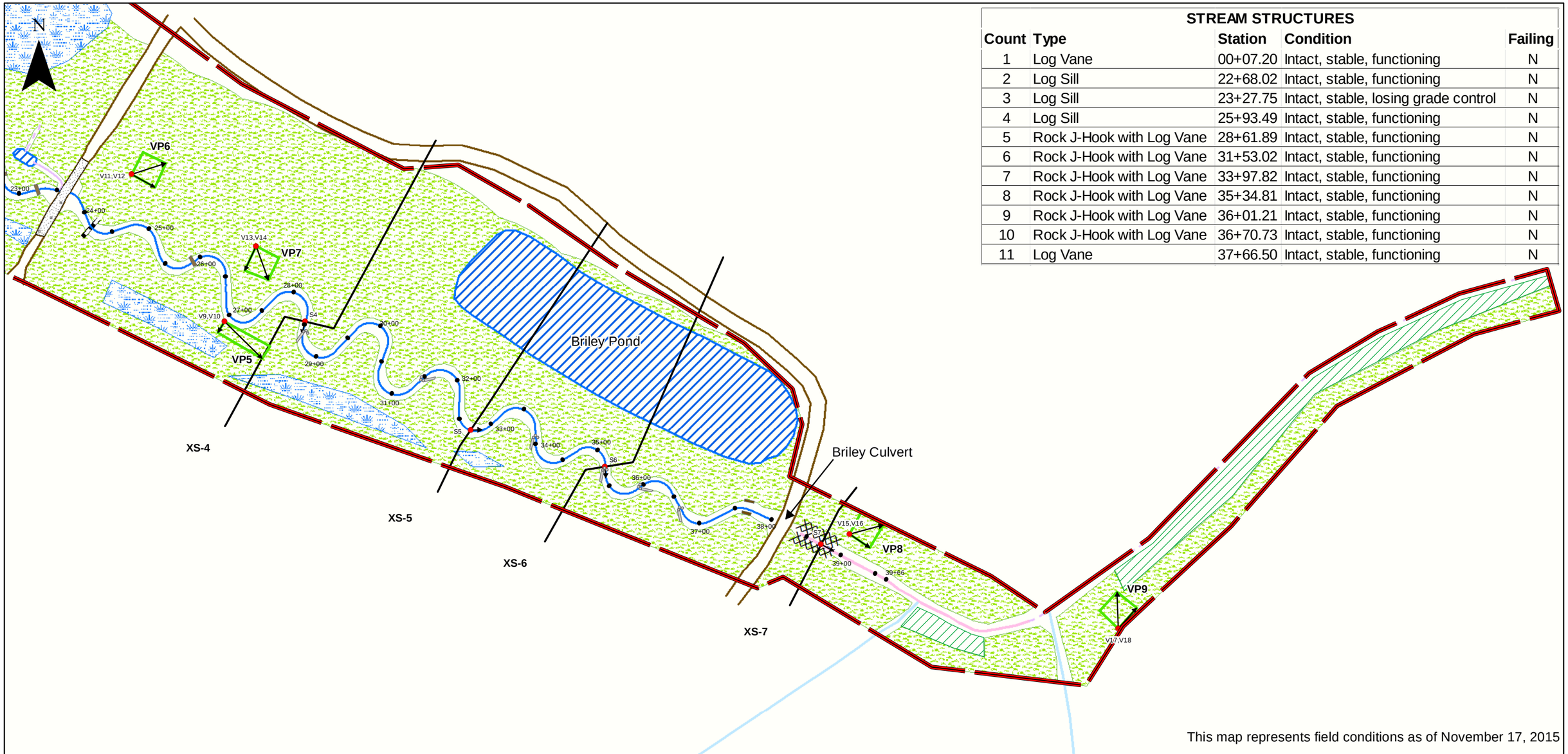
Vegetation Plot Success (VP 1-9)
Buffer=Yes, Stream=Yes or n/a; Y
Buffer=No, Stream=n/a
Buffer=No, Stream=No; N

Existing Trees
Ponds
Other on-site hydrography
Non-buffered waterways (Buffer credit area reduced by 0.1 ac for each waterway)
Crest gage
Log Vane
Log Sill
Rock J-Hook with Log Vane

Mitigation Components
Riparian Buffer Restoration (774,084.2 sqft)
Section 1 Stream Restoration Centerline (3,789 ft)
Section 2 Stream Enhacement II (329 ft)
Wetland Preservation (1.37 ac)

Problem Areas
Beaver Dam
Dead livestakes

0 50 100 200 Feet



STREAM STRUCTURES

Count	Type	Station	Condition	Failing
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5	Rock J-Hook with Log Vane	28+61.89	Intact, stable, functioning	N
6	Rock J-Hook with Log Vane	31+53.02	Intact, stable, functioning	N
7	Rock J-Hook with Log Vane	33+97.82	Intact, stable, functioning	N
8	Rock J-Hook with Log Vane	35+34.81	Intact, stable, functioning	N
9	Rock J-Hook with Log Vane	36+01.21	Intact, stable, functioning	N
10	Rock J-Hook with Log Vane	36+70.73	Intact, stable, functioning	N
11	Log Vane	37+66.50	Intact, stable, functioning	N

This map represents field conditions as of November 17, 2015

Figure 2b. Current Condition Plan View MY5

Oakley Crossroads Stream and Buffer Restoration Project
EEP #: 273
Pitt County, North Carolina
December 2015

- Photo points (Veg=V, Stream=S)
- Stream cross-section surveys (XS 1-7)
- Farm paths
- Ford crossing
- Conservation easement

Vegetation Plot Success (VP 1-9)

- Buffer=Yes, Stream=Yes or n/a; Y
- Buffer=No, Stream=n/a
- Buffer=No, Stream=No; N

- Existing Trees
- Ponds
- Other on-site hydrography
- Non-buffered waterways (Buffer credit area reduced by 0.1 ac for each waterway)
- Crest gage
- Log Vane
- Log Sill
- Rock J-Hook with Log Vane

Mitigation Components

- Riparian Buffer Restoration (774,084.2 sqft)
- Section 1 Stream Restoration Centerline (3,789 ft)
- Section 2 Stream Enhacement II (329 ft)
- Wetland Preservation (1.37 ac)

Problem Areas

- Beaver Dam
- Dead livestakes

0 50 100 200 Feet

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Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Reach 1**
Assessed Length **3800**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	N/A	56			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	56	56			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	56	56			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	56	56			100%			
		2. Thalweg centering at downstream of meander (Glide)	56	56			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	11	11			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	11	11			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	11	11			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	11	11			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	11	11			100%			

Table 6. Vegetation Condition Assessment						
Oakley Crossroads Stream and Buffer Restoration (EEP# 273)						
Planted acreage*	18					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygon**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover of woody material	0.1 acres	none	0	0	0.0%
2. Low Stem Density	Woody stem densities below target levels for stem count success criteria	0.1 acres	none	0	0	0.0%
			Total	0	0	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	0.25 acres	None	0	0	0.0%
			Total	0	0	0.0%
Easement acreage	26.6					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygon**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive areas of concern	None	1000 SF	n/a	0	0	0.0%
5. Encroachment areas	None	none	n/a	0	0	0.0%

*Total planted acreage

Stream Station Photos

Photo Station S1 – Stream channel looking downstream at cross-section 1
Station 00+72 - Priority 2 (11/17/15 Year 5)

Photo Station S2 –Stream channel looking downstream at cross-section 2
Station 06+17 – Priority 2 (11/17/15 Year 5)

Photo Station S3 – Stream channel looking downstream at cross-section 3 Station 12+59 – Priority 2 (11/17/2015 Year 5)

Photo Station S4 – Stream channel looking downstream at cross-section 4 Station 28+46 – Priority 2 (11/17/2015 Year 5)

Photo Station S5 – Stream channel looking downstream at cross-section 5
Station 32+71 – Priority 2 (11/17/2015 Year 5)

Photo Station S6 – Stream channel looking downstream at cross-section 6
Station 35+24 – Priority 2 (11/17/2015 Year 5)

Photo Station S7 – Stream channel looking downstream at cross-section 7 Station 38+71 – Enhancement 2 (11/17/2015 Year 5)

Photo Station S8 – Crest gauge indicating a bankfull event (09/16/2015 Year 5)

Photo Station S9 – Sediment on vegetation above bankfull limits (09/16/2015 Year 5)

Vegetation Plot Photos

Photo Station V1 - Veg Plot 1 looking southeast (09/16/2015 Year 5)

Photo Station V2 - Veg Plot 1 looking east (09/16/2015 Year 5)

Photo Station V3 - Veg Plot 2 looking south (09/16/2015 Year 5)

Photo Station V4 - Veg Plot 2 looking southeast (09/16/2015 Year 5)

Photo Station V5 - Veg Plot 3 looking east (09/16/2015 Year 5)

Photo Station V6 - Veg Plot 3 looking northeast (09/16/2015 Year 5)

Photo Station V7 - Veg Plot 4 looking south (09/16/2015 Year 5)

Photo Station V8 - Veg Plot 4 looking southeast (09/16/2015 Year 5)

Photo Station V9 - Veg plot 5 looking south (09/16/2015 Year 5)

Photo Station V10 - Veg plot 5 looking southeast (09/16/2015 Year 5)

Photo Station V11 - Veg plot 6 looking east (09/16/2015 Year 5)

Photo Station V12 - Veg plot 6 looking northeast (09/16/2015 Year 5)

Photo Station V13 - Veg plot 7 looking south (09/16/2015 Year 5)

Photo Station V14 - Veg plot 7 looking southeast (09/16/2015 Year 5)

Photo Station V15 - Veg plot 8 looking east (09/16/2015 Year 5)

Photo Station V16 - Veg plot 8 looking northeast (09/16/2015 Year 5)

Photo Station V17 - Veg plot 9 looking northeast (09/16/2015 Year 5)

Photo Station V18 - Veg plot 9 looking north (09/16/2015 Year 5)

Appendix C. Vegetation Plot Data

Table 7a,b. – Vegetation Plot Mitigation Success Summary
Table 8 – CVS Vegetation Metadata
Table 9 – CVS Stem Count Total and Planted by Plot and Species

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Oakley Crossroads (G) (#273)

Year 5 (16-Sep-2015)

Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems[1]	Stream/ Wetland Stems[2]	Live Stakes	Invasives	Volunteers[3]	Total[4]	Unknown Growth Form
0001	20	22	0	0	17	**39**	0
0002	8	8	0	0	30	**38**	0
0003	21	21	0	0	7	**28**	0
0004	19	20	0	0	9	**29**	0
0005	11	11	0	0	6	**17**	0
0006	20	20	0	0	581	**601**	0
0007	6	6	0	0	12	**18**	0
0008	12	12	0	0	5	**17**	0
0009	18	18	0	0	24	**42**	0

Wetland/Stream Vegetation Totals

(per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
0001	890	688	1578	Yes
0002	324	1214	1538	Yes
0003	850	283	1133	Yes
0004	809	364	1174	Yes
0005	445	243	688	Yes
0006	809	23512	24322	Yes
0007	243	486	728	Yes
0008	486	202	688	Yes
0009	728	971	1700	Yes
Project Avg	**621**	**3107**	**3728**	**Yes**

Riparian Buffer Vegetation Totals

(per acre)

Plot #	Riparian Buffer Stems[4]	Success Criteria Met?
0001	1578	Yes
0002	1538	Yes
0003	1133	Yes
0004	1174	Yes
0005	688	Yes
0006	24322	Yes
0007	728	Yes
0008	688	Yes
0009	1700	Yes
Project Avg	**3728**	**Yes**

Stem Class	**characteristics**
[1]Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.
[2]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[3]Volunteers	Native woody stems. Not planted. No vines.
[4]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

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%

Table 8 - CVS Metadata	
Oakley Crossroads Stream and Buffer Restoration - EEP #273	
Report Prepared By	Alex Baldwin
Date Prepared	10/12/2015 16:59
database name	STantec_Oakley_2015cvs-eep-entrytool-v2.3.1.mdb
database location	U:\175613016\project\site_data\vegetation
computer name	BALDWINA-LT
file size	62853120
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	273
project Name	Oakley Crossroads (G)
Description	Stream and Wetland Restoration
River Basin	Tar-Pamlico
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	9

Table 9. CVS Stem Count Total and Planted by Plot and Species

EEP Project Code 273. Project Name: Oakley Crossroads

			Current Plot Data (MY5 2015)																										Annual Means																	
			E273-01-0001			E273-01-0002			E273-01-0003			E273-01-0004			E273-01-0005			E273-01-0006			E273-01-0007			E273-01-0008			E273-01-0009			MY5 (2015)			MY4 (2014)			MY3 (2013)			MY2 (2012)			MY1 (2011)			MY0 (2011)		
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	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
Acer rubrum	red maple	Tree			7			15			3			4						580	1	1	9						7	1	1	625			596			124								
Acer rubrum var. rubrum	red maple	Tree																																						147					
Alnus serrulata	hazel alder	Shrub						9																							9			7			6			4					
Cornus amomum	silky dogwood	Shrub																																						2					
Eubotrys racemosa																																									1	1	1	1	1	1
Fraxinus pennsylvanica	green ash	Tree	4	4	4				4	4	4	4	4	4				7	7	7							5	5	5	24	24	24	25	25	25	22	22	22	22	22	22	13	13	13	13	13	13
Liquidambar styraciflua	sweetgum	Tree			5			5						3															14			27			40			41			33					
Liriodendron tulipifera	tuliptree	Tree												1																		1			1			1								
Magnolia virginiana	sweetbay	Tree	1	1	1							1	1	1				1	1	1										3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Morella cerifera	wax myrtle	shrub	2	2	2							1	1	1												1				3	3	4	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3
Nyssa biflora	swamp tupelo	Tree				6	6	6													1	1	1							7	7	7	7	7	7	8	8	8	9	9	9	1	1	1	1	1	1
Nyssa sylvatica	blackgum	Tree	3	3	3				3	3	3	3	3	3	3	3	3	5	5	5							1	1	1	18	18	18	17	17	17	16	16	17	13	13	13	2	2	2	2	2	2
Pinus taeda	loblolly pine	Tree			1															1												2			2			1								
Platanus occidentalis	American sycamore	Tree	4	4	4			1	7	7	8	6	6	7				4	4	4							4	4	4	25	25	28	26	26	28	27	27	33	28	28	28	14	14	14	14	14	14
Quercus	oak	Tree																																							2	2	2	7	7	7
Quercus falcata	southern red oak	Tree	8	8	8				6	6	8	5	5	5	1	1	1	2	2	2				2	2	2	7	7	10	31	31	36	34	34	36	32	32	36	30	30	30	10	10	10	12	12	12
Quercus lyrata	overcup oak	Tree				2	2	2							1	1	1	1	1	1										4	4	4	4	4	4	7	7	8	7	7	7	7	7	7	4	4	4
Quercus michauxii	swamp chestnut oak	Tree													2	2	2				1	1	1							3	3	3	2	2	2	4	4	4	6	6	6	7	7	7	9	9	9
Quercus nigra	water oak	Tree							1	1	1													9	9	9	1	1	1	11	11	11	13	13	13	13	13	13	14	14	14	13	13	13	7	7	7
Quercus pagoda	cherrybark oak	Tree																						1	1	1				1	1	1	2	2	2	2	2	2	3	3	3	2	2	2			
Quercus phellos	willow oak	Tree													4	4	4				2	2	2							6	6	6	5	5	5	10	10	10	10	10	10	12	12	12	16	16	16
Quercus rubra	northern red oak	Tree																																						1					
Rhus copallinum	flameleaf sumac	shrub			4															4												8			8			6								
Salix nigra	black willow	Tree																			1	1	5							1	1	5	1	1	6												
Sambucus canadensis	Common Elderberry	Shrub									1						6															7			7			1			3					
Toxicodendron radicans	eastern poison ivy	Vine																																						1					
Unknown		Shrub or Tree																																									1	1	1
		Stem count	22	22	39	8	8	38	21	21	28	20	20	29	11	11	17	20	20	601	6	6	18	12	12	17	18	18	42	138	138	829	142	142	813	147	147	340	148	148	339	90	90	90	93	93	93
		size (ares)	1			1			1			1			1			1			1			1			1			9			9			9			9			9			9		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.22			0.22			0.22			0.22			0.22			0.22		
		Species count	6	6	10	2	2	6	5	5	7	6	6	9	5	5	6	6	6	8	5	5	5	3	3	5	5	5	7	14	14	20	13	13	20	12	12	19	12	12	19	14	14	14	14	14	14
		Stems per ACRE	890.3	890.3	1578	323.7	323.7	1538	849.8	849.8	1133	809.4	809.4	1174	445.2	445.2	688	809.4	809.4	24322	242.8	242.8	728.4	485.6	485.6	688	728.4	728.4	1700	620.5	620.5	3728	638.5	638.5	3656	661	661	1529	665.5	665.5	1524	404.7	404.7	404.7	418.2	418.2	418.2

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 excluding livestakes

P-all = All planted stems including livestakes

T = All planted and natural recruit stems including livestakes

Total includes natural recruit stems

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Appendix D. Stream Survey Data

Figures 3a-g – Cross-Sections with Annual Overlays
Figure 4 – Longitudinal Profiles with Annual Overlays
Table 10a,b. – Baseline – Stream Data Summary
Table 11a. – Monitoring – Cross-section Morphology Data
Table 11b. – Monitoring – Stream Reach Morphology Data

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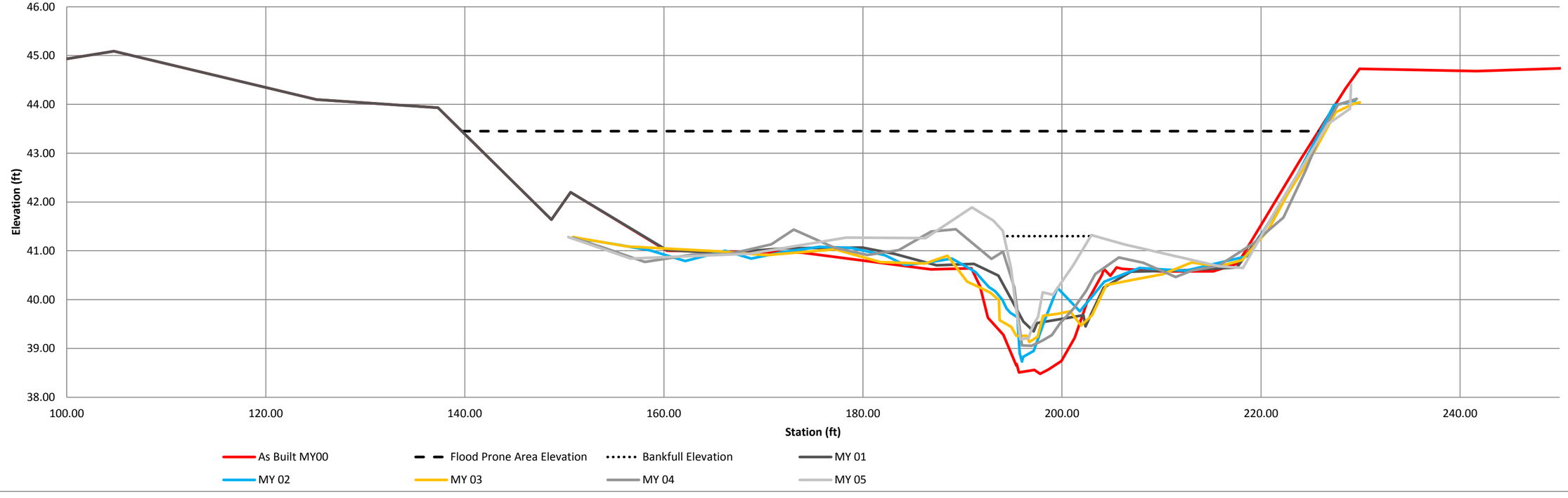
River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-1, Riffle, STA 0+72
Drainage Area(sq. mi.)	1.59
Date	11/17/2015
Field Crew	T. Taylor, A. Baldwin

Sta. 0+75 Looking Downstream

MY 00		MY 01		MY 02		MY 03		MY 04		MY 05	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
12.21	49.05	12.21	49.05	150.82	41.25	150.84	41.28	150.9	41.263	150.4	41.28
19.33	48.29	19.33	48.29	153.07	41.20	156.31	41.09	153.97	41.063	156.65	40.84
28.16	46.74	28.16	46.74	155.79	41.11	165.33	40.99	158.08	40.773	168.6	40.94
35.77	46.38	35.77	46.38	158.62	41.01	170.30	40.91	162.84	40.923	178.33	41.27
47.80	45.82	47.80	45.82	162.14	40.79	177.18	41.03	166.57	40.933	186.3	41.26
59.77	45.48	59.77	45.48	166.15	41.00	181.76	40.77	170.79	41.133	190.95	41.89
74.68	45.23	74.68	45.23	168.77	40.84	186.24	40.74	173.05	41.433	193.09	41.62
81.30	45.02	81.30	45.02	172.16	40.98	188.48	40.90	177.14	41.063	194.05	41.41
87.17	45.62	87.17	45.62	175.62	41.08	190.46	40.37	180.46	40.913	194.88	40.65
93.57	44.59	93.57	44.59	178.75	41.06	191.75	40.25	183.59	41.013	195.37	39.84
98.13	44.87	98.13	44.87	182.20	40.91	192.82	40.14	186.85	41.393	195.81	39.19
104.75	45.09	104.75	45.09	184.20	40.71	193.66	39.99	189.32	41.443	196.64	39.21
125.09	44.10	125.09	44.10	186.59	40.76	193.73	39.58	192.91	40.833	197.06	39.47
137.30	43.93	137.30	43.93	188.93	40.84	194.91	39.44	194.07	40.983	197.59	39.64
148.71	41.64	148.71	41.64	191.29	40.57	195.40	39.26	195.21	40.243	198.07	40.15
150.62	42.20	150.62	42.20	192.64	40.26	196.46	39.26	195.98	39.063	199.08	40.1
160.31	41.00	160.25	41.02	193.29	40.17	196.71	39.13	196.94	39.053	201.11	40.7
173.90	40.96	165.47	40.95	194.00	40.00	197.55	39.24	197.95	39.153	202.96	41.32
186.83	40.62	172.19	41.05	194.43	39.82	198.10	39.67	198.98	39.273	206.3	41.13
190.89	40.64	179.93	41.07	194.80	39.73	199.56	39.71	199.8	39.513	215.87	40.68
191.77	40.27	183.19	40.94	195.51	39.64	200.82	39.76	201.19	39.823	218.19	40.65
192.56	39.63	187.40	40.70	195.74	38.90	201.92	39.47	202.44	40.183	221.59	41.87

SUMARY DATA	MY00	MY01	MY02	MY03	MY04	MY05
Bankfull Elevation	40.63	40.72	40.57	40.37	40.86	41.30
Bankfull Cross-Sectional Area	18.33	8.37	9.77	9.15	11.21	9.42
Bankfull Width	20.80	12.39	15.49	15.73	11.65	8.81
Flood Prone Area Elevation	42.78	41.63	42.41	41.61	42.67	43.45
Flood Prone Width	80.66	65.65	78.50	70.36	80.93	86.30
Max Depth at Bankfull	2.15	1.14	1.84	1.24	1.81	2.13
Mean Depth at Bankfull	0.88	0.68	0.63	0.58	0.96	1.07
W/D Ratio	23.64	18.22	24.59	27.12	12.14	8.23
Entrenchment Ratio	3.88	5.30	5.07	4.47	6.95	9.80
Bank Height Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Stream Type	C	C	C	C	C	E

Oakley Crossroads - UT to Tranters Creek
X-Section 1, Riffle, Station 0+72



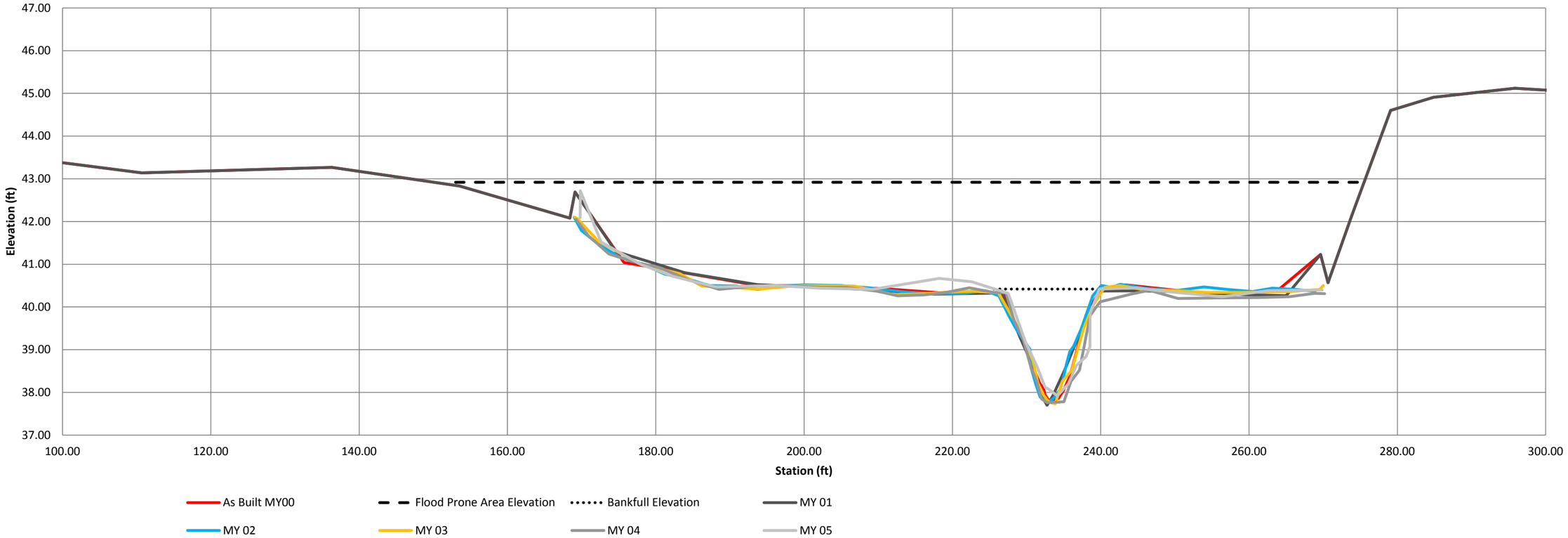
River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-2, Riffle, STA 6+17
Drainage Area(sq. mi.)	1.59
Date	11/17/2015
Field Crew	T. Taylor, A. Baldwin

Sta. 6+17 Looking Downstream

MY 00		MY 01		MY 02		MY 03		MY 04		MY 05	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
12.76	46.91	12.76	46.91	169.00	42.10	169.04	42.10	169.24	42.05	169.81	42.09
33.99	44.63	33.99	44.63	169.98	41.79	169.40	42.07	170.96	41.66	169.83	42.72
54.24	44.37	54.24	44.37	172.32	41.46	172.25	41.54	173.68	41.24	172.62	41.52
72.47	43.91	72.47	43.91	175.26	41.16	177.69	41.02	176.7	41.07	178.06	40.99
92.77	43.54	92.77	43.54	178.46	40.99	183.24	40.78	180.43	40.92	182.47	40.71
110.68	43.14	110.68	43.14	181.16	40.77	186.21	40.49	184.5	40.63	188.11	40.47
136.32	43.27	136.32	43.27	184.02	40.67	193.91	40.42	188.53	40.41	196.32	40.5
153.53	42.83	153.53	42.83	187.28	40.50	199.31	40.50	192.63	40.48	202.01	40.44
168.42	42.08	168.42	42.08	190.92	40.49	206.79	40.49	195.45	40.5	209.16	40.41
169.10	42.69	169.10	42.69	193.78	40.41	212.08	40.29	198.12	40.5	218.23	40.67
175.71	41.04	174.60	41.30	196.48	40.49	216.27	40.31	202.29	40.46	222.6	40.59
193.21	40.52	183.93	40.80	199.93	40.52	219.32	40.35	205.68	40.46	227.53	40.32
210.45	40.43	193.68	40.52	205.00	40.50	222.74	40.37	209.82	40.37	229.84	39.18
219.41	40.32	208.61	40.41	208.82	40.45	226.20	40.33	212.6	40.26	231.38	38.62
223.60	40.35	217.46	40.30	213.63	40.35	229.24	39.41	216.16	40.28	232.5	38.12
226.57	40.33	226.67	40.33	217.51	40.31	230.85	38.74	219.12	40.34	232.93	38.08
226.69	40.37	229.04	39.32	221.63	40.32	231.55	38.21	222.26	40.45	234.15	37.92
227.04	40.30	230.82	38.62	224.41	40.38	232.36	37.92	225.58	40.34	235.64	38.2
228.42	39.64	231.63	38.04	226.25	40.26	233.06	37.77	227.21	40.33	236.71	38.63
229.95	38.99	232.76	37.70	227.67	39.77	233.87	37.73	228.32	39.68	238.01	38.84
231.78	38.21	233.53	37.92	228.58	39.49	234.81	38.26	229.55	39.23	238.55	39.07
232.29	38.09	235.12	38.52	229.56	39.23	236.06	38.51	230.61	38.57	238.56	39.85

SUMARY DATA	MY00	MY01	MY02	MY03	MY04	MY05
Bankfull Elevation	40.35	40.38	40.38	40.33	40.33	40.42
Bankfull Cross-Sectional Area	18.16	17.88	18.17	18.06	20.68	19.23
Bankfull Width	16.60	13.16	15.09	13.85	17.67	14.11
Flood Prone Area Elevation	42.89	43.06	42.99	42.93	42.90	42.92
Flood Prone Width	124.27	124.27	124.27	125.00	124.68	122.00
Max Depth at Bankfull	2.54	2.68	2.61	2.60	2.57	2.50
Mean Depth at Bankfull	1.09	1.37	1.20	1.30	1.17	1.36
W/D Ratio	15.23	9.61	12.58	10.65	15.10	10.38
Entrenchment Ratio	7.49	9.44	8.24	9.03	7.06	8.65
Bank Height Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Stream Type	C	C	C	C	C	E

Oakley Crossroads - UT to Tranters Creek
X-Section 2, Riffle, Station 6+17



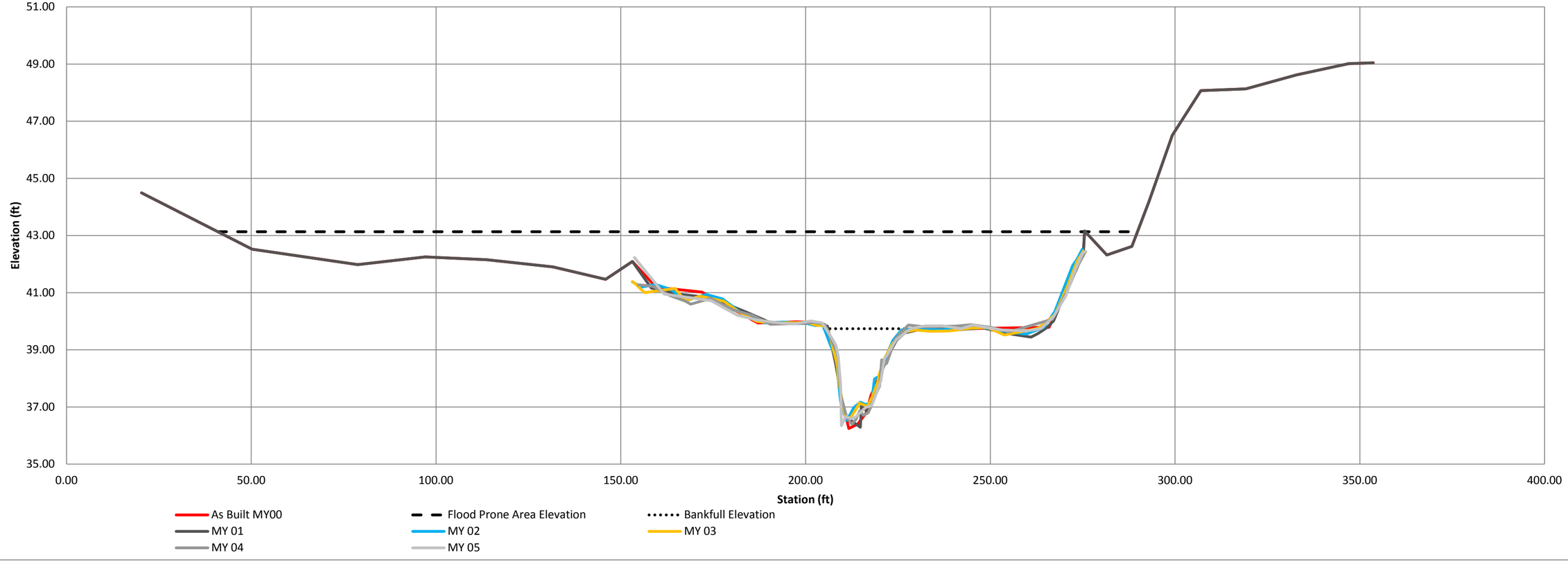
River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-3, Pool, STA 12+59
Drainage Area(sq. mi.)	1.59
Date	11/17/2015
Field Crew	T. Taylor, A. Baldwin

Sta. 12+59 Looking Downstream

MY 00		MY 01		MY 02		MY 03		MY 04		MY 05	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
20.32	44.49	20.32	44.49	153.13	41.38	153.13	41.39	154.78	41.28	153.64	42.23
50.25	42.52	50.25	42.52	155.51	41.19	153.61	41.35	158.74	41.22	161.72	40.95
78.82	41.98	78.82	41.98	159.37	41.29	156.40	41.00	163.33	40.9	174.45	40.72
97.11	42.25	97.11	42.25	163.57	41.11	164.69	41.15	167.41	40.71	181.53	40.21
113.72	42.15	113.72	42.15	167.64	40.72	167.39	40.72	168.93	40.6	186.98	40.04
131.64	41.90	131.64	41.90	173.09	40.94	171.43	40.88	174.28	40.8	193.83	39.93
145.91	41.47	145.91	41.47	177.54	40.78	177.86	40.70	180.59	40.39	197.19	39.91
153.13	42.09	153.13	42.09	182.58	40.30	182.06	40.32	185.53	40.21	201.37	40.01
159.54	41.19	158.28	41.16	185.77	40.12	186.87	39.99	190.46	39.89	204.51	39.94
171.94	41.02	166.00	40.94	188.89	39.94	191.07	39.94	195.18	39.91	207.49	39.33
180.95	40.38	170.52	40.88	194.18	39.97	195.94	39.95	199.32	39.92	208.22	39.15
187.04	39.94	179.13	40.57	200.51	39.92	200.44	39.96	202.19	39.96	208.84	38.76
197.51	39.98	184.61	40.28	202.61	39.85	202.76	39.86	205.16	39.89	209.47	37.8
200.36	39.97	190.41	39.96	204.72	39.85	205.35	39.83	207.2	39.28	209.72	36.35
205.21	39.84	194.41	39.92	206.71	39.17	206.48	39.54	208.7	38.84	210.89	36.68
205.63	39.82	200.59	39.97	207.89	38.84	208.05	38.73	209.52	37.42	212.18	36.59
205.93	39.76	205.91	39.83	208.23	38.73	208.65	38.40	211.12	36.64	213.44	36.64
207.79	38.83	208.18	38.48	209.46	37.19	208.82	38.03	212.51	36.4	216.2	36.98
209.56	37.40	209.36	37.63	210.59	36.70	209.67	37.40	213.65	36.57	217.89	37.06
210.71	36.78	209.67	37.18	211.02	36.53	210.70	36.68	214.7	36.87	219.41	37.57
211.70	36.25	210.78	36.66	212.13	36.75	211.91	36.56	215.67	36.71	220.39	37.93
214.13	36.40	214.84	36.29	213.04	36.98	213.77	36.95	216.98	36.8	221.31	38.67

SUMARY DATA	MY00	MY01	MY02	MY03	MY04	MY05
Bankfull Elevation	39.68	39.70	39.70	39.61	39.87	39.74
Bankfull Cross-Sectional Area	36.86	37.87	34.50	32.69	40.27	37.31
Bankfull Width	20.58	24.45	20.80	19.56	22.77	22.93
Flood Prone Area Elevation	43.11	43.11	42.87	42.66	43.34	43.13
Flood Prone Width	248.46	248.07	244.10	245.00	252.64	249.00
Max Depth at Bankfull	3.43	3.41	3.17	3.05	3.47	3.39
Mean Depth at Bankfull	1.79	1.55	1.66	1.67	1.77	1.63
W/D Ratio	11.50	15.77	12.53	11.71	12.86	14.07
Entrenchment Ratio	12.07	10.15	11.74	12.53	11.10	10.86
Bank Height Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Stream Type	C	C	C	C	C	C

Oakley Crossroads - UT to Tranters Creek
X-Section 3, Pool, Station 12+59



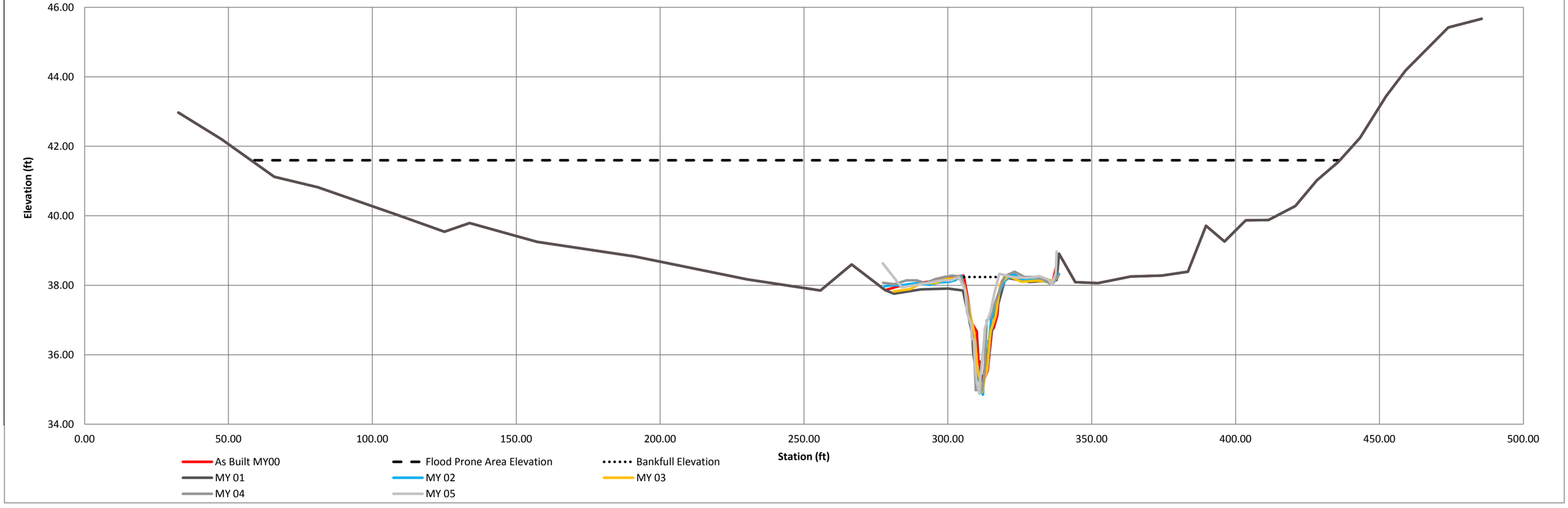
River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-4, Riffle, STA 28+46
Drainage Area(sq. mi.)	1.59
Date	11/17/2015
Field Crew	T. Taylor, A. Baldwin

Sta. 28+46 Looking Downstream

MY 00		MY 01		MY 02		MY 03		MY 04		MY 05	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
32.58	42.97	32.58	42.97	278.00	37.97	281.19	37.82	277.51	38.07	277.39	38.63
47.64	42.20	47.64	42.20	280.52	38.00	286.99	37.89	281.36	38.03	283.92	37.94
65.92	41.12	65.92	41.12	284.26	38.00	290.83	38.06	285.67	38.14	293.63	38.07
81.03	40.82	81.03	40.82	289.18	38.06	295.88	38.06	289.16	38.14	297.65	38.14
88.43	40.61	88.43	40.61	293.86	38.01	298.80	38.17	292.29	38.06	301.06	38.14
108.82	40.02	108.82	40.02	296.90	38.08	304.41	38.22	295.68	38.18	303.79	38.24
125.06	39.54	125.06	39.54	300.54	38.10	305.66	38.03	298.8	38.24	306.02	37.85
133.82	39.79	133.82	39.79	302.64	38.15	309.07	36.68	301.5	38.28	306.64	37.22
157.24	39.25	157.24	39.25	304.70	38.27	309.58	36.30	303.97	38.25	308.18	36.85
191.12	38.83	191.12	38.83	306.16	37.79	309.72	36.15	305.4	38.06	308.29	36.5
230.32	38.17	230.32	38.17	307.54	37.21	310.35	35.59	306.85	37.46	309.08	36.41
255.76	37.85	255.76	37.85	308.62	36.83	311.02	35.33	308.04	36.82	309.39	35.78
266.56	38.60	266.56	38.60	309.70	36.33	311.95	34.93	309.06	36.31	309.99	35.2
278.21	37.86	278.21	37.86	309.97	35.76	312.92	35.37	309.7	34.98	310.99	34.88
282.75	37.97	281.24	37.759	310.39	35.64	313.7	35.56	310.31	35.01	311.28	35.3
293.74	38.11	290.68	37.881	311.02	35.24	314.1	35.99	311.11	34.89	312.65	36.45
305.40	38.28	300.11	37.906	312.16	34.85	314.87	36.67	311.88	34.99	312.85	36.76
305.58	38.25	305.26	37.848	312.3	35.04	316.62	37.12	312.78	35.51	314.85	37.24
306.89	37.65	307.23	37.095	312.89	35.48	318.28	38.04	313.53	36.99	316.12	37.76
308.24	36.93	308.54	36.55	314.04	35.74	321.01	38.27	314.65	37.04	317.86	38.33
310.07	36.67	308.85	36.062	314.17	36.4	325.68	38.1	316.63	37.54	322.23	38.24
310.71	35.71	309.92	35.422	314.34	36.04	330.21	38.13	319.74	38.26	327.45	38.21

SUMARY DATA	MY00	MY01	MY02	MY03	MY04	MY05
Bankfull Elevation	38.24	37.85	38.13	38.22	38.25	38.24
Bankfull Cross-Sectional Area	20.90	18.22	19.85	21.57	21.30	18.08
Bankfull Width	14.64	13.70	14.70	16.10	15.73	13.80
Flood Prone Area Elevation	41.23	40.54	41.41	41.51	41.61	41.60
Flood Prone Width	367.14	332.68	367.00	367.00	378.73	377.00
Max Depth at Bankfull	2.99	2.69	3.28	3.29	3.36	3.36
Mean Depth at Bankfull	1.43	1.33	1.35	1.34	1.35	1.31
W/D Ratio	10.24	10.30	10.89	12.01	11.65	10.53
Entrenchment Ratio	25.08	24.28	24.97	22.80	24.08	27.32
Bank Height Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Stream Type	C	C	E	C	E	E

Oakley Crossroads - UT to Tranters Creek
X-Section 4, Riffle, Station 28+46



River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-5, Pool, STA 32+71
Drainage Area(sq. mi.)	1.59
Date	11/17/2015
Field Crew	T. Taylor, A. Baldwin

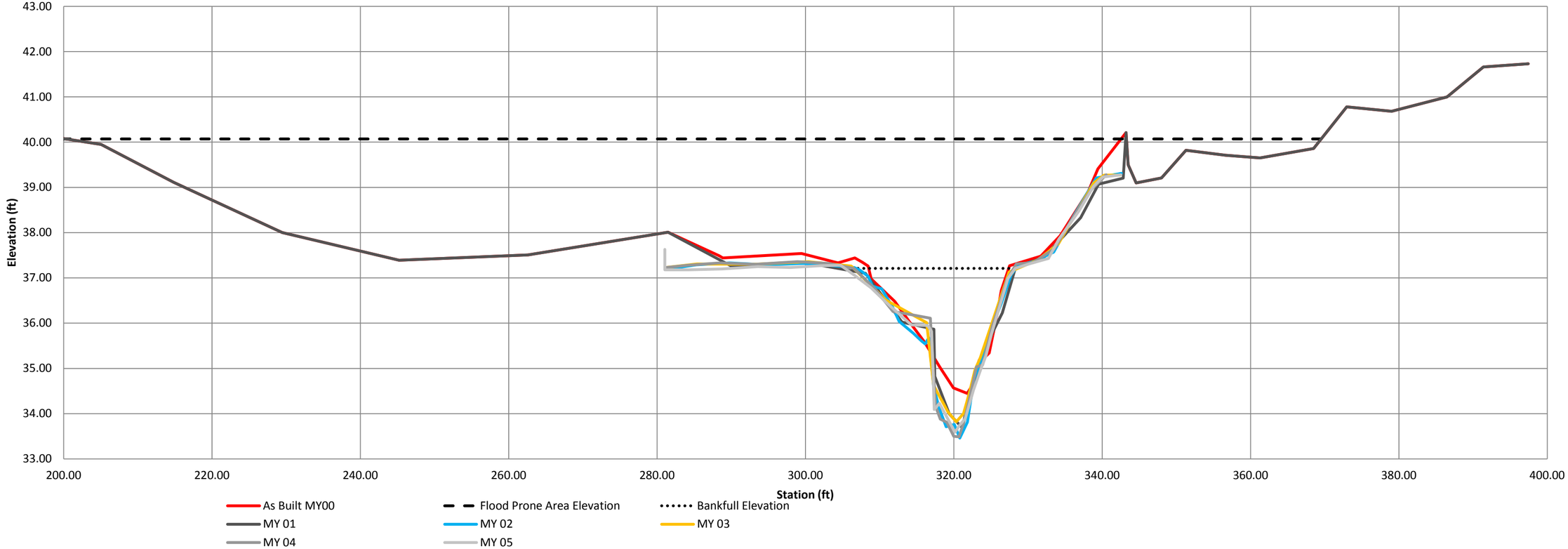
Sta. 32+71 Looking Downstream

*Floodprone width adjusted to not include adjacent farm pond.

MY 00		MY 01		MY 02		MY 03		MY 04		MY 05	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
26.15	42.13	26.15	42.13	281.30	37.19	281.17	37.23	281.2	37.23	281.05	37.63
36.87	42.19	36.87	42.19	285.24	37.29	285.36	37.31	284.25	37.28	281.05	37.18
68.22	41.81	68.22	41.81	289.79	37.33	292.98	37.30	288.5	37.33	284.33	37.18
85.37	36.59	85.37	36.59	294.67	37.29	300.40	37.36	293.25	37.3	288.8	37.2
90.80	34.92	90.80	34.92	299.78	37.32	306.17	37.26	298.92	37.36	293.55	37.25
176.23	35.02	176.23	35.02	303.71	37.27	310.85	36.51	303.13	37.32	297.93	37.23
177.81	35.70	177.81	35.70	306.55	37.23	316.32	36.01	306.54	37.21	301.95	37.27
185.44	38.11	185.44	38.11	307.36	37.17	317.26	34.63	309.29	36.77	304.73	37.28
195.27	40.20	195.27	40.20	308.48	37.03	319.20	34.04	311.78	36.26	306.68	37.05
205.06	39.95	205.06	39.95	309.01	36.82	320.31	33.82	314.51	36.18	308.86	36.78
214.85	39.11	214.85	39.11	310.26	36.76	321.31	34.00	316.83	36.11	310.89	36.46
229.47	38.00	229.47	38.00	311.69	36.37	322.05	34.43	317.52	34.17	314.28	35.96
245.21	37.39	245.21	37.39	312.62	36.04	322.85	34.97	318.16	33.88	316.47	35.95
262.60	37.51	262.60	37.51	314.52	35.78	323.56	35.24	319.05	33.81	317.01	35.82
281.47	38.01	281.47	38.01	315.69	35.60	327.45	37.13	319.98	33.5	317.37	34.09
288.37	37.49	289.99	37.262	316.15	35.54	331.31	37.4	320.67	33.49	318.04	34.23
288.85	37.44	300.08	37.334	316.61	35.68	334.08	37.75	321.3	33.78	318.85	33.99
299.46	37.54	308.08	37.1	317.26	34.62	336.39	38.41	321.98	34.23	320.16	33.59
304.38	37.33	313.02	36.025	317.96	34.15	338.86	39.1	323.05	35.03	320.81	33.75
306.65	37.44	317.31	35.866	318.95	33.71	340.26	39.27	323.88	35.08	321.55	33.89
307.72	37.34	317.44	34.823	320.06	33.763	342.43	39.27	324.53	35.51	322.64	34.52
308.44	37.26	319.38	33.992	320.8	33.461			325.21	35.95	323.71	35.02

SUMARY DATA	MY00	MY01*	MY02	MY03	MY04	MY05
Bankfull Elevation	37.26	37.33	37.23	37.19	37.31	37.21
Bankfull Cross-Sectional Area	29.47	35.63	34.74	30.33	35.00	33.84
Bankfull Width	19.06	29.71	23.49	21.70	24.97	22.97
Flood Prone Area Elevation	40.07	40.98	41.00	40.56	41.13	40.83
Flood Prone Width	289.16	315.10	301.17	300.00	300.00	300.00
Max Depth at Bankfull	2.81	3.65	3.77	2.82	3.82	3.62
Mean Depth at Bankfull	1.55	1.20	1.48	1.40	1.40	1.47
W/D Ratio	12.30	24.76	15.87	15.50	17.84	15.63
Entrenchment Ratio	15.17	10.61	12.82	13.82	12.01	13.06
Bank Height Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Stream Type	C	C	C	C	C	C

Oakley Crossroads - UT to Tranters Creek
X-Section 5 Pool, Station 32+71



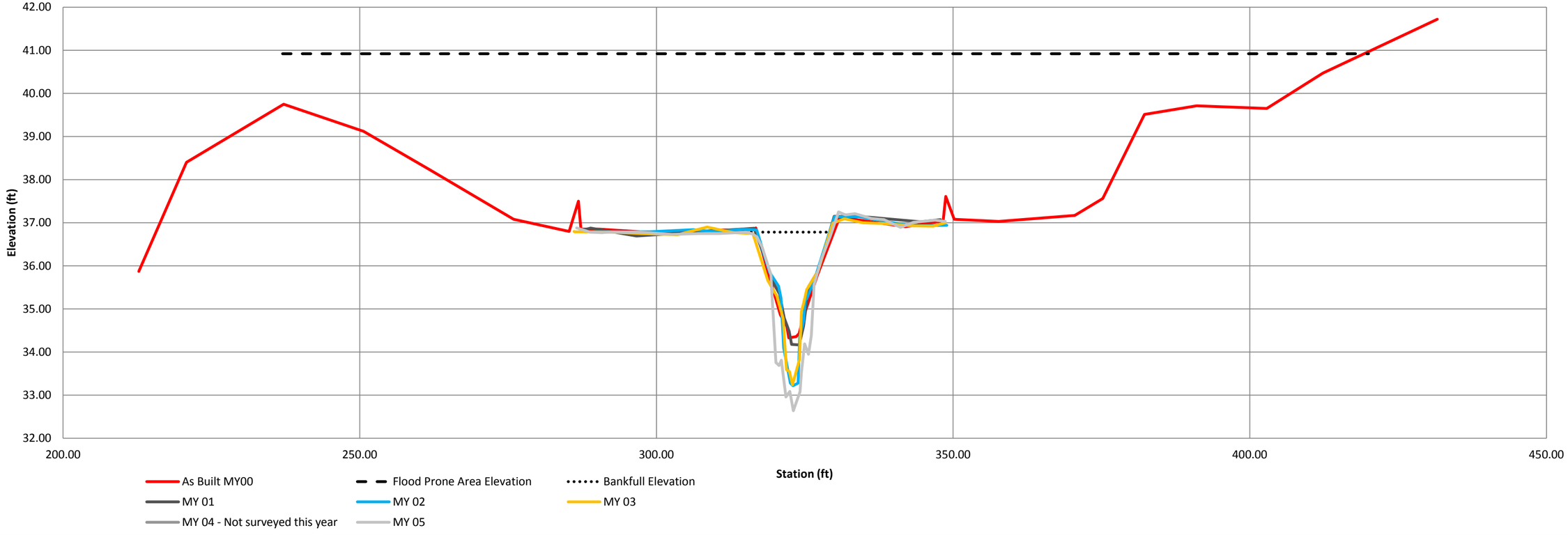
River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-6, Riffle, STA 35+24
Drainage Area(sq. mi.)	1.59
Date	11/17/2015
Field Crew	T. Taylor, A. Baldwin

Sta. 35+24 Looking Downstream

MY 00		MY 01		MY 02		MY 03		MY 04		MY 05	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
212.76	35.87	212.76	35.87	286.34	36.79	286.10	36.80			286.55	36.88
220.80	38.40	220.80	38.40	298.82	36.79	286.16	36.79			288.79	36.78
237.17	39.75	237.17	39.75	306.18	36.84	292.51	36.78			290.81	36.77
250.63	39.12	250.63	39.12	310.11	36.79	297.54	36.75			291.86	36.78
261.67	38.24	261.67	38.24	314.68	36.85	303.55	36.72			297.28	36.78
275.95	37.08	275.95	37.08	316.91	36.83	308.55	36.90			302.56	36.73
285.28	36.80	285.28	36.80	319.06	35.85	312.98	36.77			307.05	36.75
286.84	37.50	286.84	37.50	320.59	35.53	316.25	36.75			310.56	36.75
287.26	36.85	287.26	36.85	320.98	35.25	318.78	35.66			313.65	36.77
290.35	36.85	287.43	36.82	321.44	34.10	320.27	35.30			315.06	36.78
301.91	36.75	288.9	36.88	322.57	33.28	321.36	34.78			316.2	36.74
310.76	36.83	296.65	36.69	323.02	33.22	321.92	33.59			316.94	36.67
316.51	36.84	316.45	36.87	323.87	33.28	322.42	33.55			317.83	36.43
316.76	36.88	319.93	35.55	324.13	34.34	322.92	33.24			319.29	35.79
318.89	35.81	320.76	35.34	324.78	34.72	324.11	33.83			319.35	35.57
320.87	34.87	321.54	34.79	325.06	35.20	324.44	34.94			319.71	34.75
321.98	34.60	322.35	34.49	325.33	35.24	324.79	35.13			320.12	33.76
322.30	34.33	322.78	34.18	326.57	35.65	325.31	35.45			320.68	33.69
323.55	34.36	324.04	34.17	328.9	36.67	327.21	35.87			321.06	33.81
324.04	34.43	324.79	34.60	330.01	37.14	329.71	36.99			321.83	32.96
324.63	34.76	325.66	35.52	334.1	37.14	331.66	37.09			322.48	33.09
327.11	35.78	327.28	35.89	342.78	36.93	334.82	37.00			323.07	32.64
330.86	37.13	329.96	37.15	348.93	36.94	338.31	36.98			324.21	33.08

SUMARY DATA	MY00	MY01	MY02	MY03	MY04	MY05
Bankfull Elevation	36.88	36.87	36.83	36.75		36.78
Bankfull Cross-Sectional Area	18.91	17.43	19.10	18.74		25.51
Bankfull Width	17.17	12.92	12.37	12.92		14.51
Flood Prone Area Elevation	39.43	39.57	40.44	40.26		40.92
Flood Prone Width	158.46	166.08	160.00	160.00		200.00
Max Depth at Bankfull	2.55	2.70	3.61	3.51		4.14
Mean Depth at Bankfull	1.10	1.35	1.54	1.45		1.76
W/D Ratio	15.61	9.59	8.03	8.91		8.24
Entrenchment Ratio	9.23	12.82	12.93	12.38		13.78
Bank Height Ratio	1.00	0.95	1.00	1.00		1.00
Stream Type	C	C	E	E		E

Oakley Crossroads - UT to Tranters Creek
X-Section 6, Riffle, Station 35+24



River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-7, Riffle, STA 38+71
Drainage Area(sq. mi.)	1.59
Date	11/17/2015
Field Crew	T. Taylor, A. Baldwin

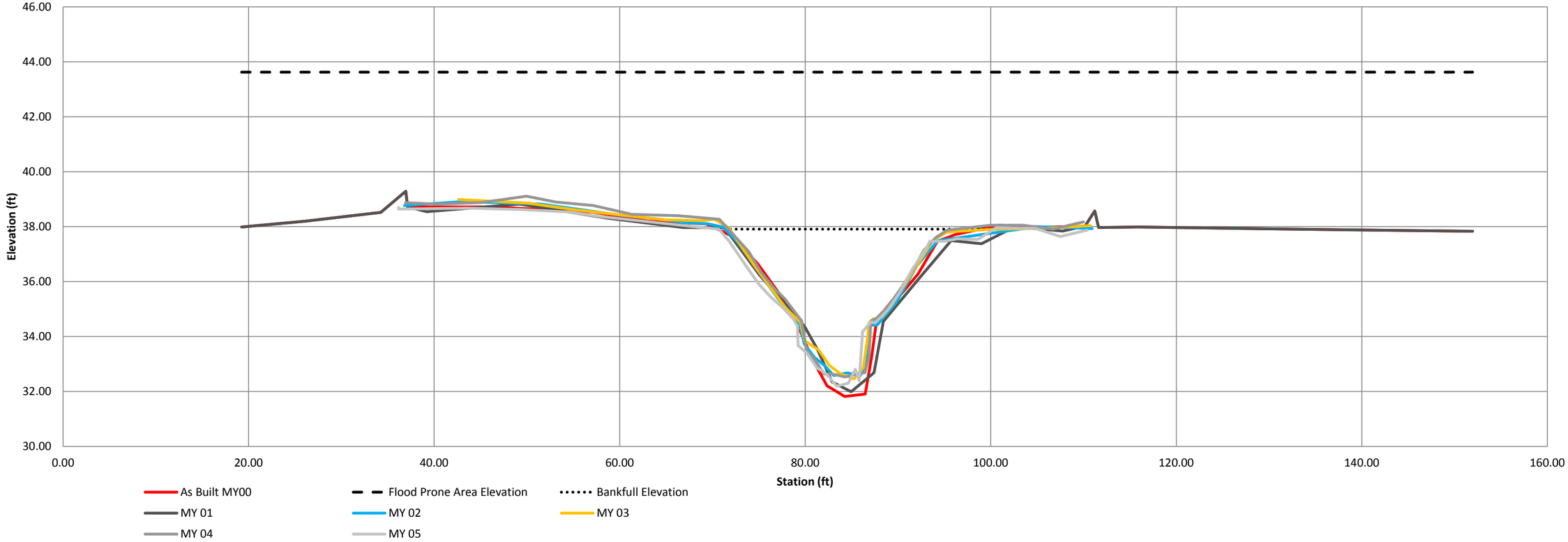
Sta. 38+71 Looking Downstream

MY 00		MY 01		MY 02		MY 03		MY 04		MY 05	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
19.24	37.99	19.24	37.99	36.80	38.77	42.64	38.99	36.9	38.87	36.17	38.7
26.11	38.20	26.11	38.20	43.00	38.91	50.02	38.86	40.3	38.82	36.19	38.64
34.24	38.52	34.24	38.52	51.58	38.82	55.25	38.61	45.08	38.88	43.69	38.67
36.95	39.29	36.95	39.29	60.15	38.41	64.77	38.25	49.96	39.11	49.44	38.62
37.14	38.72	37.14	38.72	64.02	38.28	68.82	38.22	53.09	38.9	54.61	38.53
39.57	38.72	39.21	38.544	66.96	38.15	70.21	38.27	57.14	38.77	57.86	38.37
46.18	38.72	49.19	38.823	69.41	38.11	71.74	37.97	61.3	38.45	68.03	38
57.09	38.53	58.73	38.308	71.14	37.99	74.54	36.57	66.33	38.4	70.68	37.91
63.06	38.20	66.87	37.967	72.73	37.43	77.9	35.04	70.75	38.27	71.77	37.49
66.76	38.14	71.32	37.96	77.16	35.34	79.48	34.52	73.91	37.09	73.79	36.49
69.33	38.10	75.06	36.251	79.17	34.57	79.92	33.85	75.24	36.34	75.01	35.9
72.02	37.67	79.92	34.376	79.57	34.2	81.46	33.51	76.73	35.73	76.27	35.44
74.83	36.67	81.32	33.533	79.89	33.73	82.62	32.95	77.81	35.37	77.74	35
77.89	35.25	82.9	32.353	80.99	33.24	83.77	32.65	79.61	34.57	78.73	34.63
79.27	34.35	84.95	31.993	82.14	32.93	85.27	32.46	80.13	33.52	79.15	34.39
80.79	33.16	87.42	32.686	83.07	32.58	86.26	32.87	81.12	33.12	79.24	33.67
82.34	32.21	88.42	34.553	84.53	32.68	86.76	34.07	82.03	32.63	80.17	33.4
84.27	31.82	92.45	36.186	85.93	32.58	86.84	34.47	82.91	32.64	81.28	32.85
86.46	31.91	95.74	37.49	86.64	33.08	87.31	34.64	84.26	32.53	81.88	32.74
87.16	33.28	98.99	37.375	86.87	34.26	88.27	34.72	85.25	32.61	82.67	32.49
87.65	34.47	102.57	37.996	86.98	34.41	89.28	35.13	86.45	32.69	83.38	32.2
89.37	35.16	107.75	37.837	87.78	34.43	93.79	37.51	86.86	33.24	84.64	32.3
92.14	36.27	110.16	38.02	89.78	35.23	95.27	37.80	87.08	34.57	85.41	32.81

* REVISED X-SEC DATA

SUMARY DATA	MY00*	MY01	MY02	MY03	MY04	MY05
Bankfull Elevation	38.05	38.00	38.00	37.85	37.97	37.91
Bankfull Cross-Sectional Area	75.91	77.93	71.24	62.90	65.91	70.71
Bankfull Width	31.46	36.52	34.07	25.52	26.26	29.66
Flood Prone Area Elevation	44.28	44.01	43.42	43.24	43.41	43.62
Flood Prone Width	132.69	132.69	>200	200.00	200.00	200.00
Max Depth at Bankfull	6.23	6.01	5.42	5.39	5.44	5.71
Mean Depth at Bankfull	2.41	2.13	2.09	2.46	2.51	2.38
W/D Ratio	13.05	17.15	16.30	10.37	10.46	12.46
Entrenchment Ratio	4.22	3.63	5.87	7.84	7.62	6.74
Bank Height Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Stream Type	C	C	C	E	E	C

Oakley Crossroads - UT to Tranters Creek
X-Section 7 Riffle, Station 38+71



Oakley Crossroads Stream and Buffer Restoration - Longitudinal Profile
Station 0+00 to 38+79
2015 Monitoring - Year 0, Year 01, Year 02, Year 03, Year 04, Year 05

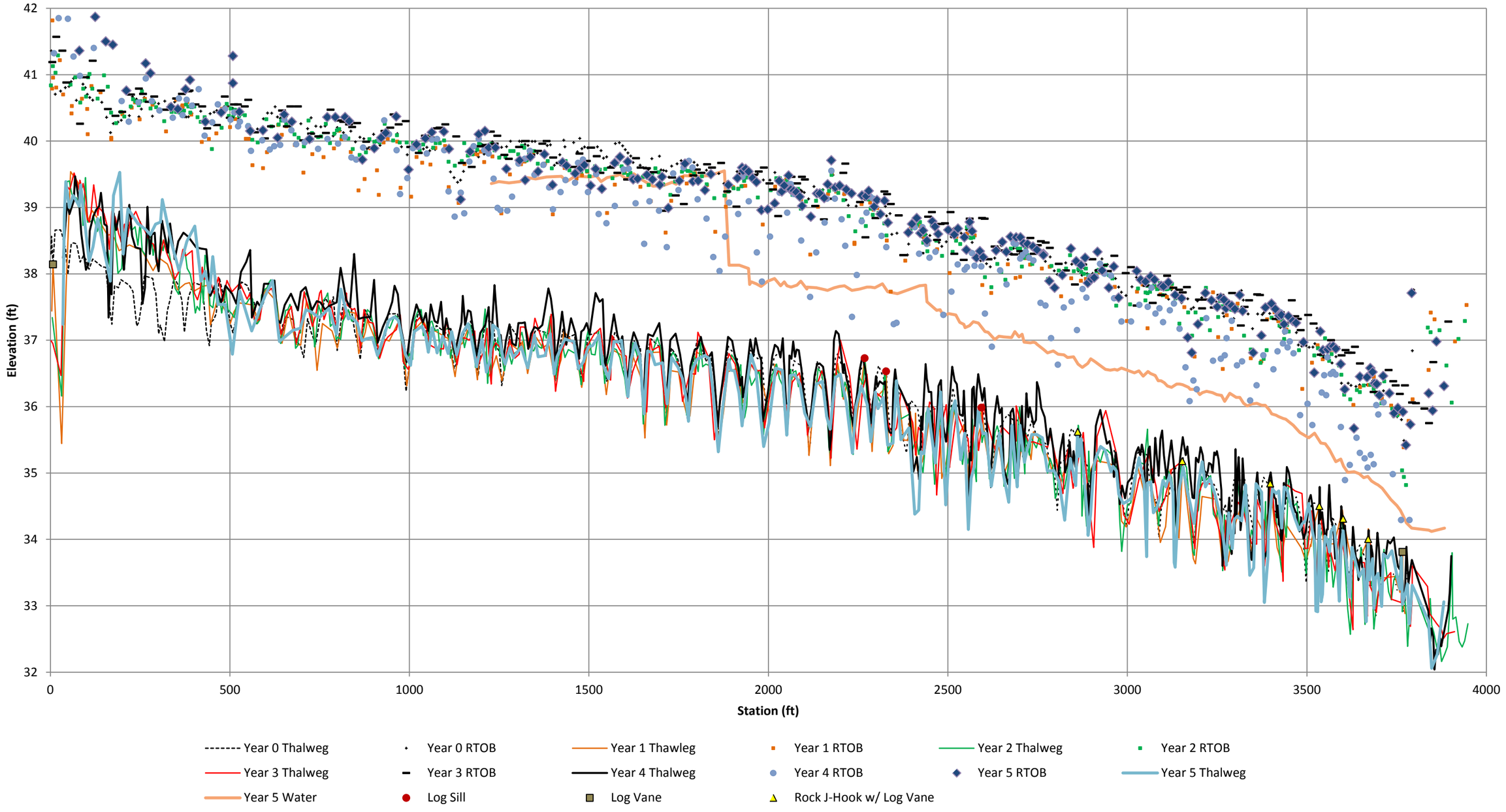


Table 10a. Baseline Stream Data Summary
Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3,950 feet)

Parameter	Gauge[2]	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[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					-	10.40	-	-	-	4	7.80	11.20	-	14.60	-	2	-	12.3	-	14.64	17.31	-	20.82	-	4
Floodprone Width (ft)					-	15.00	-	-	-	4	120.00	126.50	-	133.00	-	2	-	240.0	-	80.66	182.63	-	367.14	-	4
Bankfull Mean Depth (ft)					-	1.80	-	-	-	4	0.70	1.15	-	1.60	-	2	-	1.5	-	0.88	1.13	-	1.43	-	4
[1]Bankfull Max Depth (ft)					-	2.70	-	-	-	4	1.60	1.85	-	2.10	-	2	-	2.4	-	2.15	2.56	-	2.99	-	4
Bankfull Cross Sectional Area (ft^2)					-	19.00	-	-	-	4	9.50	11.05	-	12.60	-	2	-	19.0	-	18.16	19.08	-	20.90	-	4
Width/Depth Ratio					-	5.70	-	-	-	4	4.80	13.60	-	22.40	-	2	-	8.0	-	10.24	16.19	-	23.66	-	4
Entrenchment Ratio					-	1.40	-	-	-	4	8.20	12.65	-	17.10	-	2	-	19.5	-	4.66	10.55	-	21.21	-	4
[1]Bank Height Ratio					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Profile																									
Riffle Length (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24.83	35.98	-	53.02		4
Riffle Slope (ft/ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.003	-	0.006		4
Pool Length (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.47	33.67	-	44.45		2
Pool Max depth (ft)					-	-	-	-	-	-	1.7	2.3	-	2.9	-	2	-	4	-	2.81	3.12	-	3.43		2
Pool Spacing (ft)					-	-	-	-	-	-	5	27	35	67	-	4	43	52.5	62	43.4	64.26	-	94.03		2
Pattern																									
Channel Beltwidth (ft)					-	-	-	-	-	-	45	72.5	-	100		2	62	74.0	86	38.56	55.94	-	86.18	-	48.00
Radius of Curvature (ft)					-	-	-	-	-	-	8	12.8	14	21		4	22	27.0	31	19.24	27.81	-	36.28	-	56.00
Rc:Bankfull width (ft/ft)					-	-	-	-	-	-	0.5	1.2	1.4	1.8		4	1.8	2.2	2.5	1.11	1.61	-	2.10	-	56.00
Meander Wavelength (ft)					-	-	-	-	-	-	17	75	100	156		4	86	111	135	85.46	103.92	-	118.61	-	48.00
Meander Width Ratio					-	-	-	-	-	-	5.8	6.3	-	6.8		2	5	6.0	7	2.23	3.23	-	4.98	-	48.00
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					0.2												0.14			0.093					
Max part size (mm) mobilized at bankfull					-												-			25					
Unit Stream Power (transport capacity) lbs/ft/s per unit width[6]					0.25												0.17			0.16					
Additional Reach Parameters																									
Rosgen Classification					G5c						C5, E5						E5			C4					
Bankfull Velocity (fps)					1.9												1.7			1.65					
Bankfull Discharge (cfs)					30																				
Valley length (ft)					-						-														
Channel Thalweg length (ft)					-						-						-			3950					
Sinuosity (ft)					1.01						1.18						1.28			1.4					
Water Surface Slope (Channel) (ft/ft)					0.0018						0.002						0.0014			0.00146					
BF slope (ft/ft)					-						-						-			**0.00144**					
[3]Bankfull Floodplain Area (acres)					-						-						-			-					
[4]% of Reach with Eroding Banks					-						-														
Channel Stability or Habitat Metric					-						-														
Biological or Other					-						-														

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

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3; 6. Units changed from W/m^2 to reflect those provided in original design.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3,950 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	-	0	-	0	0			-	-	-	-	-			-	-	-	-	-			52	-	48	-	-		
[1]SC% / Sa% / G% / C% / B% / Be%	0	33	67	0	0	0		0	100	0	0	0	0															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.14	0.26	0.5	4.4	7.3	-	30	0.3	0.4	0.5	0.9	1.2	-	-														
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	-	-	-	-	-			-	-	-	-	-										-	-	-	-	-		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0	-	-	-	-				-	-	-	-											-	-	-	-			

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

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

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3- These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-constrution distribution of these parameters, leaving the reader/consumer with a sample that is weighted
the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be re
a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3,950 feet)

	Cross Section 1 (STA 0+72, Riffle)							Cross Section 2 (STA 6+17, Riffle)							Cross Section 3 (STA 12+59, Pool)							Cross Section 4 (STA 28+46, Riffle)							Cross Section 5 (STA 32+71, Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used		40.49	40.57	40.37	40.86	41.30			40.38	40.38	40.33	40.33	40.42			39.70	39.70	39.61	39.87	39.74			37.85	37.93	38.22	38.25	38.24			37.33	37.23	37.19	37.31	37.21	
Bankfull Width (ft)	20.82	12.39	15.49	15.73	11.65	8.81		16.60	13.16	15.09	13.85	17.67	14.11		20.58	24.38	20.80	19.56	22.77	22.93		14.64	13.70	14.70	16.10	15.73	13.80		19.06	29.71	23.49	21.70	24.97	22.97	
Floodprone Width (ft)	80.66	65.65	78.50	78.50	80.93	86.30		124.27	131.28	128.50	125.00	124.68	122.00		248.08	120.86	244.10	245.00	252.64	249.00		367.14	332.68	367.00	367.00	378.73	377.00		289.16	315.10	301.17	300.00	300.00	300.00	
Bankfull Mean Depth (ft)	0.88	0.68	0.63	0.88	0.96	1.07		1.09	1.37	1.20	1.30	1.17	1.36		1.79	1.55	1.66	1.67	1.77	1.63		1.43	1.33	1.35	1.34	1.35	1.31		1.55	1.20	1.48	1.40	1.40	1.47	
Bankfull Max Depth (ft)	2.15	1.14	1.84	2.15	1.81	2.13		2.54	2.68	2.61	2.60	2.57	2.50		3.43	3.41	3.17	3.05	3.47	3.39		2.99	2.69	3.28	3.29	3.36	3.36		2.81	3.65	3.77	2.82	3.82	3.62	
Bankfull Cross Sectional Area (ft^2)	18.33	8.37	9.77	9.15	11.21	9.42		18.16	17.88	18.17	18.06	20.68	19.23		36.86	37.87	34.50	32.69	40.27	37.31		20.90	18.22	19.85	21.57	21.30	18.08		29.47	35.63	34.74	30.33	35.00	33.84	
Bankfull Width/Depth Ratio	23.66	18.22	24.59	27.12	12.14	8.23		15.23	9.61	12.58	10.65	15.10	10.38		11.50	15.73	12.53	11.71	12.86	14.07		10.24	10.30	10.89	12.01	11.65	10.53		12.30	24.76	15.87	15.50	17.84	15.63	
Bankfull Entrenchment Ratio	3.88	5.30	5.07	4.99	6.95	9.80		7.49	7.51	8.52	9.03	7.06	8.65		12.05	4.96	11.74	12.53	11.10	10.86		25.08	24.28	24.97	22.80	24.08	27.32		15.17	10.61	12.82	13.82	12.01	13.06	
Bankfull Bank Height Ratio	1.00	0.95	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	1.00	1.00		1.00	0.90	1.00	1.00	1.00	1.00		1.00	0.98	1.00	1.00	1.00	1.00	
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

	Cross Section 6 (STA 35+24, Riffle)							Cross Section 7 (STA 38+71, Other)							Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used		36.87	36.83	36.75		36.78			38.00	38.00	37.85	37.97	37.91																						
Bankfull Width (ft)	17.17	12.92	12.37	12.92		14.51		31.46	36.52	34.07	25.52	26.26	29.66																						
Floodprone Width (ft)	158.46	166.08	160.00	160.00		300.00		132.69	132.69	>200	200.00	200.00	200.00																						
Bankfull Mean Depth (ft)	1.10	1.35	1.54	1.45		1.76		2.41	2.13	2.09	2.46	2.51	2.38																						
Bankfull Max Depth (ft)	2.55	2.70	3.61	3.51		4.14		6.23	6.01	5.42	5.39	5.44	5.71																						
Bankfull Cross Sectional Area (ft^2)	18.91	17.43	19.10	18.74		25.51		75.91	77.93	71.24	62.90	65.91	70.71																						
Bankfull Width/Depth Ratio	15.61	9.59	8.03	8.91		8.24		13.05	17.15	16.30	10.37	10.46	12.46																						
Bankfull Entrenchment Ratio	9.23	12.82	12.93	12.38		13.78		4.22	3.63	5.87	7.84	7.62	6.74																						
Bankfull Bank Height Ratio	1.00	0.95	1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00																						
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: “It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary.”

Table 11b. Monitoring Data - Stream Reach Data Summary
Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3,950 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	14.6	17.31	-	20.82	-	4	12.4	12.8	12.92	13.16	0.394	4	12.4	14.4	14.9	15.49	1.399	4	12.9	14.7	14.8	16.1	1.5	4	11.7	15.02	15.73	17.67	3.073	3	8.8	12.8	14.0	14.5	2.7	4
Floodprone Width (ft)	80.7	182.63	-	367.14	-	4	65.7	118.7	124.3	166.1	50.45	4	78.5	183.5	144.3	367	126.9	4	78.5	182.6	142.5	367	127.4	4	80.9	194.78	124.7	379	160.8	3	86.3	221.3	211.0	377.0	139.7	4
Bankfull Mean Depth (ft)	0.9	1.13	-	1.43	-	4	0.7	1.1	1.35	1.37	0.393	4	0.6	1.2	1.275	1.54	0.392	4	0.9	1.2	1.3	1.5	0.2	4	1.0	1.16	1.17	1.35	0.195	3	1.1	1.4	1.3	1.8	0.3	4
[1]Bankfull Max Depth (ft)	2.2	2.56	-	2.99	-	4	1.1	2.2	2.683	2.703	0.897	4	1.8	2.8	2.945	3.61	0.783	4	2.2	2.9	2.9	3.5	0.6	4	1.8	2.58	2.57	3.36	0.775	3	2.1	3.0	2.9	4.1	0.9	4
Bankfull Cross Sectional Area (ft^2)	18.2	19.08	-	20.9	-	4	8.4	8.4	17.43	17.88	5.365	4	9.8	16.7	18.64	19.85	4.686	4	9.2	16.9	18.4	21.6	5.4	4	11.2	17.73	20.7	21.30	5.655	3	9.4	18.1	18.7	25.5	6.6	4
Width/Depth Ratio	10.2	16.19	-	23.66	-	4	9.6	12.5	9.606	18.22	4.978	4	8.0	14.0	11.73	24.59	7.289	4	8.9	14.7	11.3	27.1	8.4	4	11.7	12.96	12.14	15.10	1.867	3	8.2	9.3	9.3	10.5	1.3	4
Entrenchment Ratio	4.7	10.55	-	21.21	-	4	5.3	9.2	9.443	12.82	3.767	4	5.1	12.9	10.73	24.97	8.682	4	5.0	12.3	10.7	22.8	7.6	4	7.0	12.70	7.06	24.1	9.858	3	8.7	14.9	11.8	27.3	8.6	4
[1]Bank Height Ratio	-	-	-	-	-	-	1	1	1	1	0	4	1	1	1	1	0	4	1.0	1	1	1	0	4	1.0	1.00	1.00	1.00	0	3	1.0	1.0	1.0	1.0	0.0	4
Profile																																				
Riffle Length (ft)	24.8	35.98	-	53.02	-	4	24.2	35.2	-	53.1	-	4	20.28	30.8	-	55.2		4	19.4	33.1		52.1		4	15.05	24.8		33.53		4	23.9	31.5		41.75		4
Riffle Slope (ft/ft)	0.002	0.003	-	0.006	-	4	0.002	0.003	-	0.006	-	4	0.002	0.004	-	0.006		4	0.00	0.004		0.01		4	0.00	0.0034		0.01		4	0.003	0.004		0.006		2
Pool Length (ft)	20.47	33.67	-	44.45	-	2	21	32.54	-	45.21	-	2	26.76	38.88	-	51		2	22.02	33		44.04		2	24.76	32.2		39.64		2	23.9	33.5		41.8		2
Pool Max depth (ft)	2.81	3.12	-	3.43	-	2	3.41	3.53	-	3.65	-	2	3.17	3.47	-	3.77		2	3.02	3.4		3.77		2	2.27	2.73		3.18		2	3.2	3.4		3.7		2
Pool Spacing (ft)	43.4	64.26	-	94.03	-	2	42.1	65.2	-	95.2	-	2	28.72	64	-	106		33	27.48	64.31		113		33	25.52	63.62		116.8		52	25.7	62.7		110.9		32
Pattern																																				
Channel Beltwidth (ft)	38.6	55.94	-	86.18	-	48																														
Radius of Curvature (ft)	19.2	27.81	-	36.28	-	56																														
Rc:Bankfull width (ft/ft)	1.1	1.61	-	2.1	-	56																														
Meander Wavelength (ft)	85.5	103.92	-	118.61	-	48																														
Meander Width Ratio	2.2	3.23	-	4.98	-	48																														

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	C4,E5						C4,E5						C4,E5						C4,E5						C4,E5						C4,E5					
Channel Thalweg length (ft)																																				
Sinuosity (ft)	1.4						1.4						1.4						1.4						1.4						1.4					
Water Surface Slope (Channel) (ft/ft)	0.00146						0.00145						0.00145						0.00152						0.0015						n/a					
BF slope (ft/ft)	0.00144						0.00139						0.00137						0.00135						0.00132						0.0013					
[3]Ri% / Ru% / P% / G% / S%	**52**	-	**48**	-	-		**52**	-	**48**	-	-		**52**	-	**48**	-	-		**52**	-	**48**	-	-		**52**	-	**48**	-	-		**52**	-	**48**	-	-	
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Appendix E. Hydrology Data

Table 12 – Verification of Bankfull Events

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Table 12 - Verification of Bankfull Events Oakley Crossroads Stream and Buffer Restoration Project - EEP Project No. 273			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo**
September 13, 2011	unknown	Visual observation of debris lines	n/a
October 4, 2012	unknown	Crest gauge	S9 (MY2)
October 10, 2012	unknown	Visual observation of debris lines	S8 (MY2)
March 28, 2013	unknown	Crest gauge	S8 (MY3)
April 2, 2014	unknown	Crest gauge	S8 (MY4)
October 7, 2014	unknown	Sediment on vegetation	S9 (MY4)
September 16, 2015	unknown	Crest gauge and debris piles observed	S9 (MY5)