Mitigation Project Name	**Jacobs Landing**	**County**	**Rowan**	**USACE Action ID**	**2012-01006**
DMS ID	**95024**	**Date Project Instituted**	**6/28/2011**	**NCDWR Permit No**	**2012-0773**
River Basin	**Yadkin**	**Date Prepared**	**5/22/2018**		
Cataloging Unit	**03040105**				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)		4,368.600												
Potential Credits (As-Built Survey)		4,527.600												
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%	1,358.280			2014	10/8/2014	30%				30%		N/A	N/A
3 (Year 1 Monitoring)	10%	452.760			2015	4/23/2015	10%				10%		N/A	N/A
4 (Year 2 Monitoring)	10%	452.760			2016	4/25/2016	15%				15%		N/A	N/A
5 (Year 3 Monitoring)	10%	452.760			2017	4/3/2017	20%				20%		N/A	N/A
6 (Year 4 Monitoring)	10%	452.760			2018	4/25/2018	10%				10%		N/A	N/A
7 (Year 5 Monitoring)	15%				2019		15%				15%		N/A	N/A
Stream Bankfull Standard	15%	679.140			2017	4/3/2017	N/A				N/A			
Total Credits Released to Date		3,848.460												

DEBITS (released credits only)

Ratios			1	1.5	2.5	5	1	3	2	5	1	3	2	5	1	3	2	5
			Stream Restoration	Stream Enhancement I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)			4,484.000		109.000													
As-Built Amounts (mitigation credits)			4,484.000		43.600													
Percentage Released			85%		85%													
Released Amounts (feet / acres)			3,811.400		92.650													
Released Amounts (credits)			3,811.400		37.060													
NCDWR Permit	USACE Action ID	Project Name																
2016-0805	2012-00417	NCDOT TIP U-3440, NC 3 Widening, Cabarrus County	804.150															
	2016-02124	NCDOT TIP I-3804 - Division 9	718.000															
	2011-01460	NCDOT TIP U-5608 - Division 9	568.000															
2017-1250	2016-00248	NCDOT TIP P-5704	310.000															
2011-0431	2011-01237	NCDOT TIP R-2123CE - Charlotte Outer Loop	1,411.250		92.650													
Remaining Amounts (feet / acres)			0.000		0.000													
Remaining Amounts (credits)			0.000		0.000													

Contingencies (if any): None

Signature of Wilmington District Official Approving Credit Release

9/6/18
Date

1 - For DMS, no credits are released during the first milestone

2 - For DMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCEEP Portal, provided the following criteria have been met:

1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Reciept of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required

3 - A 15% reserve of credits is to be held back until the bankfull event performance standard has been met

Jacob's Landing
Stream Restoration Monitoring Report
DMS Project # 95024
DMS Contract # 003984
Monitoring Year 05

Submitted to:

NCDEQ-DMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Construction Completed: January 2014
Data Collection: 2018
Submitted: January 2019

Design and Monitoring Firm

4505 Falls of Neuse Road
Suite 400
Raleigh, NC 27609
Phone: (919) 278-2514
Fax: (919) 783-9266

Project Manager: Tim Morris
Email: tim.morris@kci.com
Project No: 20110675

KCI ASSOCIATES OF NORTH CAROLINA, PA

ENGINEERS • SCIENTISTS • SURVEYORS • CONSTRUCTION MANAGERS

4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 (919) 783-9214 (919) 783-9266 Fax

MEMORANDUM

Date: February 1, 2019

To: Matthew Reid, DMS Project Manager

From: Adam Spiller, Project Manager
KCI Associates of North Carolina, PA

Subject: Jacob's Landing Stream Restoration Site
MY-05 Monitoring Report Comments
Yadkin River Basin CU 03040105
Rowan County, North Carolina
NCDMS Project # 95024
Contract # 003984

Please find below our responses in italics to the MY-05 Monitoring Report comments from NCDMS received on January 22, 2019, for the Jacob's Landing Stream Restoration Site.

- Report discusses supplemental plantings that occurred in 2015 and 2018. CCPV shows supplemental plantings dated 2016 and 2018. Please revise and/or update report discussion to include all supplemental plantings. A short discussion regarding size, quantity and species would be helpful. Did the planting that occurred in 2018 affect the outcome of the vegetation plot totals? Is the 2016 planting referring to the 2015 effort, or was this a separate supplemental planting?

➢ *The reference to a 2015 planting was a typo. The only supplemental plantings that occurred on site were in 2016 and 2018. This error has been corrected and a brief description of the extent of each planting has been added to the report. No new stems were reported in any of the veg plots in 2018.*

- Is the "Total Cross-section Area" measurement the previous method used to determine area? The report indicates that this is a new metric. A short explanation in the report about this metric would help clear up any confusion. Please list the fixed elevation used for the measurement on the graph and/or table for each cross-section.

➢ *Total Cross-section Area represents the previous method used to determine area (i.e. area under the baseline bankfull elevation). A short explanation of this has been added to the report and Table 11 has been updated with the baseline bankfull elevation for each cross-section.*

- Update Table 2 to include all supplemental plantings..

➢ *Table 2 has been updated.*

- DMS met with KCI on December 4, 2018 to view the Jacob Landing site. Dense privet was observed on Reach T2A. Please show this area on the CCPV and include the treatment date if it has occurred on Table 2.
  - *This area of privet was treated on December 13, 2018. This date has been added to Table 2 and the area has been added to the CCPV.*

- A large tree fell and damaged portion of the fence on T2. Has this tree been removed and the fence repaired?
  - *The area around the tree is currently too wet to access and so the tree has not been removed. Once the area dries out, KCI will remove the tree and repair the fence. The landowner does not have his cows in this area of his pasture and has said he will keep the cows away from this area until the fence is repaired.*

- Table 11c (T2) is missing the Total Cross Section Area line as shown on Table 11b (T1). Please update.
  - *This table has been updated.*

Please contact me if you have any questions or would like clarification concerning these responses.

Sincerely,

Adam Spiller
Project Manager

Table of Contents

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Jacob's Landing Stream Restoration Site is a full-delivery project that was developed for the North Carolina Division of Mitigation Services (DMS). Construction was completed in November 2013. The site includes the restoration of 4,484 linear feet of restoration and 109 linear feet of enhancement on four tributaries to Irish Buffalo Creek in the Yadkin-Pee Dee River Basin. The project is located west of China Grove and north of Kannapolis off of Saw Road in Rowan County (Figure 1, Appendix A). This project will expand aquatic and terrestrial habitat in the Rocky River Watershed (03040105). The project is within the 03040105020040 Irish Buffalo Creek Local Watershed Unit (14-digit HUC) (NCDENR, EEP 2009). In DMS' most recent publication of excluded and Targeted Local Watersheds/Hydrologic Units, the 03040105020040 14-digit HUC has been identified as a Targeted Local Watershed. The project is located in the Piedmont Physiographic Province and the project streams initiate as headwater systems out of moderately-sloped, forested hills before reaching the floodplain of Irish Buffalo Creek. The site's 0.72-square mile watershed is mostly pasture and mixed hardwoods with small pockets of rural residential development. Prior to construction the site was actively used for timber and cattle production for over five generations.

The project goals and objectives are listed below.

Project Goals

- Restore a diverse riparian corridor that connects forested stream systems upstream and downstream of the project.
- Reduce the sediment supply entering Irish Buffalo Creek.

Project Objectives

- Restore stable channel planforms to streams that have been straightened and modified.
- Reshape and stabilize eroding stream banks.
- Plant the site with native trees to help reestablish a diverse riparian corridor.
- Install exclusion fencing and alternative watering options to keep livestock out of the project streams.

During the Proposal Stage of the project, Reach T2-A was identified as Enhancement Level 1 at a 1.5:1 credit ratio. During the assessment and design stage for this reach, a more aggressive restoration approach was determined to be need, and the because of this the decision was made to completely change the stream type from a G-type channel to a C/B type channel. This required a restoration level approach during construction and because of this KCI requested a reallocation of credit type from the IRT from 1.5:1 to 1:1. After several meetings and discussions with the IRT, this reallocation of credit type was agreed to and resulted in an increase of 155 credits from the credits listed in the mitigation plan. See Appendix F for more information on this change.

Vegetation success is based on the criteria established in the USACE Stream Mitigation Guidelines (2003). This document states that vegetation monitoring results should have the following planted stem density minimums in the corresponding monitoring years: 320 stems/acre through Year Three, 288 stems/acre in Year Four, and 260 stems/acre in Year Five. The fifth-year vegetation monitoring was based on the Level 2 CVS-EEP vegetation monitoring protocol. The site's average density for this monitoring period is 392 planted stems/acre, with none of the plots having live stakes planted in them. Ten of the thirteen plots had greater than 260 planted stems/acre. There are three monitoring plots that have calculated planted stem densities less than 260 stems/acre; (Plots 3, 4, and 6). To ensure continued vegetative success, some parts of the site received supplemental planting in early 2016. This consisted of 80 one gallon size trees and approximately 1,400 bare root trees spread across the lower third of both tributaries. An additional supplemental planting occurred in early 2018, consisting of approximately 320 one gallon

size trees spread primarily along the left bank of Tributary 2. See the Current Condition Planview in Appendix B for the locations of these plantings. Including volunteers, the monitoring plots averaged 1,055 total stems/acre.

Fifth-year monitoring found the Jacob's Landing Site to be stable, with only minor changes from the as-built conditions. Two small areas of bank erosion that were reported on T1 during MY02 were repaired with soil lifts in the beginning of 2016 and these have shown no signs of instability since. The monitoring components were installed in February/March 2014. Two automatic recording gauges have been installed along T1 and T2. Both stream gauges recorded several bankfull events during 2018. The monitoring plan for each tributary is as follows: T1 has a 1,500 foot longitudinal profile, 3 riffle cross-sections, and 1 pool cross-section; T2 has a 1,500 foot longitudinal profile, 5 riffle cross-sections and 2 pool cross-sections; T1A and T2A are being monitored visually since they are short reaches and small channels. Pebble counts were conducted at all eleven cross-sections. Ten permanent photo reference points have been established with a total of twenty-two photos to be taken annually. The fifth year of monitoring found the site to be functioning and T2 shows little change from the baseline conditions. While T1 has several areas of stream bed aggradation, this is not seen as problematic, but rather the natural transfer of sediment through the system. Across the five years of monitoring, a clear pattern of sediment aggradation and transport through the system has been seen and this latest evidence of aggradation is believed to be a natural part of that cycle.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan documents available on the DMS' website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

2.0 METHODOLOGY

The survey data were collected using a real-time kinematic GPS instrument between December 17 and 19, 2018.

Based on feedback from the IRT and DMS, the cross-section measurements have been reviewed and have been updated. These measurements are now calculated by adjusting the bankfull elevation so that the cross-sectional area remains the same throughout the monitoring period. A metric called total cross-sectional area has been added that shows the cross-sectional area based off of the baseline bankfull elevation.

The CVS-EEP protocol, Level 2 (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data from the site. The vegetation monitoring was completed on July 27, 2018.

3.0 REFERENCES

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

NCDENR, Ecosystem Enhancement Program. 2009. Lower Yadkin Pee-Dee River Basin Priorities 2009. Raleigh, NC. http://www.nceep.net/services/restplans/Yadkin_Pee_Dee_RBRP_2009_Final.pdf

USACE. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

Appendix A

Project Vicinity Map and Background Tables

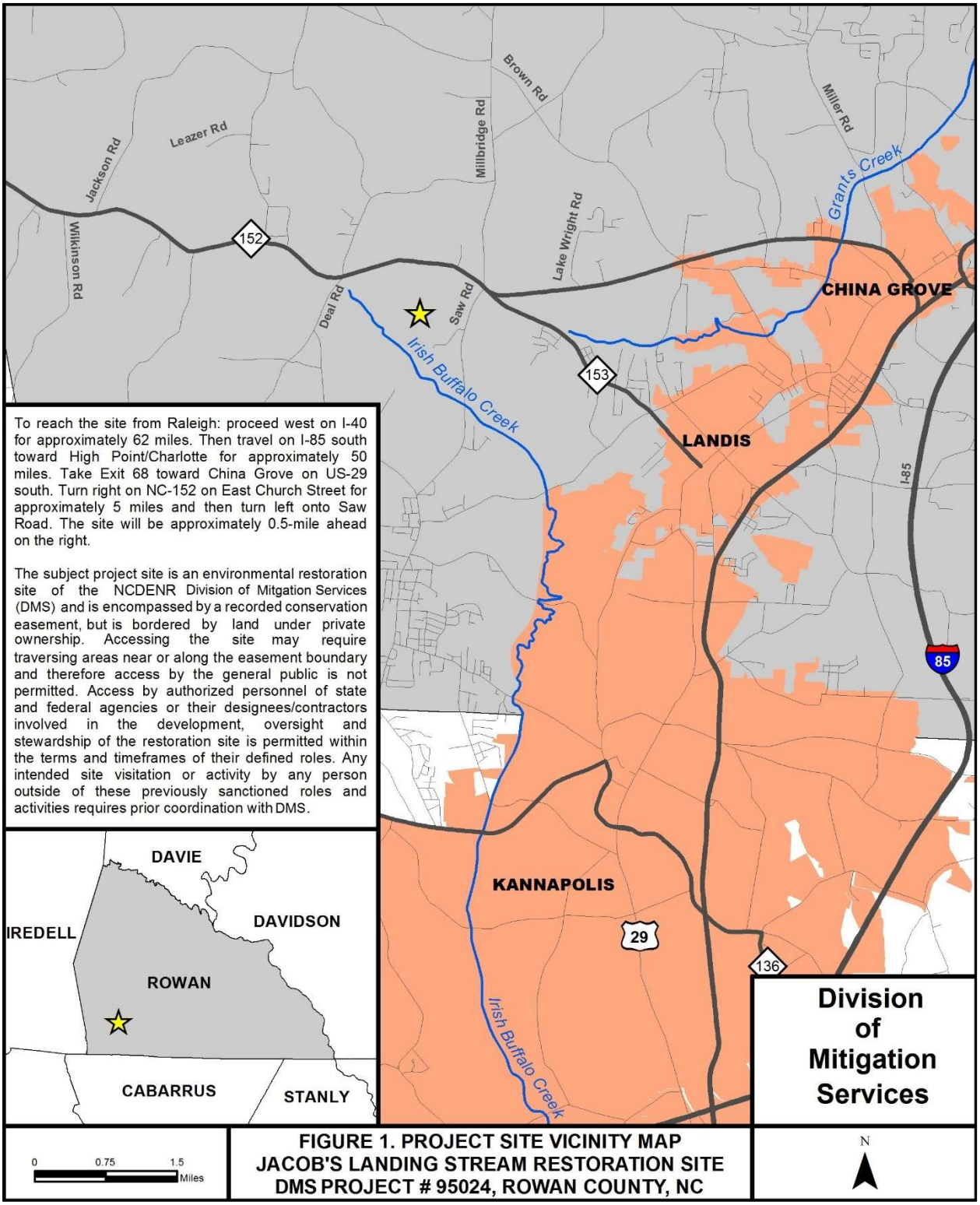


FIGURE 1. PROJECT SITE VICINITY MAP
JACOB'S LANDING STREAM RESTORATION SITE
DMS PROJECT # 95024, ROWAN COUNTY, NC

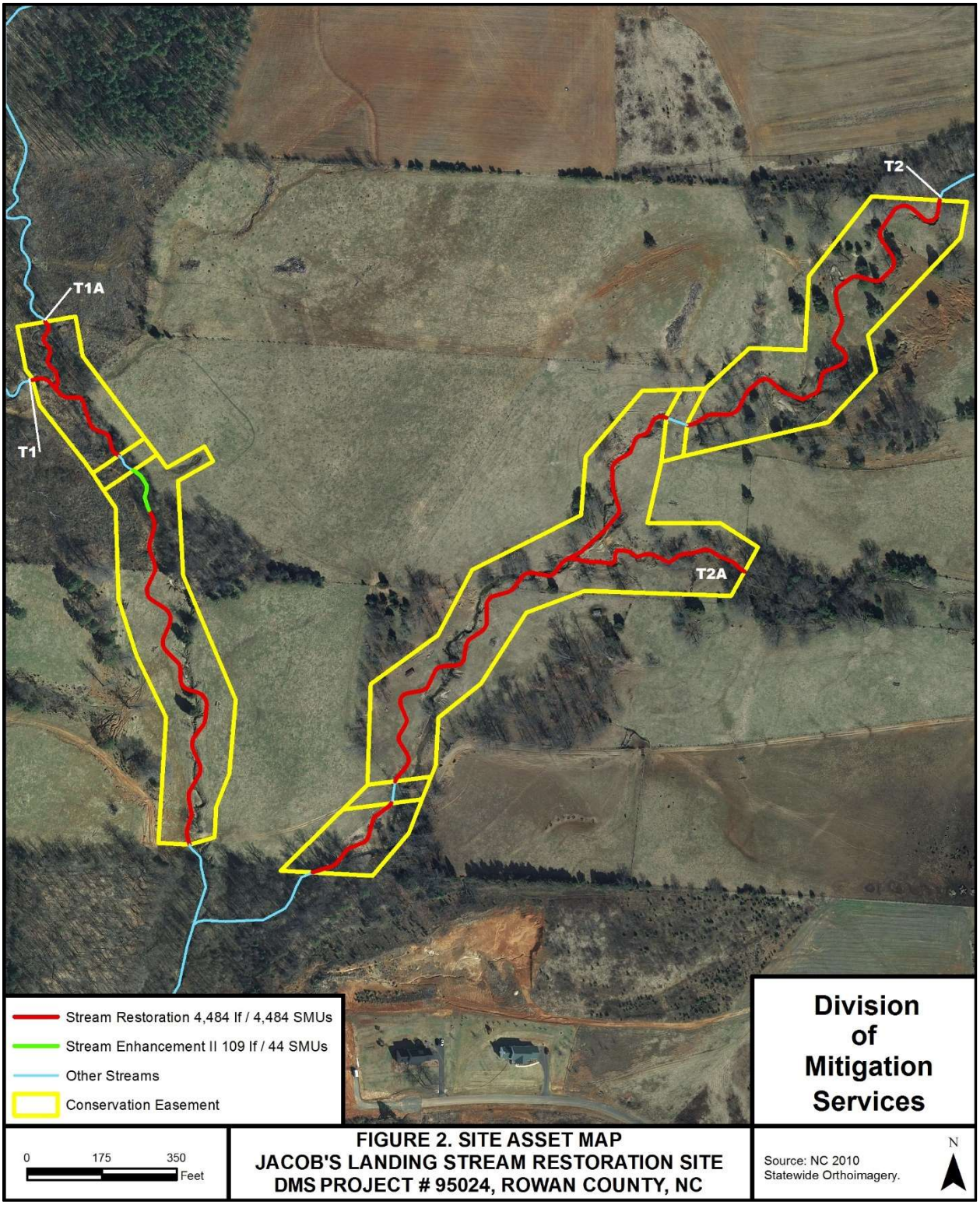

T1A
T1
T2
T2A
Stream Restoration 4,484 lf / 4,484 SMUs
Stream Enhancement II 109 lf / 44 SMUs
Other Streams
Conservation Easement
Division of Mitigation Services
0 175 350 Feet
FIGURE 2. SITE ASSET MAP
JACOB'S LANDING STREAM RESTORATION SITE
DMS PROJECT # 95024, ROWAN COUNTY, NC
Source: NC 2010 Statewide Orthoimagery.
N

Table 1. Project Components and Mitigation Credits
Jacob's Landing Stream Restoration Site, DMS Project # 95024

Mitigation Credits

	Stream		Riparian Wetland	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset
Type	R	EII				
Length	4,484	109				
Credits	4,484	44				
TOTAL CREDITS	4,528					

Project Components

Project Component -or- Reach ID	Design Stationing/ Location	Existing Footage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage	Mitigation Ratio
T1	10+00 – 13+03	326	P2	Restoration	303	1:1
T1	13+52 – 14+61	158	-	Enhancement II	109*	1:2.5
T1	14+61 – 23+54	846	P2	Restoration	893	1:1
T1A	40+00 – 41+78	294	P2	Restoration	178	1:1
T2	50+00 – 77+45	2,935	P2	Restoration	2,645*	1:1
T2A	100+00 – 104+65	465	P2	Restoration	465	1:1

Component Summation

Restoration Level	Stream (linear feet)	Mitigation Units (SMU)
Total Restoration	4,484	4,484
Total Enhancement II	109	44
TOTAL SMU		**4,528**

*Mitigation units have been calculated to exclude the easement exceptions and water utility easements.

Though not formal BMPs, several small water quality detention structures were installed throughout the project to improve water quality from the surrounding drainage area.

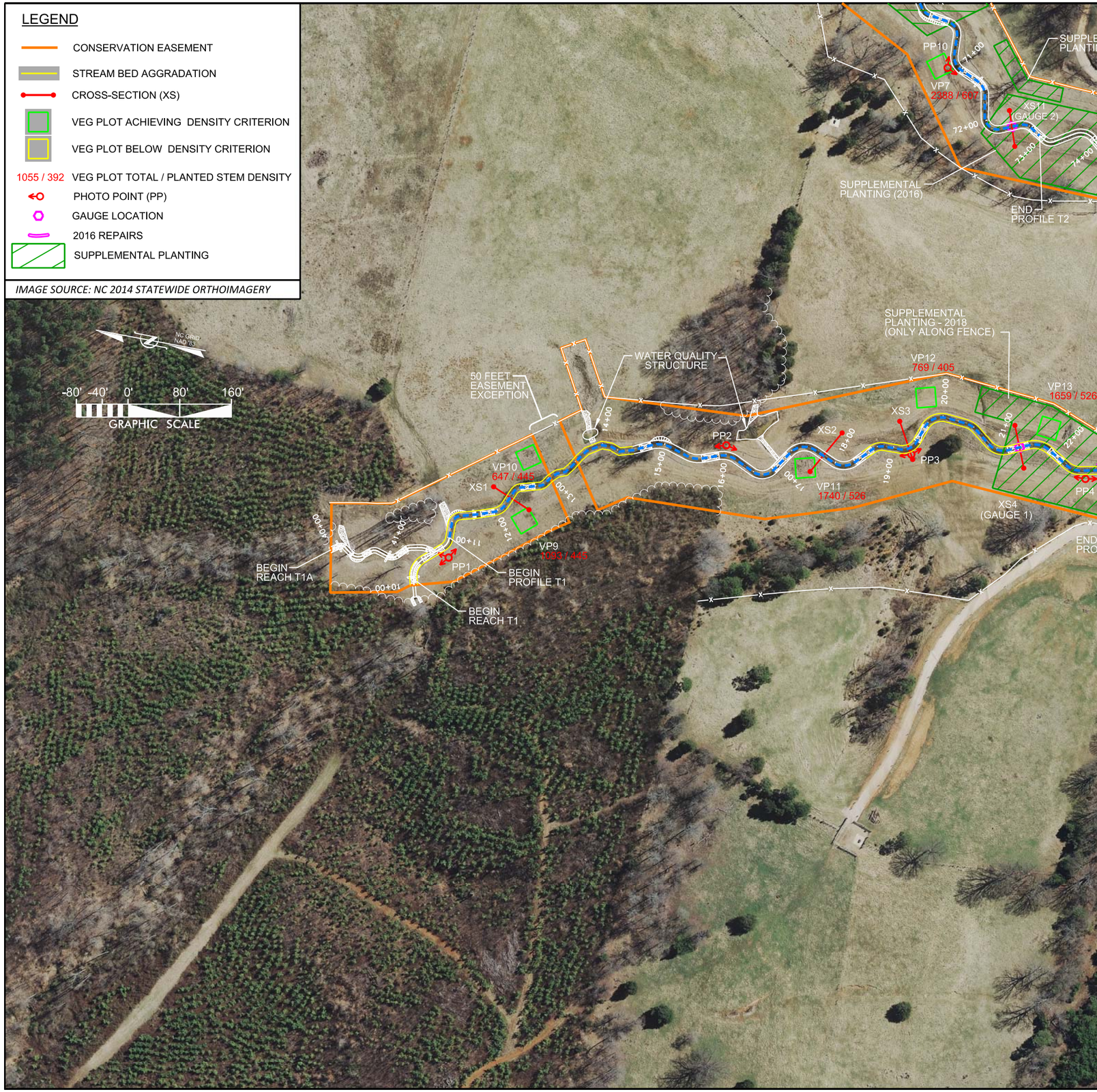
Table 2. Project Activity & Reporting History Jacob's Landing Stream Restoration Site, DMS Project # 95024		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Sept 12
Final Design - Construction Plans		Dec 12
Construction		Nov 13
Planting		Jan 14
Baseline Monitoring/Report	March 14	April 14
Vegetation Monitoring	Feb. 20, 2014	
Photo Points	March 11, 2014	
Stream Survey	Feb. 25, 2014	
Year 1 Monitoring	Oct 14	Nov 14
Vegetation Monitoring	Oct. 1, 2014	
Photo Points	Oct. 29, 2014	
Stream Survey	Oct. 29, 2014	
Year 2 Monitoring	August 15	Dec 15
Vegetation Monitoring	July 28, 2015	
Photo Points	Dec. 17, 2015	
Stream Survey	Aug. 11, 2015	
Bank erosion repair		Jan 16
Supplemental Planting		April 16
Year 3 Monitoring	Dec 16	Dec 16
Vegetation Monitoring	Aug. 31, 2016	
Photo Points	Nov. 15, 2016	
Stream Survey	June 10, 2016 (T1), Dec. 8, 2016 (T2)	
Year 4 Monitoring	Dec 17	Dec 17
Vegetation Monitoring	Aug. 14, 2017	
Photo Points	Nov. 17, 2017	
Stream Survey	June 2, 2017 (T1), Dec. 11 2017 (T2)	
Supplemental Planting		April 18
Year 5 Monitoring	Dec 18	Jan 19
Vegetation Monitoring	July 27, 2018	
Photo Points	Dec. 19, 2018	
Stream Survey	Dec. 19, 2018	
Invasive Treatment		Dec 18

Table 3. Project Contacts Jacob's Landing Stream Restoration Site, DMS Project # 95024	
Design Firm	KCI Associates of North Carolina 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	Wright Contracting, LLC 160 Walker Road Lawndale, NC 28090 Contact: Mr. Stephen James Phone: (704) 692-4633
Planting Contractor	Forestree Management Co. 1280 Maudis Road Bailey, NC 27807 Contact: Mr. Tony Cortez Phone: (252) 243-2513
Monitoring Performers	
	KCI Associates of North Carolina 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Information Jacob's Landing Stream Restoration Site, DMS Project # 95024				
Project Name	Jacob's Landing Stream Restoration Site			
County	Rowan County			
Project Area (acres)	13.9 acres			
Project Coordinates (lat. and long.)	35.552956 N, 80.653116 W			
Project Watershed Summary Information				
Physiographic Province	Piedmont			
River Basin	Yadkin-Pee Dee			
USGS Hydrologic Unit 8-digit	03040105	USGS Hydrologic Unit 14-digit	03040105020040	
DWQ Sub-basin	13-17-09			
Project Drainage Area	459 acres/0.72 square miles			
Project Drainage Area Percentage of Impervious Area	2.3% / 6 acres			
CGIA Land Use Classification	4.8% Cultivated, 60.1% Managed Herbaceous Cover, and 35.1% Mixed Upland Hardwoods.			
Reach Summary Information (Post-Restoration)				
Parameters	**T1**	**T1A**	**T2**	**T2A**
Length of reach (linear feet)	1,305	178	2,645	465
Valley classification	VIII	VIII	VIII	VIII
Drainage area (acres)	258.6 acres	136.9 acres	200.6 acres	35.7 acres
NCDWQ Water Quality Classification	Class C, WSIII	Class C, WSIII	Class C, WSIII	Class C, WSIII
Morphological Description (stream type)	C4	B4c/C4	C4	B4c/C4
Evolutionary trend	Stage II (Constructed)	Stage II (Constructed)	Stage II (Constructed)	Stage II (Constructed)
Mapped Soil Series	Chewacla loam	Chewacla loam	Pacolet sandy loam and Chewacla loam	Pacolet sandy loam
Drainage class	Poorly drained	Well drained	Poor to Well drained	Well drained
Soil Hydric status	Non hydric	Non hydric	Non hydric	Non hydric
Slope	0-2%	0-2%	0-2%	0-2%
FEMA classification	N/A	N/A	N/A	N/A
Native vegetation community	Piedmont Alluvial Forest	Piedmont Alluvial Forest	Piedmont Alluvial Forest	Mesic Mixed Hardwood Forest
Percent composition of exotic invasive vegetation	0%	0%	0%	0%
Regulatory Considerations				
Regulation	**Applicable?**	**Resolved?**		**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes, received 404 permit.		N/A
Waters of the United States – Section 401	Yes	Yes, received 401 permit.		N/A
Endangered Species Act	No	N/A		N/A
Historic Preservation Act	No	N/A		N/A
Coastal Zone Management Act* (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A		N/A
FEMA Floodplain Compliance	Yes	Floodplain development permit obtained through Rowan County		N/A
Essential Fisheries Habitat	No	N/A		N/A

Appendix B

Visual Assessment Data



REVISIONS		
SYM.	DESCRIPTION	DATE

NCDEQ – DIVISION OF MITIGATION SERVICES

KCI
ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

JACOB'S LANDING
STREAM MITIGATION PROJECT
MONITORING YEAR 5

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T1

DATE: JAN 2019

SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

LEGEND

- CONSERVATION EASEMENT
- STREAM BED AGGRADATION
- CROSS-SECTION (XS)
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- 1055 / 392 VEG PLOT TOTAL / PLANTED STEM DENSITY
- PHOTO POINT (PP)
- GAUGE LOCATION
- 2016 REPAIRS
- SUPPLEMENTAL PLANTING

IMAGE SOURCE: NC 2014 STATEWIDE ORTHOIMAGERY

NC GRID NAD 83

-80' -40' 0' 80' 160'

GRAPHIC SCALE

WATER QUALITY STRUCTURE
BEGIN PROFILE T2
VP1 931 / 283
PP5
VP2 607 / 405
XS6
BEGIN REACH T2
XS5
VP3 283 / 243
PP6
XS7
SUPPLEMENTAL PLANTING (2018)
WATER QUALITY STRUCTURE
50 FEET EASEMENT EXCEPTION
PP7
XS8
BEGIN REACH T2A
INVASIVES TREATMENT (2018)
VP5 526 / 364
PP8
SUPPLEMENTAL PLANTING (2018)
VP4 1214 / 243
XS9
PP9
SUPPLEMENTAL PLANTING - 2018 (ONLY ALONG FENCE)
VP6 607 / 202
XS10
SUPPLEMENTAL PLANTING (2016)
VP7 2388 / 607
PP10
XS11 (GAUGE 2)
50 FEET EASEMENT EXCEPTION
SUPPLEMENTAL PLANTING (2016)
VP8 1255 / 405
END PROFILE T2
SUPPLEMENTAL PLANTING (2016)
END PROFILE T1
VP13 1659 / 526
SUPPLEMENTAL PLANTING - 2018 (ONLY ALONG FENCE)
PP4
XS4 (GAUGE 1)
VP12 769 / 405
PP3
XS3
SUPPLEMENTAL PLANTING (2016)
XS2
WATER QUALITY STRUCTURE
VP11 1740 / 526
PP2
XS1

REVISIONS		
SYM.	DESCRIPTION	DATE

NCDEQ – DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

JACOB'S LANDING
STREAM MITIGATION PROJECT
MONITORING YEAR 5

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T2

DATE: JAN 2019
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

Table 5. Visual Stream Morphology Stability Assessment
Jacob's Landing Stream Restoration Site, DMS Project # 95024
Assessed Length 2,389 Reach - T1

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
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)			2	900	62%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	12	21			57%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	16			19%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	16			19%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	11	11			100%
		2. Thalweg centering at downstream of meander (Glide)	10	10			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	6	6			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	6			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	6			N/A
	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)	6	6			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A

Table 5. Visual Stream Morphology Stability Assessment
Jacob's Landing Stream Restoration Site, DMS Project # 95024

Assessed Length 2,084 **Reach - T2**

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
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	23	23			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	26	26			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	26	26			100%
	4.**Thalweg Position**[+]	1. Thalweg centering at upstream of meander bend (Run)					N/A
		2. Thalweg centering at downstream of meander (Glide)					N/A
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
Totals					0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	15	15			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			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)	6	6			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A

[+]Due to this reach's small size and the scale of the pattern, the exact position of the thalweg in relation to the meanders and morphological features is inconsistent and not practical to evaluate

Table 6. Vegetation Condition Assessment
Jacob's Landing Stream Restoration Site, DMS Project # 95024

Planted Acreage 12.83 **Easement Acreage 13.9**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acre	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acre	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	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 acre	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1,000 SF	Pattern and Color	1*	0.48	3.5%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

*This area was treated on December 13, 2018

Stream Station Photos

Photo Point 1u: MY-00 – 3/11/14

Photo Point 1u: MY-05 – 12/19/18

Photo Point 1d: MY-00 – 3/11/14

Photo Point 1d: MY-05 – 12/19/18

Photo Point 1 Tributary: MY-00 – 3/11/14

Photo Point 1 Tributary: MY-05 – 12/19/18

Photo Point 2u: MY-00 – 3/11/14

Photo Point 2u: MY-05 – 12/19/18

Photo Point 2d: MY-00 – 3/11/14

Photo Point 2d: MY-05 – 12/19/18

Photo Point 3u: MY-00 – 3/11/14

Photo Point 3u: MY-05 – 12/19/18

Photo Point 3d: MY-00 – 3/11/14

Photo Point 3d: MY-05 – 12/19/18

Photo Point 4u: MY-00 – 3/11/14

Photo Point 4u: MY-05 – 12/19/18

Photo Point 4d: MY-00 – 3/11/14

Photo Point 4d: MY-05 – 12/19/18

Photo Point 5u: MY-00 – 3/11/14

Photo Point 5u: MY-05 – 12/19/18

Photo Point 5d: MY-00 – 3/11/14

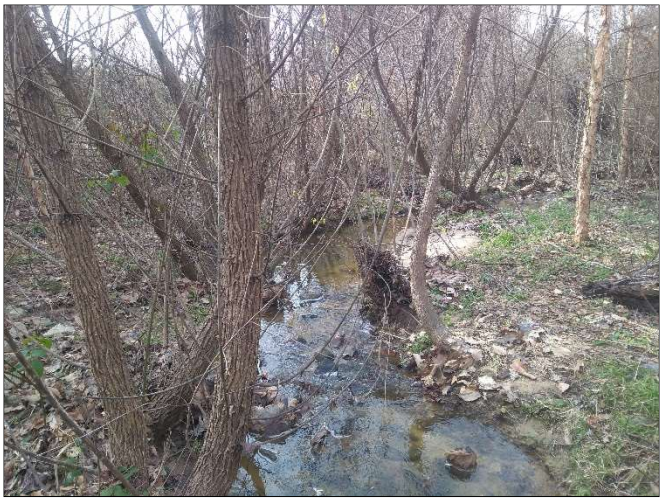


Photo Point 5d: MY-05 – 12/19/18

Photo Point 6u: MY-00 – 3/11/14

Photo Point 6u: MY-05 – 12/19/18

Photo Point 6d: MY-00 – 3/11/14

Photo Point 6d: MY-05 – 12/19/18

Photo Point 7u: MY-00 – 3/11/14

Photo Point 7u: MY-05 – 12/19/18

Photo Point 7d: MY-00 – 3/11/14

Photo Point 7d: MY-05 – 12/19/18

Photo Point 8u: MY-00 – 3/11/14

Photo Point 8u: MY-05 – 12/19/18

Photo Point 8d: MY-00 – 3/11/14

Photo Point 8d: MY-05 – 12/19/18

Photo Point 9u: MY-00 – 3/11/14

Photo Point 9u: MY-05 – 12/19/18

Photo Point 9d: MY-00 – 3/11/14

Photo Point 9d: MY-05 – 12/19/18

Photo Point 9 Tributary: MY-00 – 3/11/14

Photo Point 9 Tributary: MY-05 – 12/19/18

Photo Point 10u: MY-00 – 3/11/14

Photo Point 10u: MY-05 – 12/19/18

Photo Point 10d: MY-00 – 3/11/14

Photo Point 10d: MY-05 – 12/19/18

Vegetation Monitoring Plot Photos

Plot 1 Photo: 7/27/18 – MY05

Plot 2 Photo: 7/27/18 – MY05

Plot 3 Photo: 7/27/18 – MY05

Plot 4 Photo: 7/27/18 – MY05

Plot 5 Photo: 7/27/18 – MY05

Plot 6 Photo: 7/27/18 – MY05

Plot 7 Photo: 7/27/18 – MY05

Plot 8 Photo: 7/27/18 – MY05

Plot 9 Photo: 7/27/18 – MY05

Plot 10 Photo: 7/27/18 – MY05

Plot 11 Photo: 7/27/18 – MY05

Plot 12 Photo: 7/27/18 – MY05

Plot 13 Photo: 7/27/18 – MY05

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Jacob's Landing Stream Restoration Site, DMS Project # 95024			
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Monitoring Year 05 Planted Stem Density (stems/acre)**	**Monitoring Year 05 Total Stem Density (stems/acre)**
1	Yes	283	931
2	Yes	405	607
3	No	243	283
4	No	243	1,214
5	Yes	364	526
6	No	202	607
7	Yes	607	2,388
8	Yes	405	1,255
9	Yes	445	1,093
10	Yes	445	647
11	Yes	526	1,740
12	Yes	405	769
13	Yes	526	1,659

Table 8. CVS Vegetation Plot Metadata Jacob's Landing Stream Restoration Site, DMS Project # 95024	
Report Prepared By	Drew Rosso
Date Prepared	8/2/2018 7:08
database name	KCI-2016-L.mdb
database location	M:\2011\20110675-Jacobs Landing\Monitoring\Vegetaton CVS Database
computer name	12-39GM5H2
file size	63410176
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	95024
project Name	Jacob's Landing
Description	Stream Restoration Site
River Basin	Yadkin-Pee Dee
length(ft)	4593
area (sq m)	0.72
Required Plots (calculated)	13
Sampled Plots	13

			Current Plot Data (MY5 2018)																							
			95024-01-0001			95024-01-0002			95024-01-0003			95024-01-0004			95024-01-0005			95024-01-0006			95024-01-0007			95024-01-0008		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree																								1
Acer rubrum	red maple	Tree																								
Alnus serrulata	hazel alder	Shrub																								
Baccharis halimifolia	eastern baccharis	Shrub																								
Betula nigra	river birch	Tree	1	1	1	8	8	8	2	2	2	4	4	4				1	1	1	10	10	10	2	2	2
Callicarpa americana	American beautyberry	Shrub																								
Diospyros virginiana	common persimmon	Tree						1									1			2						
Fraxinus pennsylvanica	green ash	Tree	1	1	1													2	2	2						
Juglans nigra	black walnut	Tree												7									1			1
Juniperus virginiana	eastern redcedar	Tree			1			4						2						3			6			
Liquidambar styraciflua	sweetgum	Tree			14									15			3			5			34			16
Liriodendron tulipifera	tuliptree	Tree			1							1	1	1									1			
Nyssa biflora	swamp tupelo	Tree																								
Pinus taeda	loblolly pine	Tree																								3
Platanus occidentalis	American sycamore	Tree	4	4	4				3	3	3	1	1	1				2	2	2	2	2	2			
Prunus serotina	black cherry	Tree																								
Quercus	oak	Tree																								
Quercus alba	white oak	Tree				2	2	2																		
Quercus michauxii	swamp chestnut oak	Tree	1	1	1																					
Quercus palustris	pin oak	Tree													6	6	6									
Quercus phellos	willow oak	Tree							1	1	2										2	2	2	8	8	8
Quercus rubra	northern red oak	Tree													3	3	3				1	1	1			
Salix nigra	black willow	Tree																					2			
Sambucus canadensis	Common Elderberry	Shrub																								
Ulmus americana	American elm	Tree																								
Unknown																										
		Stem count	7	7	23	10	10	15	6	6	7	6	6	30	9	9	13	5	5	15	15	15	59	10	10	31
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	7	2	2	4	3	3	3	3	3	6	2	2	4	3	3	6	4	4	9	2	2	6
		Stems per ACRE	283	283	931	405	405	607	243	243	283	243	243	1214	364	364	526	202	202	607	607	607	2388	405	405	1255

Current Plot Data (MY5 2018)																		
			95024-01-0009			95024-01-0010			95024-01-0011			95024-01-0012			95024-01-0013		
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
Acer negundo	boxelder	Tree									1			2			3
Acer rubrum	red maple	Tree															
Alnus serrulata	hazel alder	Shrub									1						
Baccharis halimifolia	eastern baccharis	Shrub			1												
Betula nigra	river birch	Tree				3	3	3	7	7	8	1	1	1	1	1	1
Callicarpa americana	American beautyberry	Shrub				3	3	3	2	2	2				1	1	1
Diospyros virginiana	common persimmon	Tree															
Fraxinus pennsylvanica	green ash	Tree	3	3	3				3	3	3				2	2	2
Juglans nigra	black walnut	Tree															
Juniperus virginiana	eastern redcedar	Tree									1						1
Liquidambar styraciflua	sweetgum	Tree			12			2			23			7			21
Liriodendron tulipifera	tuliptree	Tree						1			1						2
Nyssa biflora	swamp tupelo	Tree															
Pinus taeda	loblolly pine	Tree															1
Platanus occidentalis	American sycamore	Tree			3						2						
Prunus serotina	black cherry	Tree						2									
Quercus	oak	Tree															
Quercus alba	white oak	Tree															
Quercus michauxii	swamp chestnut oak	Tree															
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree	7	7	7	5	5	5				8	8	8	9	9	9
Quercus rubra	northern red oak	Tree							1	1	1						
Salix nigra	black willow	Tree															
Sambucus canadensis	Common Elderberry	Shrub	1	1	1							1	1	1			
Ulmus americana	American elm	Tree															
Unknown		Shrub or Tree															
		Stem count	11	11	27	11	11	16	13	13	43	10	10	19	13	13	41
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
		Species count	3	3	6	3	3	6	4	4	10	3	3	5	4	4	9
		Stems per ACRE	445	445	1093	445	445	647	526	526	1740	405	405	769	526	526	1659

			Annual Means																	
			MY5 (2018)			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
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
Acer negundo	boxelder	Tree			7			4			6			6			3			
Acer rubrum	red maple	Tree						1												
Alnus serrulata	hazel alder	Shrub			1															
Baccharis halimifolia	eastern baccharis	Shrub			1			1						2						
Betula nigra	river birch	Tree	40	40	41	40	40	40	41	41	42	43	43	45	44	44	44	44	44	44
Callicarpa americana	American beautyberry	Shrub	6	6	6	7	7	7	9	9	9	9	9	9	11	11	12			
Diospyros virginiana	common persimmon	Tree			4			4			3			1			1			
Fraxinus pennsylvanica	green ash	Tree	11	11	11	11	11	11	9	9	11	9	9	9	1	1	1			
Juglans nigra	black walnut	Tree			9			7			1			3						
Juniperus virginiana	eastern redcedar	Tree			18			11			2			4						
Liquidambar styraciflua	sweetgum	Tree			152			126			206			171			272			
Liriodendron tulipifera	tuliptree	Tree	1	1	7	1	1	6	1	1	9	3	3	10	11	11	17			
Nyssa biflora	swamp tupelo	Tree				1	1	1	1	1	1									
Pinus taeda	loblolly pine	Tree			4			1			1									
Platanus occidentalis	American sycamore	Tree	12	12	17	12	12	18	12	12	17	16	16	19	21	21	32	3	3	3
Prunus serotina	black cherry	Tree			2															
Quercus	oak	Tree									1							11	11	11
Quercus alba	white oak	Tree	2	2	2	2	2	4	2	2	2	4	4	4	3	3	4	1	1	1
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1												
Quercus palustris	pin oak	Tree	6	6	6	7	7	7	7	7	7	5	5	5	5	5	5			
Quercus phellos	willow oak	Tree	40	40	41	41	41	41	43	43	43	46	46	46	41	41	41	54	54	54
Quercus rubra	northern red oak	Tree	5	5	5	5	5	5	5	5	5	6	6	6	5	5	5			
Salix nigra	black willow	Tree			2			2			3									
Sambucus canadensis	Common Elderberry	Shrub	2	2	2	1	1	1	2	2	2	2	2	3	1	1	1			
Ulmus americana	American elm	Tree									1									
Unknown		Shrub or Tree										1	1	1	6	6	6	133	133	133
		Stem count	126	126	339	129	129	299	132	132	372	144	144	344	149	149	444	246	246	246
		size (ares)	13			13			13			13			13			13		
		size (ACRES)	0.32			0.32			0.32			0.32			0.32			0.32		
		Species count	11	11	21	12	12	21	11	11	20	11	11	17	11	11	14	6	6	6
		Stems per ACRE	392	392	1055	402	402	931	411	411	1158	448	448	1071	464	464	1382	766	766	766

Appendix D

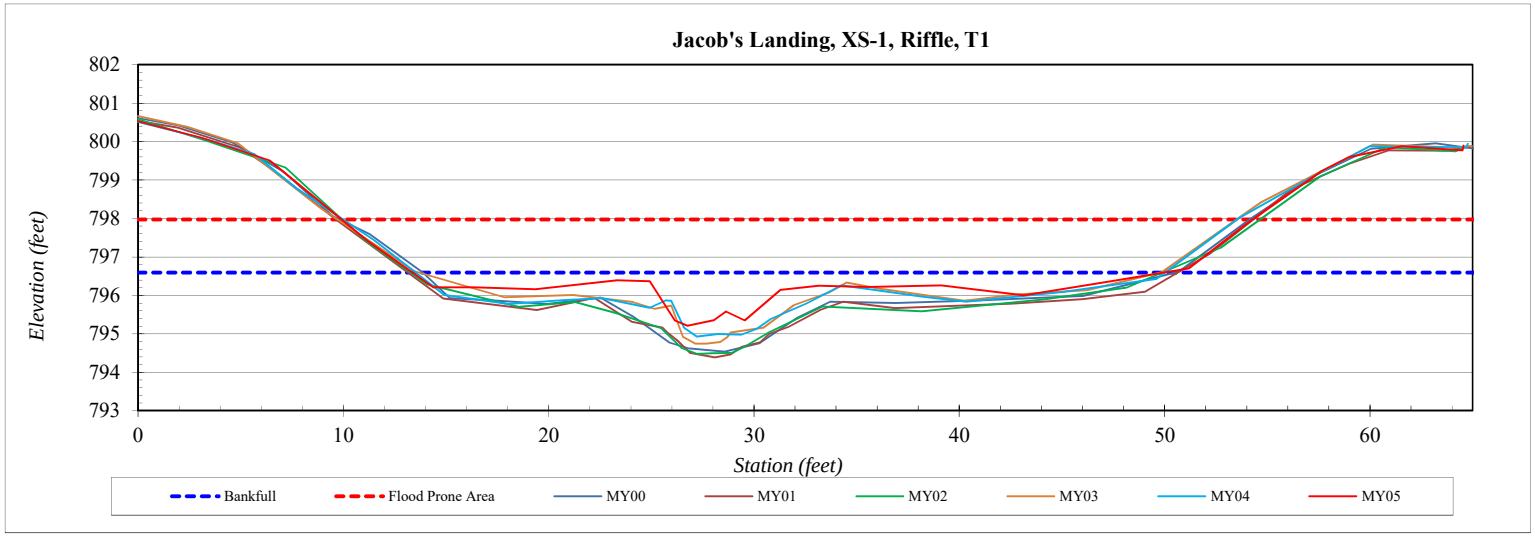
Stream Survey Data

Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-1
Drainage Area (sq mi):	0.21
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	800.53
3.09	800.11
6.41	799.51
11.18	797.42
14.39	796.20
16.38	796.21
19.36	796.16
23.33	796.39
24.92	796.36
26.14	795.35
26.76	795.21
28.02	795.35
28.63	795.59
29.56	795.35
31.28	796.14
33.15	796.24
35.53	796.22
39.12	796.26
43.14	796.00
47.38	796.37
51.16	796.70
53.93	797.83
57.65	799.24
58.98	799.59
61.56	799.87
64.50	799.77
64.55	799.89

SUMMARY DATA	
Current Bankfull Elevation:	796.6
Bankfull Cross-Sectional Area:	8.5
Total Cross-Sectional Area:	2.0
Bankfull Width:	12.2
Flood Prone Area Elevation:	798.0
Flood Prone Width:	44.4
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.7
W / D Ratio:	17.5
Entrenchment Ratio:	3.6
Bank Height Ratio:	0.7

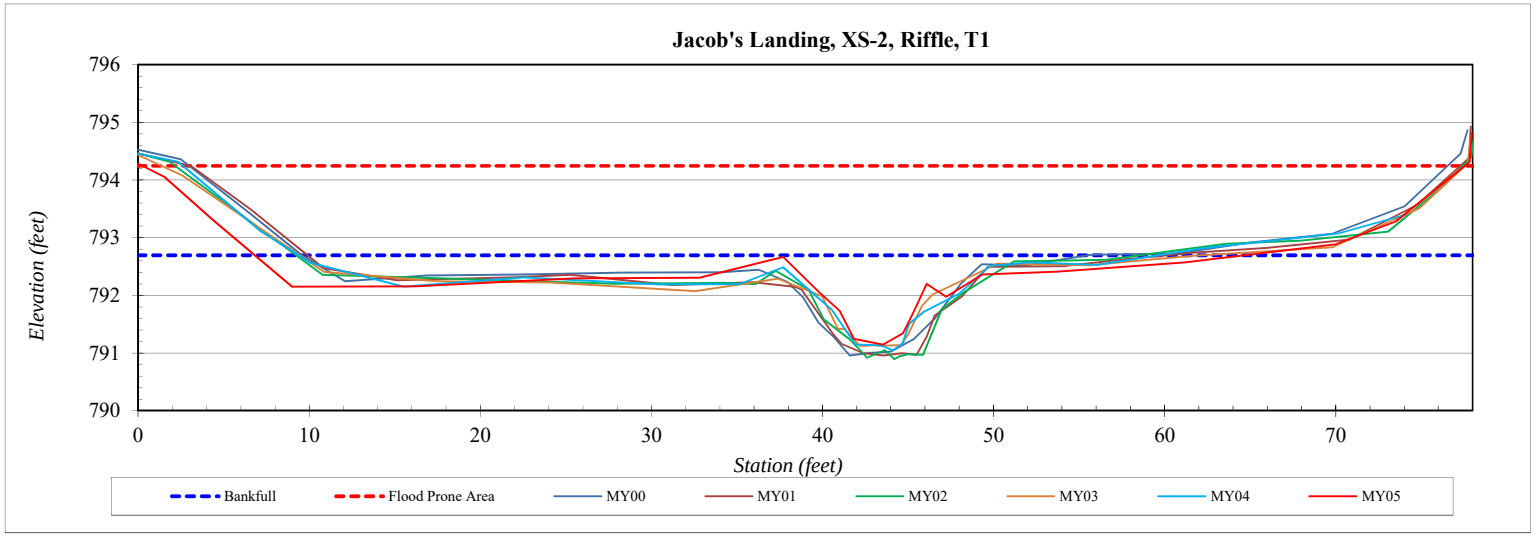


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-2
Drainage Area (sq mi):	0.21
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	794.29
1.56	794.05
4.38	793.31
9.01	792.15
16.19	792.15
25.51	792.29
32.80	792.30
37.70	792.67
39.79	792.06
40.99	791.73
41.85	791.24
43.53	791.14
44.70	791.34
45.27	791.67
46.09	792.20
47.23	791.98
49.31	792.36
53.75	792.41
61.22	792.57
69.94	792.88
73.50	793.28
77.82	794.31
77.95	794.81

SUMMARY DATA	
Current Bankfull Elevation:	792.7
Bankfull Cross-Sectional Area:	10.0
Total Cross-Sectional Area:	6.6
Bankfull Width:	11.6
Flood Prone Area Elevation:	794.2
Flood Prone Width:	77.3
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.9
W / D Ratio:	13.5
Entrenchment Ratio:	6.7
Bank Height Ratio:	0.8

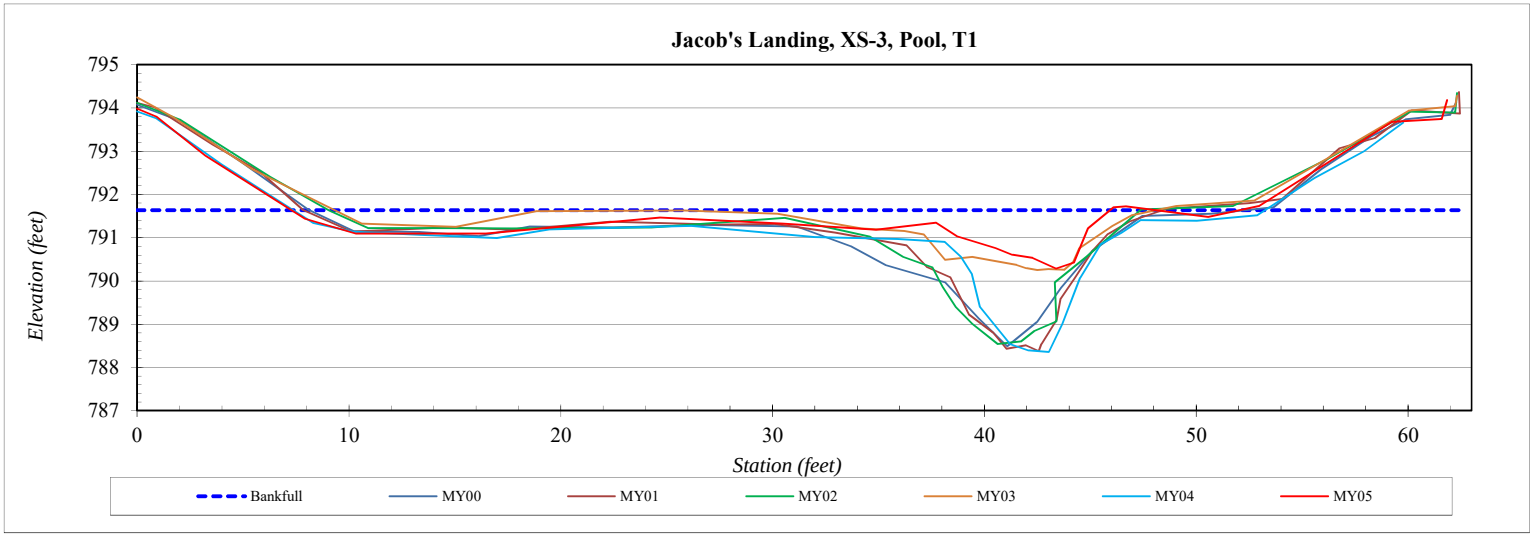


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-3
Drainage Area (sq mi):	0.36
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	793.99
0.92	793.80
3.22	792.90
7.92	791.44
10.36	791.09
16.46	791.09
24.68	791.46
30.50	791.33
34.89	791.18
37.73	791.34
38.70	791.03
40.53	790.76
41.32	790.60
42.29	790.53
43.38	790.28
44.23	790.43
44.90	791.22
46.08	791.70
46.68	791.72
50.57	791.48
52.94	791.73
55.72	792.59
59.22	793.67
61.59	793.74
61.84	794.18

SUMMARY DATA	
Current Bankfull Elevation:	791.63
Bankfull Cross-Sectional Area:	18.1
Total Cross-Sectional Area:	5.2
Bankfull Width:	38.6
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.5
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	---

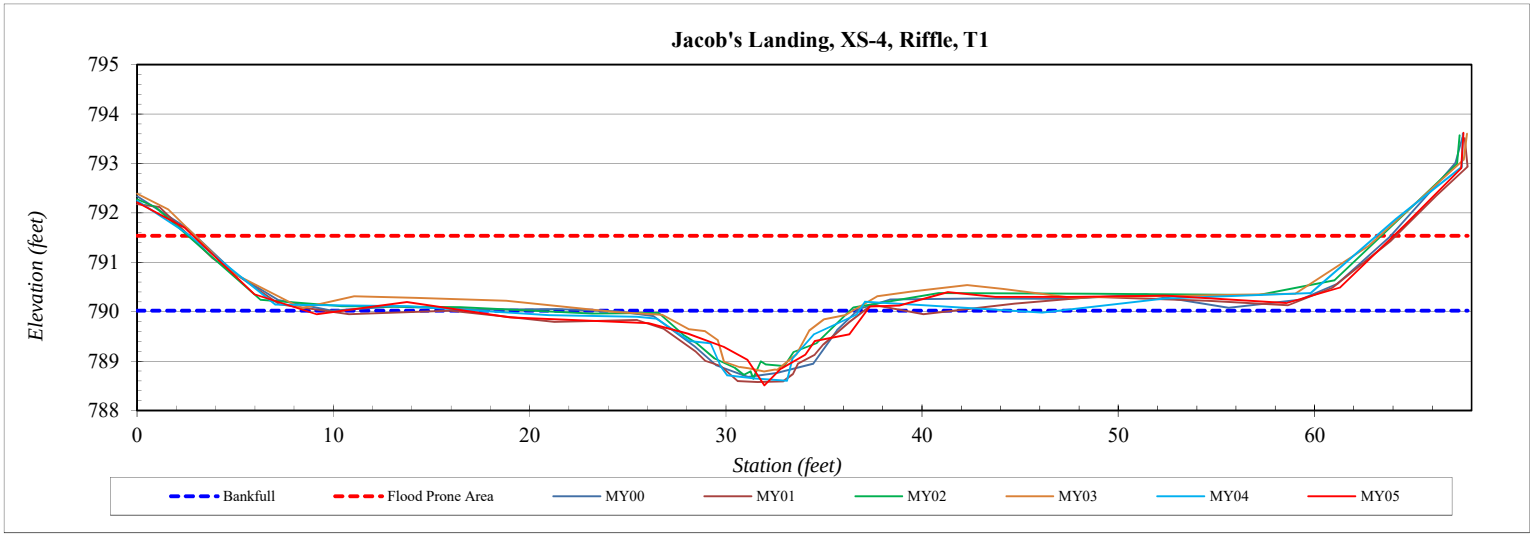


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-4
Drainage Area (sq mi):	0.36
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	792.21
2.42	791.70
5.97	790.36
9.17	789.95
13.75	790.20
18.99	789.88
26.06	789.77
28.08	789.56
29.87	789.30
31.10	789.03
31.96	788.51
32.81	788.85
34.04	789.14
34.52	789.41
36.28	789.54
37.33	790.10
38.85	790.12
41.32	790.40
43.74	790.30
47.65	790.30
52.43	790.32
58.56	790.18
61.31	790.49
64.59	791.75
67.47	792.90
67.59	793.62

SUMMARY DATA	
Current Bankfull Elevation:	790.0
Bankfull Cross-Sectional Area:	7.9
Total Cross-Sectional Area:	6.6
Bankfull Width:	11.1
Flood Prone Area Elevation:	791.5
Flood Prone Width:	61.2
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.7
W / D Ratio:	15.7
Entrenchment Ratio:	5.5
Bank Height Ratio:	0.8

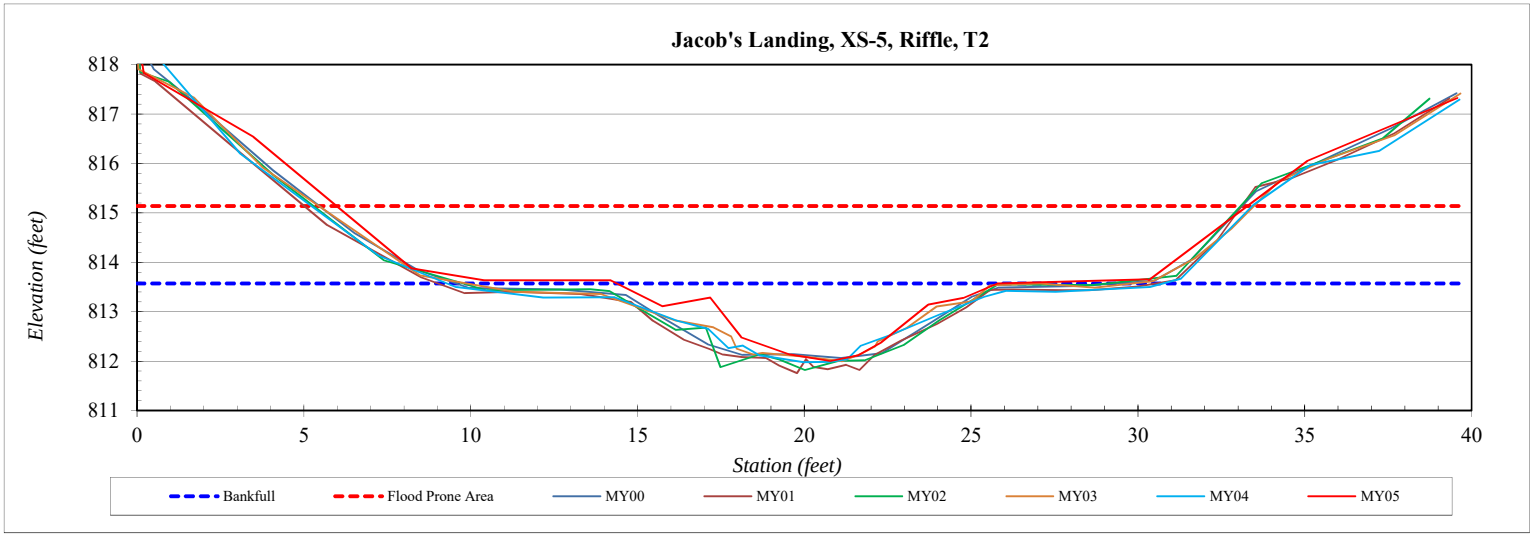


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-5
Drainage Area (sq mi):	0.36
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	818.69
0.20	817.83
3.49	816.55
8.24	813.88
10.40	813.64
14.19	813.64
15.75	813.11
17.18	813.28
18.11	812.48
19.58	812.13
20.77	812.00
21.59	812.11
22.30	812.38
23.71	813.14
24.76	813.28
25.79	813.57
30.29	813.65
30.33	813.64
35.09	816.06
39.57	817.33

SUMMARY DATA	
Current Bankfull Elevation:	813.6
Bankfull Cross-Sectional Area:	9.0
Total Cross-Sectional Area:	6.4
Bankfull Width:	11.4
Flood Prone Area Elevation:	815.1
Flood Prone Width:	27.3
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.8
W / D Ratio:	14.5
Entrenchment Ratio:	2.4
Bank Height Ratio:	1.0

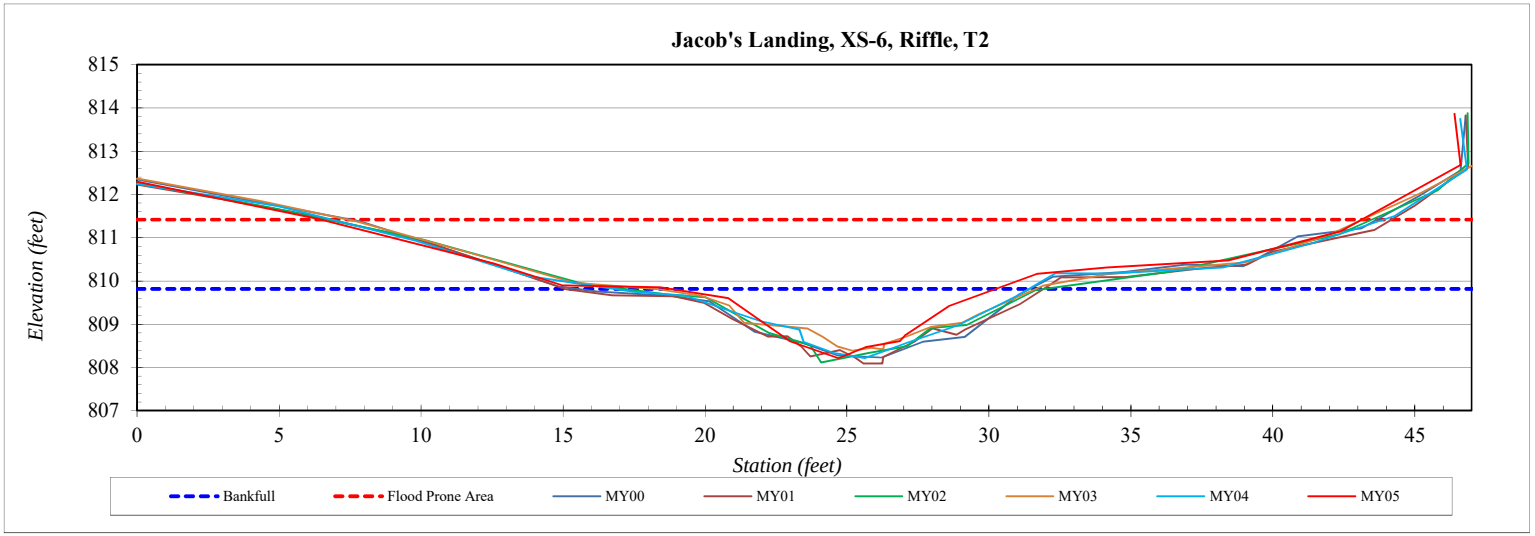


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-6
Drainage Area (sq mi):	0.67
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	812.29
6.41	811.43
12.58	810.40
15.00	809.90
18.44	809.85
20.83	809.60
22.99	808.61
24.70	808.21
25.65	808.47
26.87	808.61
27.07	808.75
28.59	809.42
31.68	810.16
34.15	810.31
38.43	810.47
42.36	811.14
46.62	812.68
46.39	813.87

SUMMARY DATA	
Current Bankfull Elevation:	809.8
Bankfull Cross-Sectional Area:	8.8
Total Cross-Sectional Area:	6.0
Bankfull Width:	11.5
Flood Prone Area Elevation:	811.4
Flood Prone Width:	36.7
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.8
W / D Ratio:	15.0
Entrenchment Ratio:	3.2
Bank Height Ratio:	0.9

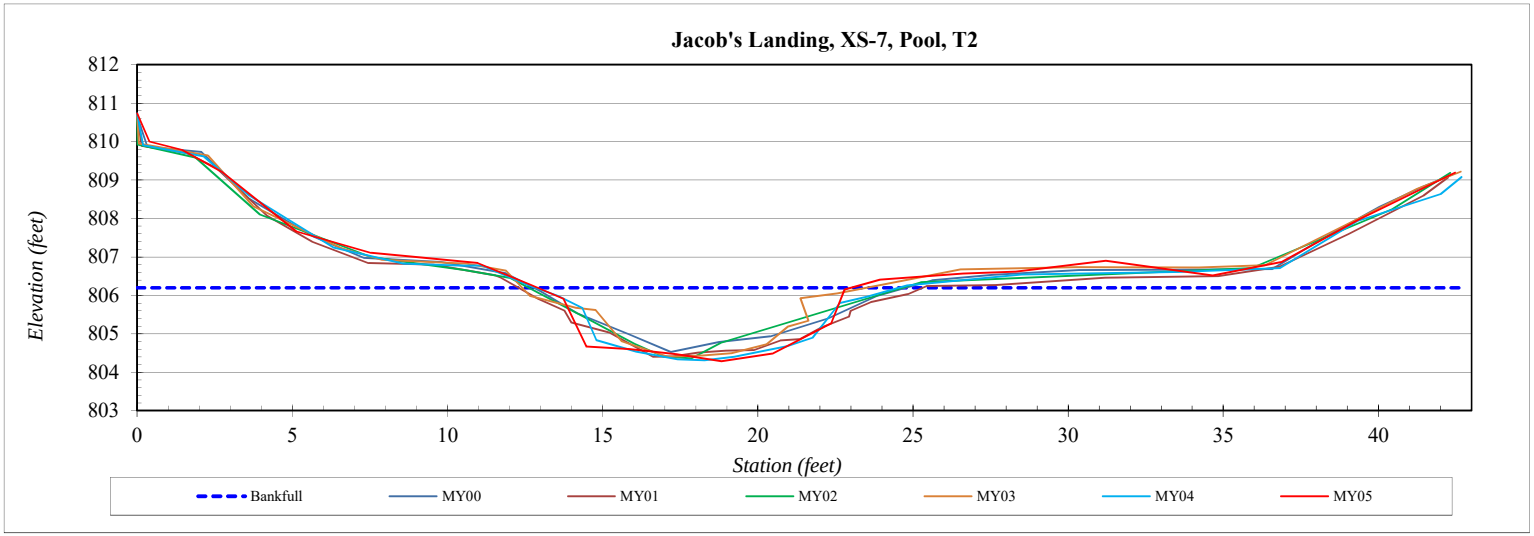


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-7
Drainage Area (sq mi):	0.67
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	810.73
0.40	810.00
1.45	809.78
2.74	809.21
5.14	807.66
7.54	807.11
8.85	807.00
10.98	806.84
12.70	806.27
13.73	805.91
14.48	804.67
15.87	804.60
17.37	804.46
18.83	804.29
20.47	804.48
22.36	805.27
22.80	806.14
23.95	806.41
26.61	806.56
28.32	806.62
31.22	806.89
34.66	806.52
36.86	806.87
39.38	807.98
42.47	809.19

SUMMARY DATA	
Current Bankfull Elevation:	806.2
Bankfull Cross-Sectional Area:	13.8
Total Cross-Sectional Area:	15.9
Bankfull Width:	10.1
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	1.4
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	---

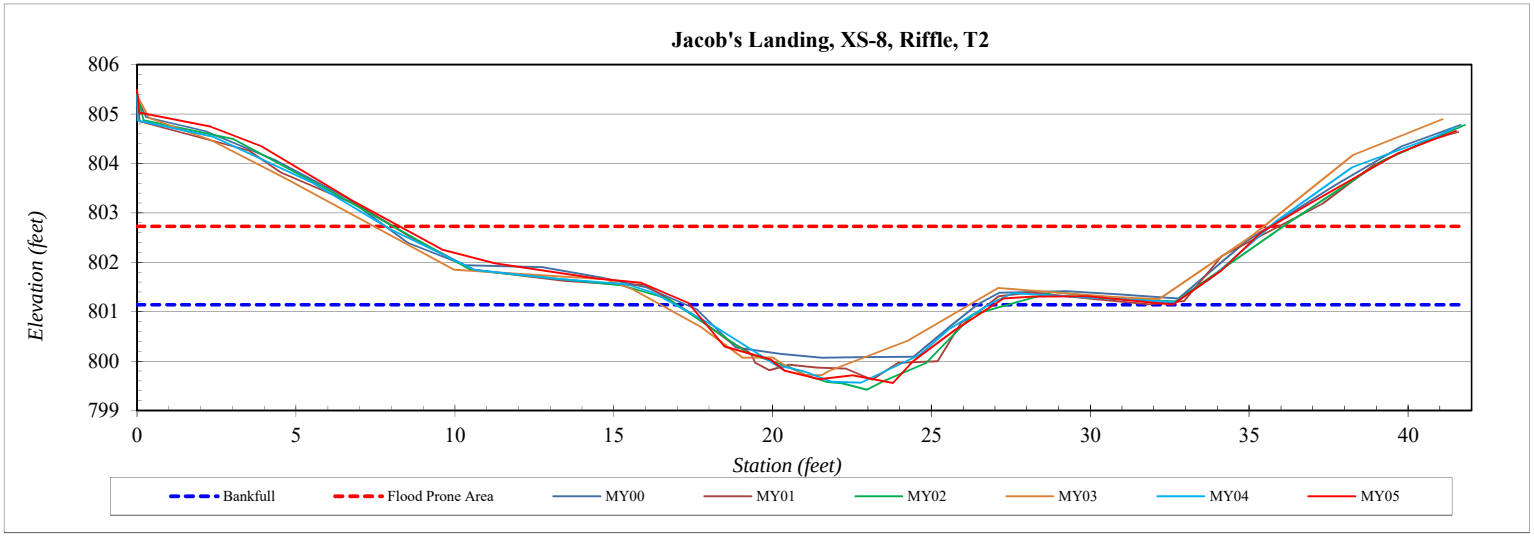


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-8
Drainage Area (sq mi):	0.70
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	805.49
0.07	805.03
2.33	804.74
3.90	804.36
6.80	803.24
9.63	802.25
11.26	801.98
14.43	801.67
15.88	801.58
17.35	801.18
18.49	800.30
19.95	800.03
20.39	799.80
21.47	799.63
22.52	799.71
23.79	799.56
24.45	800.01
25.72	800.62
27.25	801.27
28.19	801.31
29.92	801.31
32.59	801.14
34.14	801.85
35.40	802.62
36.95	803.21
39.67	804.21
41.50	804.66

SUMMARY DATA	
Current Bankfull Elevation:	801.1
Bankfull Cross-Sectional Area:	9.7
Total Cross-Sectional Area:	12.2
Bankfull Width:	9.6
Flood Prone Area Elevation:	802.7
Flood Prone Width:	27.4
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.0
W / D Ratio:	9.4
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.1

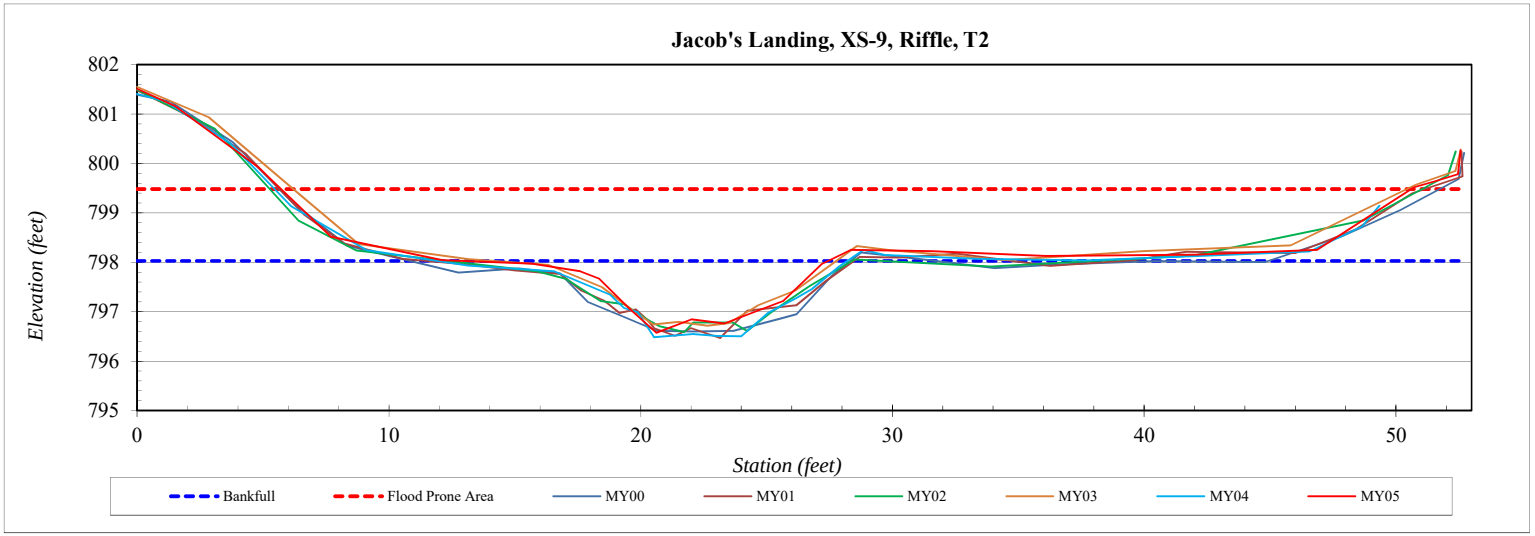


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-9
Drainage Area (sq mi):	0.70
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	801.51
1.50	801.16
4.79	799.93
7.71	798.51
12.11	798.04
15.68	797.97
17.61	797.82
18.34	797.68
19.55	797.07
20.63	796.58
22.01	796.84
23.31	796.76
24.77	797.05
25.68	797.22
27.21	797.97
28.34	798.25
31.56	798.23
36.10	798.13
42.03	798.15
46.85	798.25
50.70	799.52
51.59	799.65
52.46	799.79
52.56	800.27

SUMMARY DATA	
Current Bankfull Elevation:	798.0
Bankfull Cross-Sectional Area:	9.2
Total Cross-Sectional Area:	6.3
Bankfull Width:	14.6
Flood Prone Area Elevation:	799.5
Flood Prone Width:	44.9
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.6
W / D Ratio:	23.3
Entrenchment Ratio:	3.1
Bank Height Ratio:	0.9

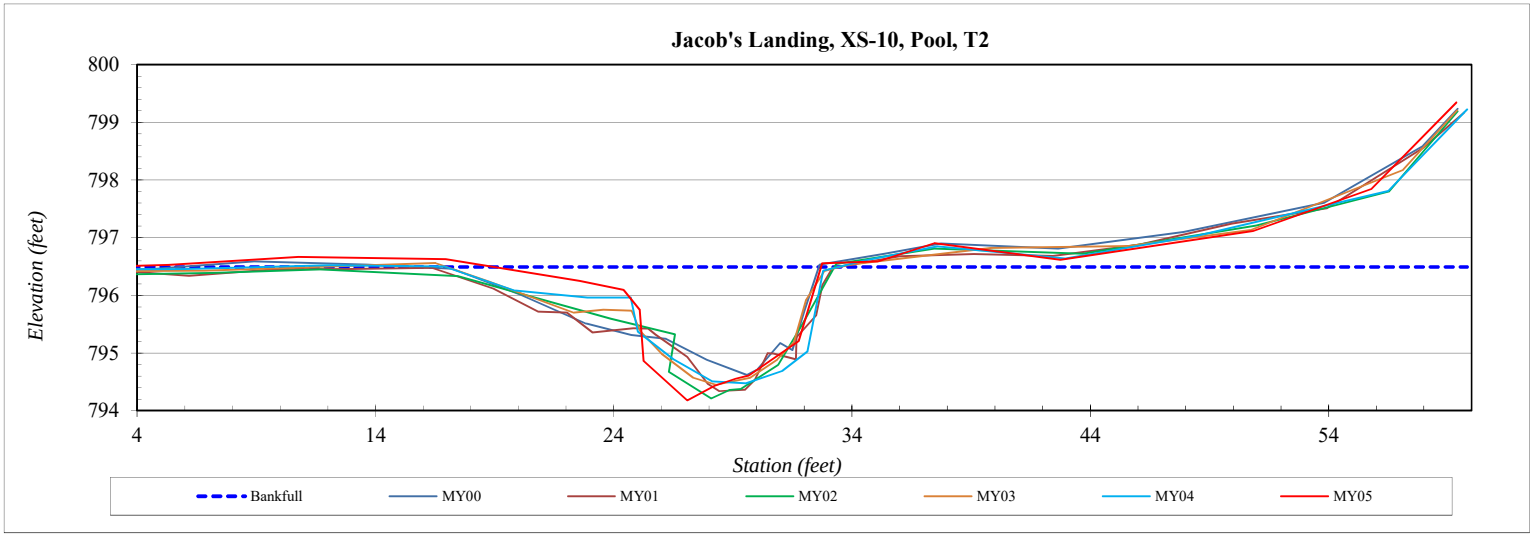


Cross-Section Plots

River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-10
Drainage Area (sq mi):	0.70
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	797.72
0.04	796.46
5.30	796.52
10.77	796.67
16.94	796.63
22.57	796.25
24.41	796.09
25.10	795.75
25.26	794.86
27.09	794.18
28.21	794.43
29.13	794.56
29.65	794.61
31.77	795.21
32.74	796.55
35.07	796.59
37.45	796.91
42.73	796.61
50.83	797.11
55.80	797.85
59.36	799.34

SUMMARY DATA	
Current Bankfull Elevation:	796.5
Bankfull Cross-Sectional Area:	14.5
Total Cross-Sectional Area:	13.9
Bankfull Width:	16.2
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	---

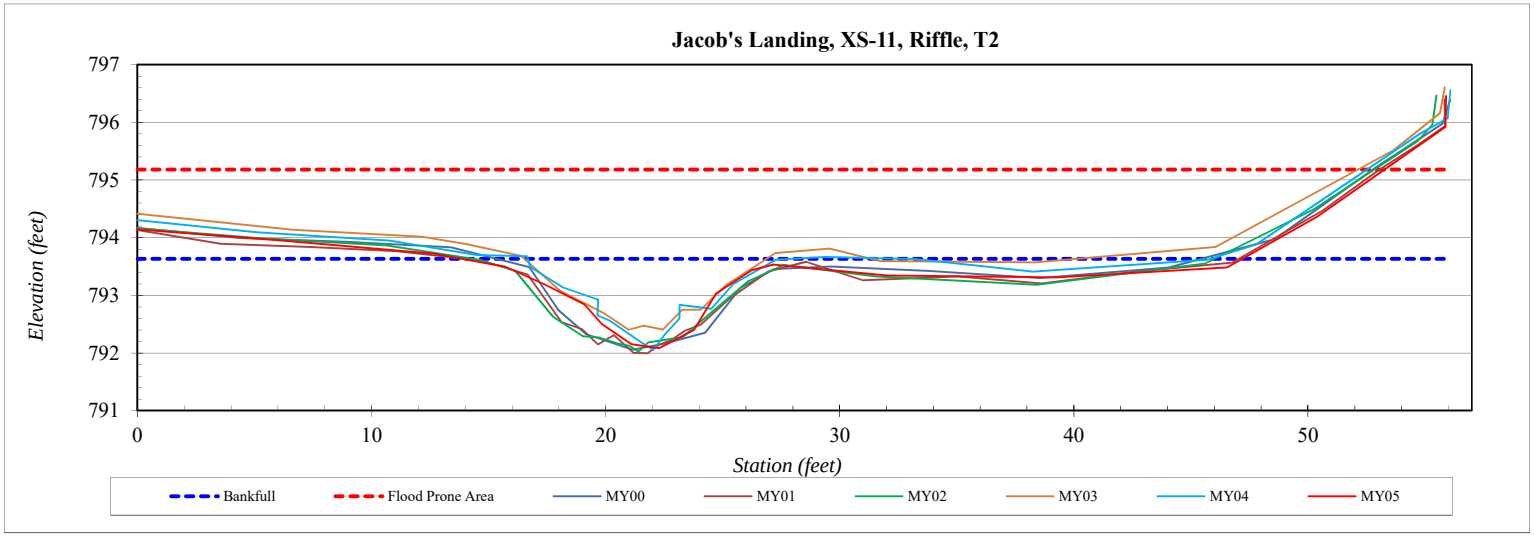


Cross-Section Plots

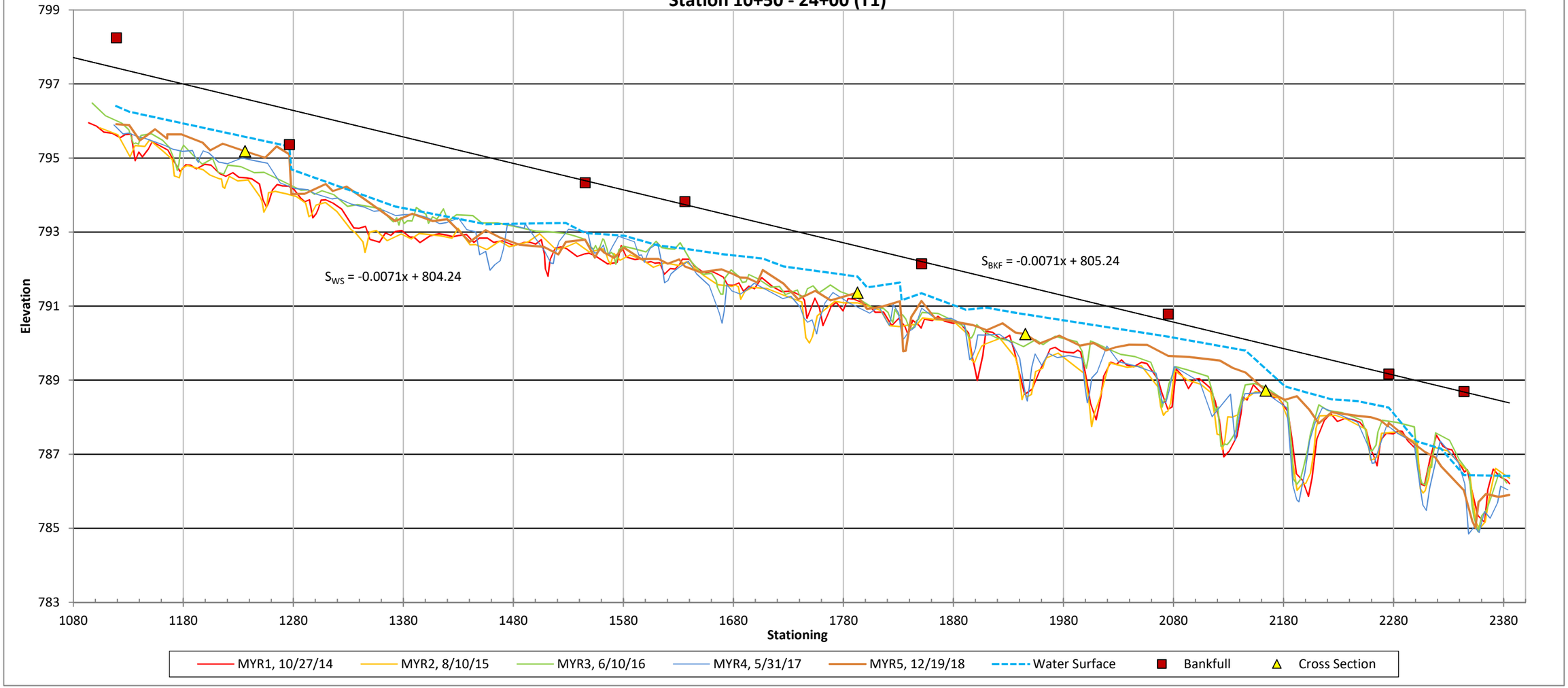
River Basin:	Yadkin-Pee Dee
Site:	Jacob's Landing
XS ID	XS-11
Drainage Area (sq mi):	0.70
Date:	12/19/2018
Field Crew:	T. Seelinger and B. Rose

Station	Elevation
0.00	794.14
6.04	793.95
12.68	793.72
15.74	793.49
17.36	793.20
19.09	792.84
19.83	792.50
21.12	792.15
22.28	792.08
23.77	792.40
24.72	793.03
26.22	793.43
27.17	793.53
32.02	793.34
39.25	793.31
46.52	793.48
50.41	794.37
55.88	795.93
55.90	796.46

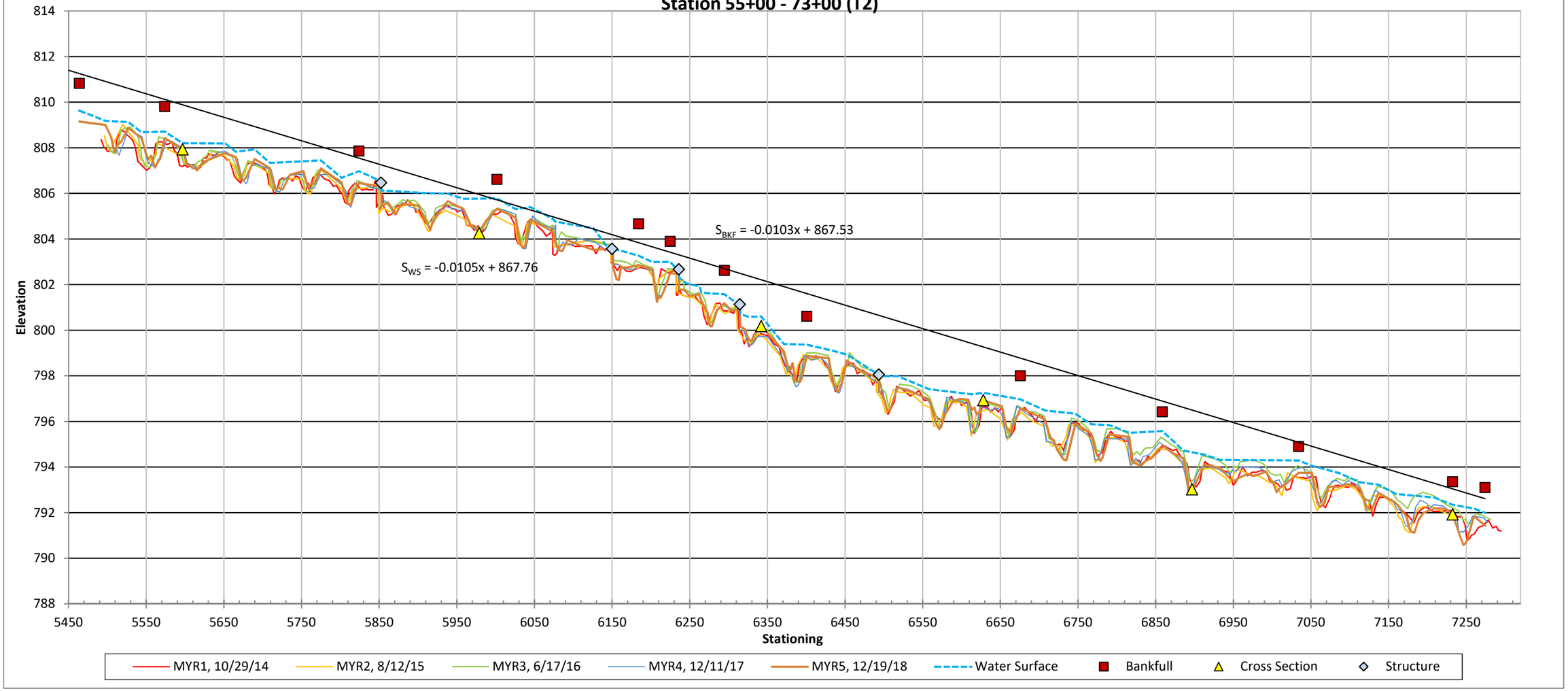
SUMMARY DATA	
Current Bankfull Elevation:	793.6
Bankfull Cross-Sectional Area:	9.5
Total Cross-Sectional Area:	7.6
Bankfull Width:	13.3
Flood Prone Area Elevation:	795.2
Flood Prone Width:	53.3
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.7
W / D Ratio:	18.7
Entrenchment Ratio:	4.0
Bank Height Ratio:	0.9



Longitudinal Profile
Jacob's Landing
DMS Project Number - 95024
Station 10+50 - 24+00 (T1)

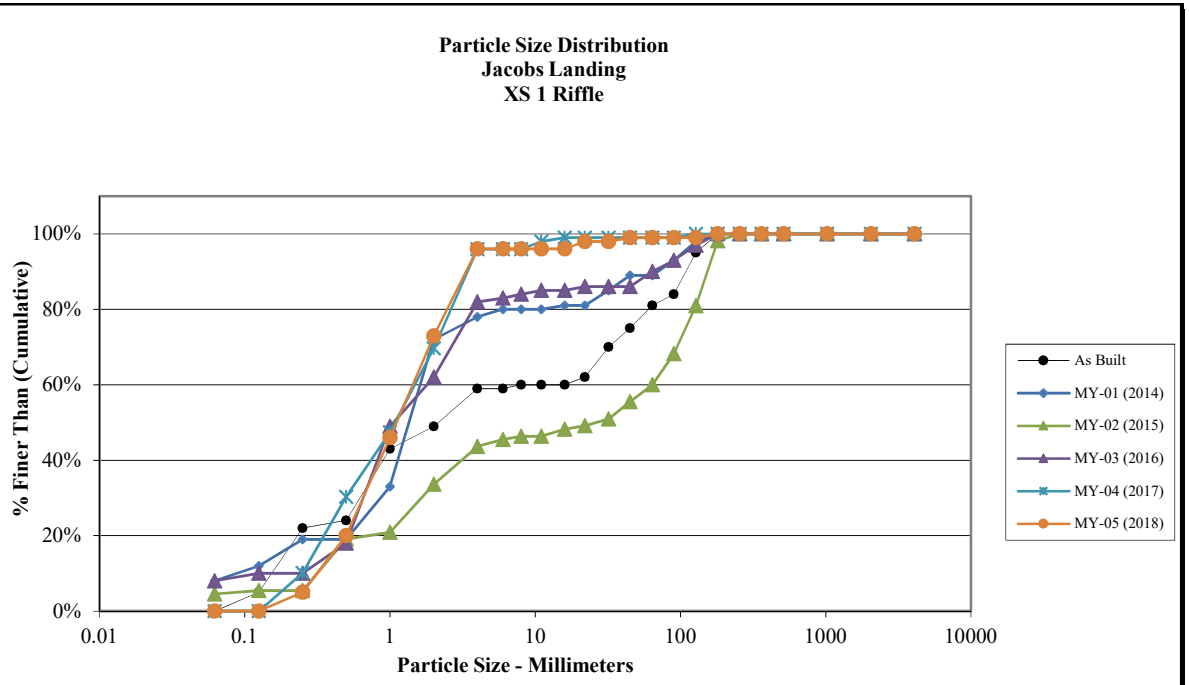


Longitudinal Profile
Jacob's Landing
DMS Project Number - 95024
Station 55+00 - 73+00 (T2)



Cross-Section 1 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	5
Medium	.25 - .50	N	15
Coarse	.50 - 1	D	26
Very Coarse	1 - 2	S	27
Very Fine	2 - 4		23
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	1
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



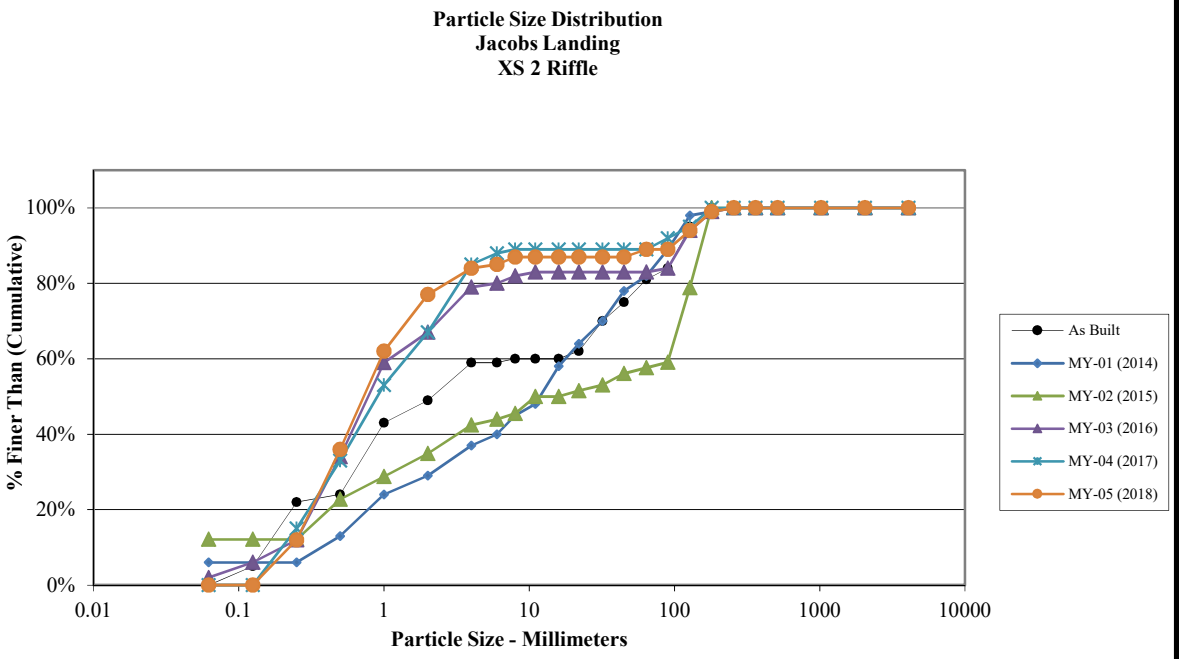
Size (mm)	
D16	0.42
D35	0.75
D50	1.1
D65	1.6
D84	2.8
D95	3.9

Size Distribution	
mean	0.9
dispersion	3.1
skewness	-0.07

Type	
silt/clay	0%
sand	73%
gravel	26%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 2 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	12
Medium	.25 - .50	N	24
Coarse	.50 - 1	D	26
Very Coarse	1 - 2	S	15
Very Fine	2 - 4		7
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		2
Small	64 - 90	C	
Small	90 - 128	O	5
Large	128 - 180	B	5
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



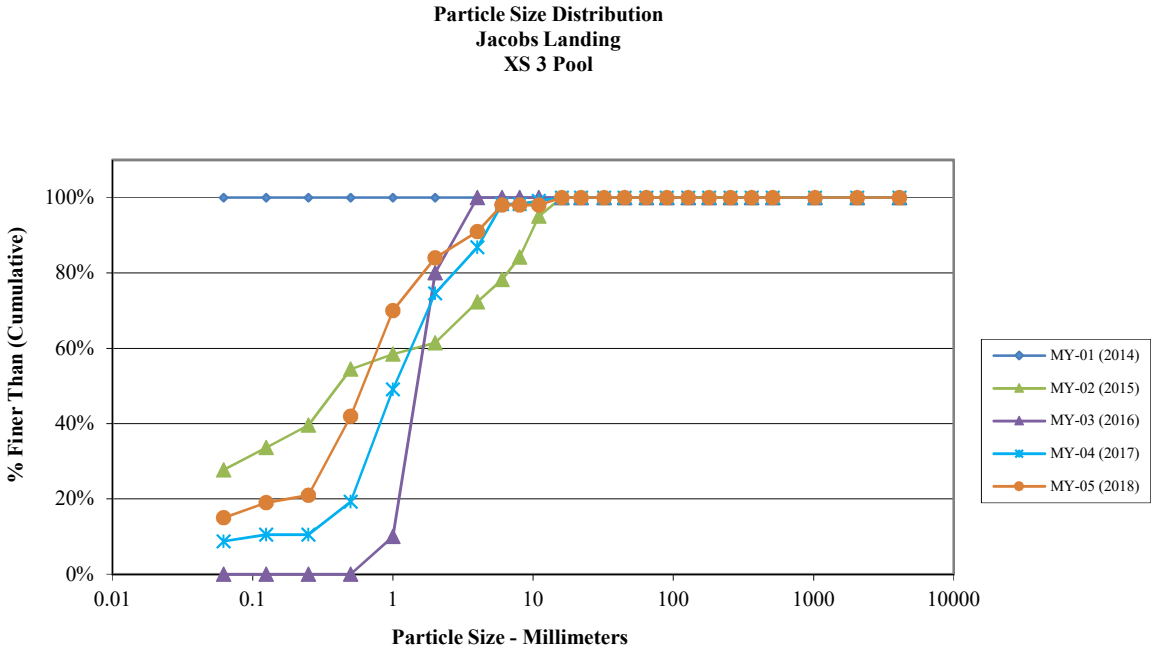
Size (mm)	
D16	0.28
D35	0.49
D50	0.73
D65	1.1
D84	4
D95	140

Size Distribution	
mean	1.1
dispersion	4.0
skewness	0.15

Type	
silt/clay	0%
sand	77%
gravel	12%
cobble	11%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3 Pool - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	15
Very Fine	.062 - .125	S	4
Fine	.125 - .25	A	2
Medium	.25 - .50	N	21
Coarse	.50 - 1	D	28
Very Coarse	1 - 2	S	14
Very Fine	2 - 4		7
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



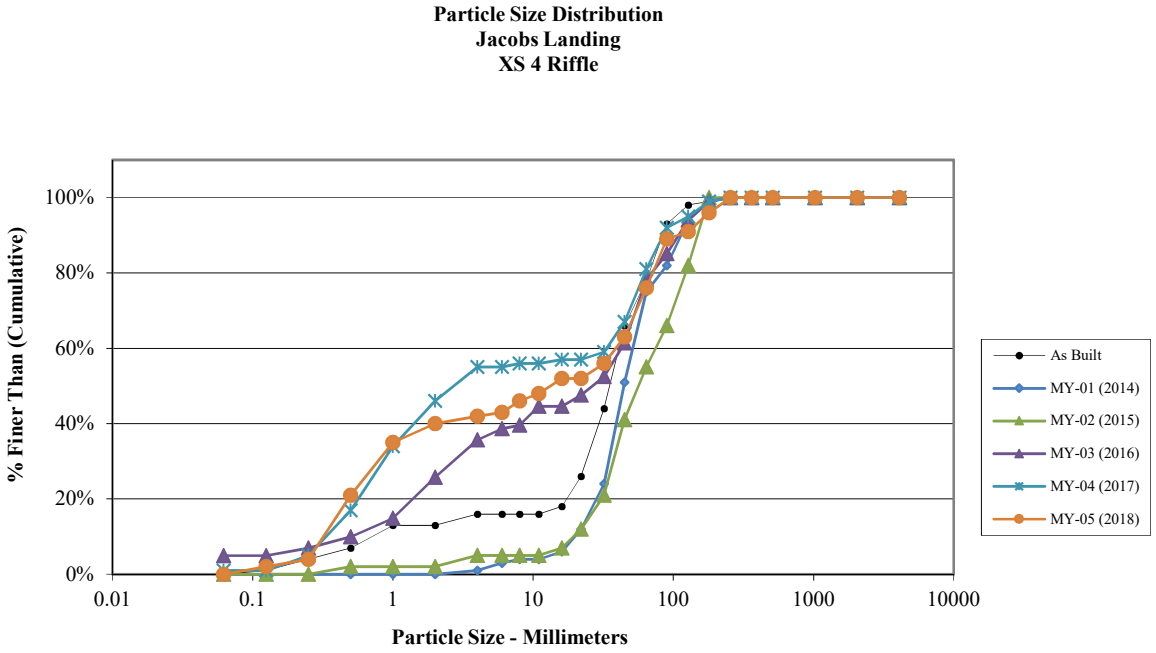
Size (mm)	
D16	0.074
D35	0.4
D50	0.61
D65	0.88
D84	2
D95	5

Size Distribution	
mean	0.4
dispersion	5.8
skewness	-0.17

Type	
silt/clay	15%
sand	69%
gravel	16%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 4 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	2
Fine	.125 - .25	A	2
Medium	.25 - .50	N	17
Coarse	.50 - 1	D	14
Very Coarse	1 - 2	S	5
Very Fine	2 - 4		2
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		13
Small	64 - 90	C	13
Small	90 - 128	O	2
Large	128 - 180	B	5
Large	180 - 256	L	4
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



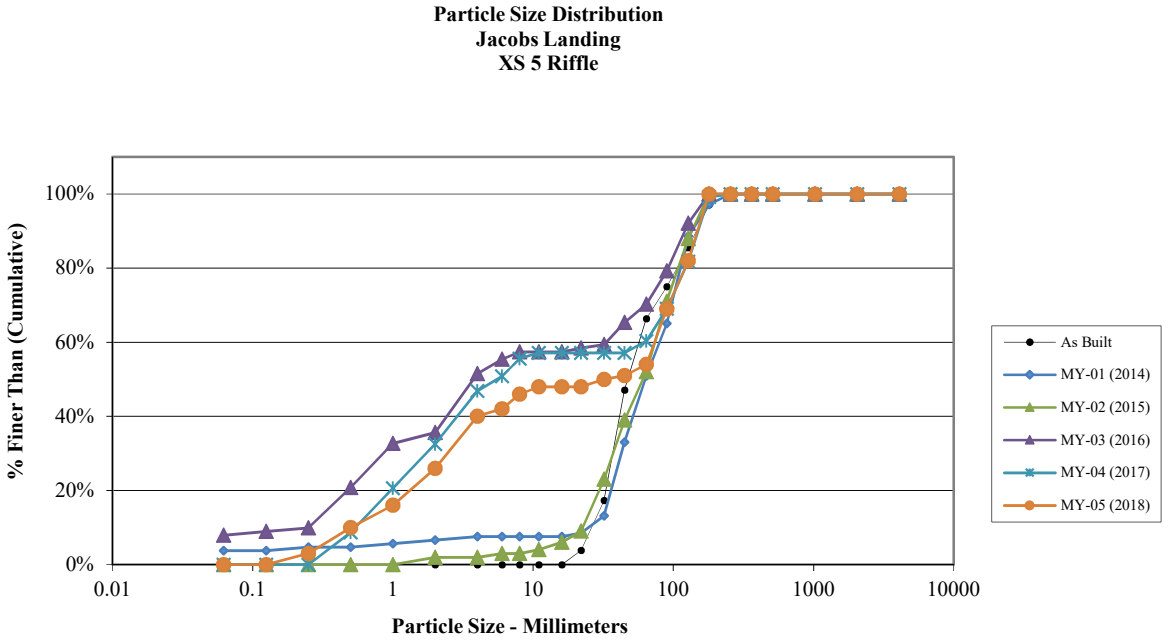
Size (mm)	
D16	0.41
D35	1
D50	13
D65	48
D84	79
D95	170

Size Distribution	
mean	5.7
dispersion	18.9
skewness	-0.24

Type	
silt/clay	0%
sand	40%
gravel	36%
cobble	24%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 5 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	3
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	6
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		14
Fine	4 - 5.7	G	2
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		3
Small	64 - 90	C	15
Small	90 - 128	O	13
Large	128 - 180	B	18
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



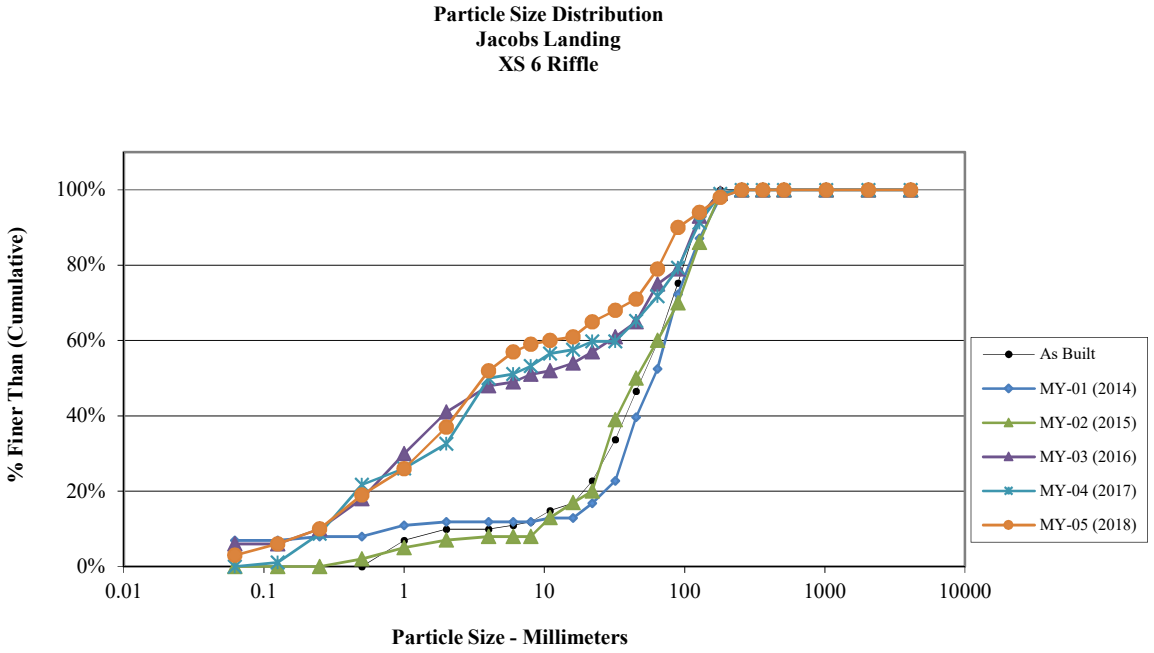
Size (mm)	
D16	1
D35	3.1
D50	32
D65	82
D84	130
D95	160

Size Distribution	
mean	11.4
dispersion	18.0
skewness	-0.31

Type	
silt/clay	0%
sand	26%
gravel	28%
cobble	46%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 6 Riffle -MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	3
Very Fine	.062 - .125	S	3
Fine	.125 - .25	A	4
Medium	.25 - .50	N	9
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	11
Very Fine	2 - 4		15
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		8
Small	64 - 90	C	11
Small	90 - 128	O	4
Large	128 - 180	B	4
Large	180 - 256	L	2
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



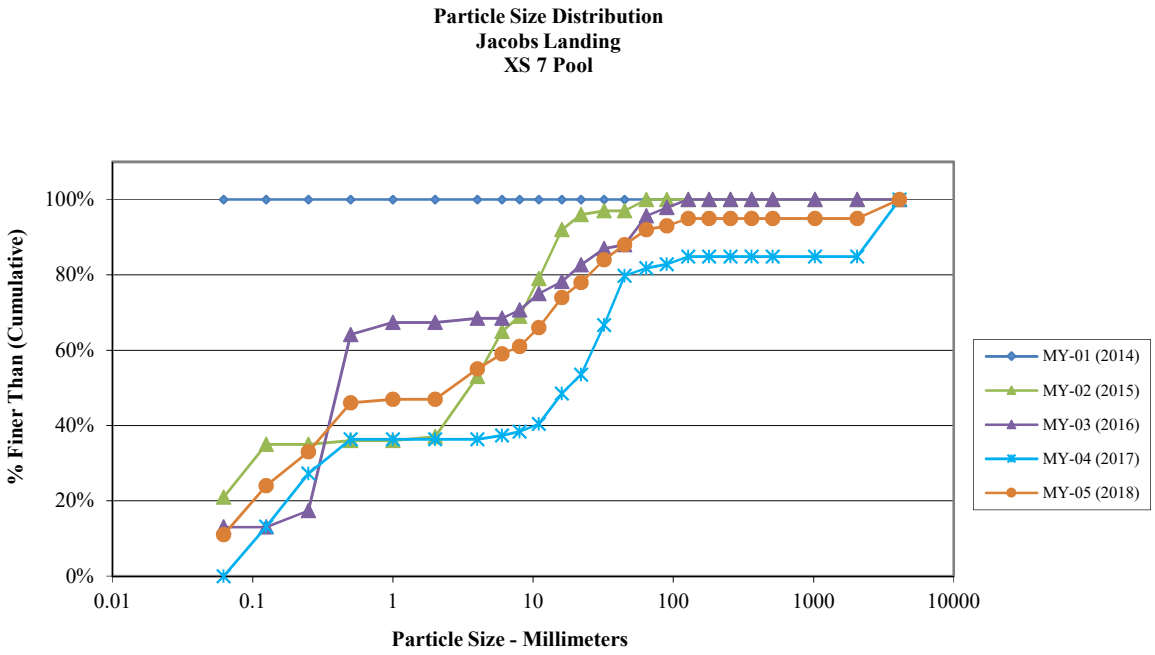
Size (mm)	
D16	0.4
D35	1.8
D50	3.6
D65	22
D84	75
D95	140

Size Distribution	
mean	5.5
dispersion	14.9
skewness	0.12

Type	
silt/clay	3%
sand	34%
gravel	42%
cobble	21%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 7 Pool -MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	11
Very Fine	.062 - .125	S	13
Fine	.125 - .25	A	9
Medium	.25 - .50	N	13
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	
Very Fine	2 - 4		8
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	8
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	4
Very Coarse	45 - 64		4
Small	64 - 90	C	1
Small	90 - 128	O	2
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	5
		Total	100

Note: Lots of saprolite, recorded as bedrock



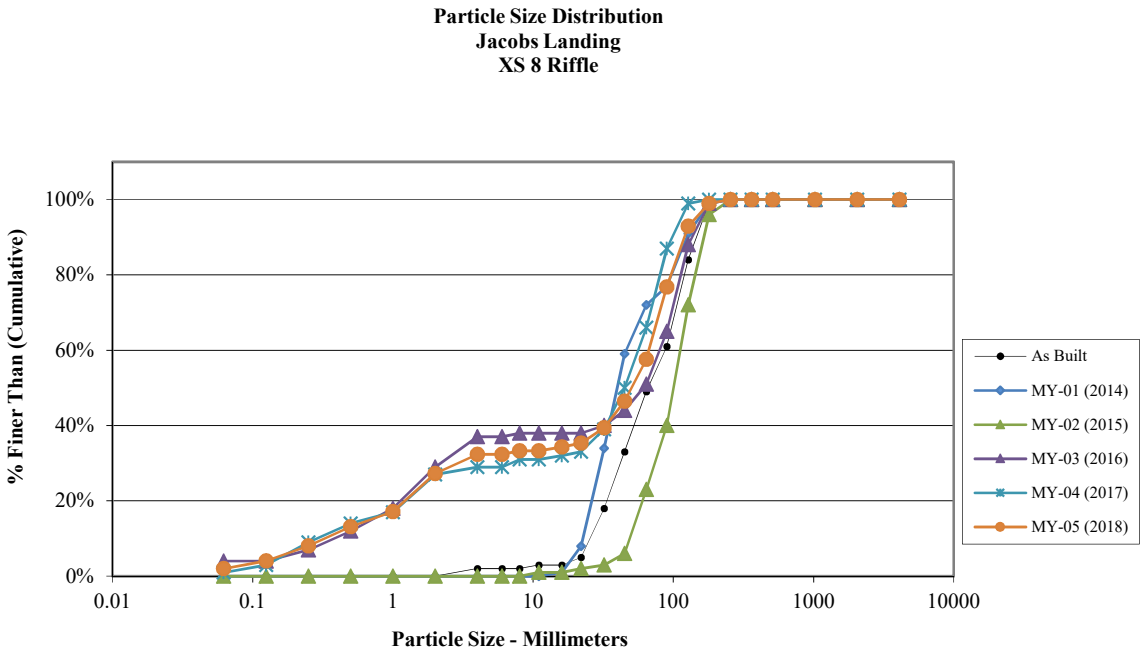
Size (mm)	
D16	0.081
D35	0.28
D50	2.6
D65	10
D84	32
D95	180

Size Distribution	
mean	1.6
dispersion	22.2
skewness	-0.13

Type	
silt/clay	11%
sand	36%
gravel	45%
cobble	3%
boulder	0%
bedrock	5%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 8 Riffle -MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	2
Very Fine	.062 - .125	S	2
Fine	.125 - .25	A	4
Medium	.25 - .50	N	5
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		5
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		11
Small	64 - 90	C	19
Small	90 - 128	O	16
Large	128 - 180	B	6
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	99

Note:



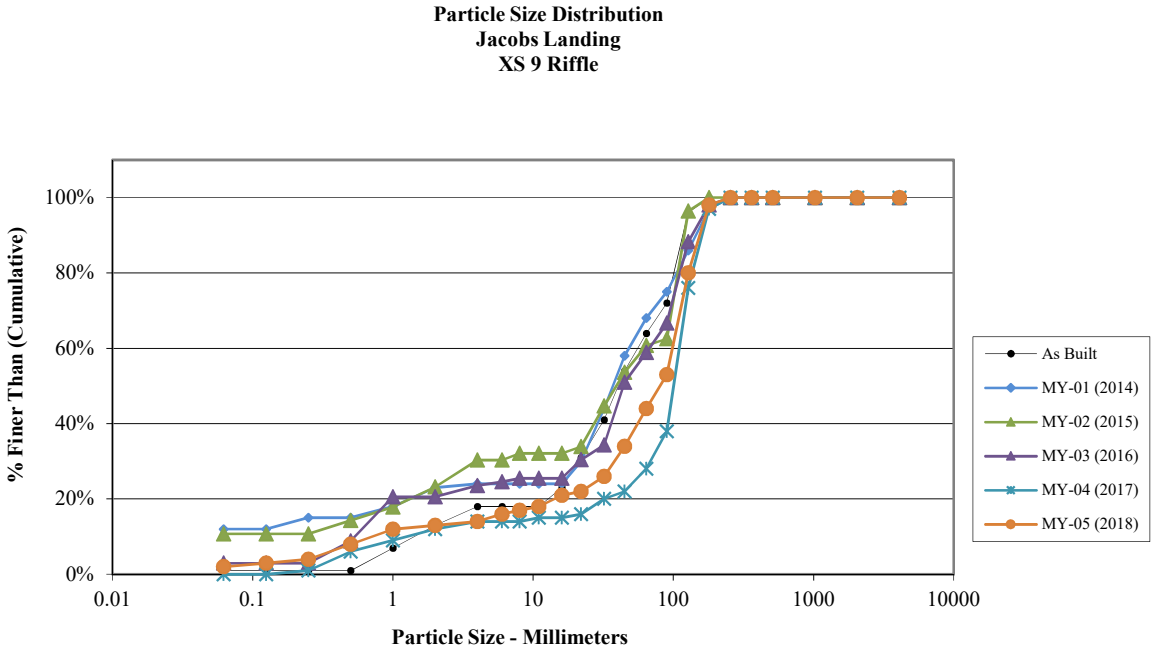
Size (mm)	
D16	0.82
D35	20
D50	50
D65	73
D84	110
D95	140

Size Distribution	
mean	9.5
dispersion	31.6
skewness	-0.49

Type	
silt/clay	2%
sand	25%
gravel	30%
cobble	42%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 9 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	2
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	1
Medium	.25 - .50	N	4
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	1
Very Fine	2 - 4		1
Fine	4 - 5.7	G	2
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	4
Very Coarse	32 - 45	S	8
Very Coarse	45 - 64		10
Small	64 - 90	C	9
Small	90 - 128	O	27
Large	128 - 180	B	18
Large	180 - 256	L	2
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



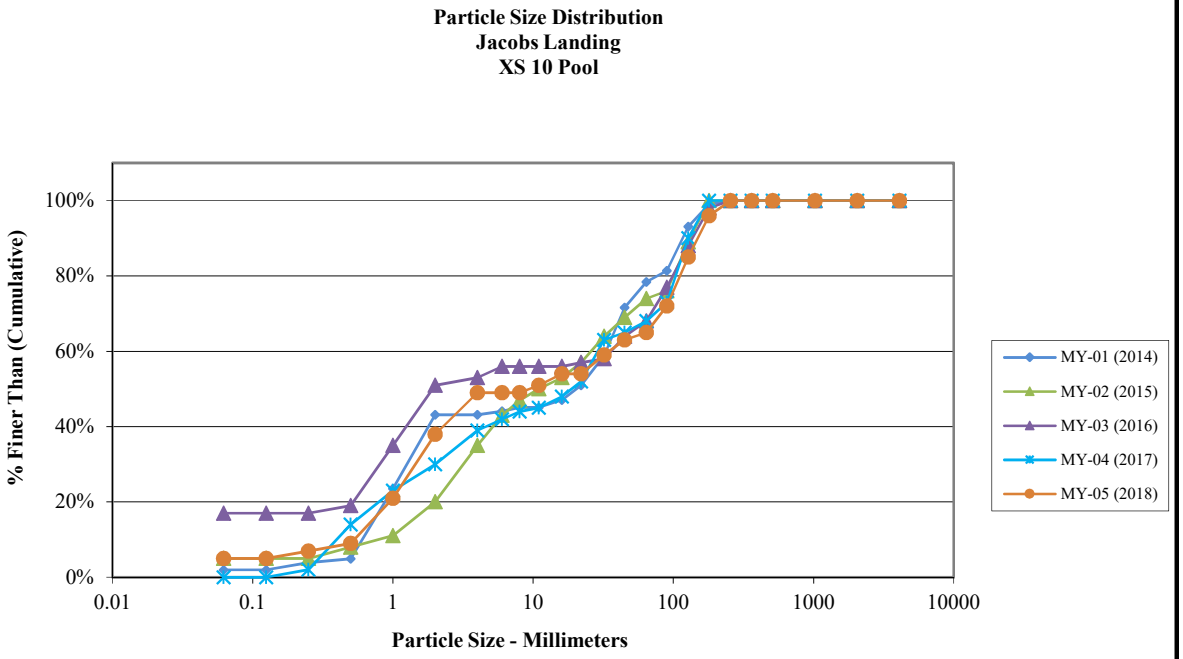
Size (mm)	
D16	6
D35	47
D50	80
D65	110
D84	140
D95	170

Size Distribution	
mean	29.0
dispersion	7.5
skewness	-0.38

Type	
silt/clay	2%
sand	11%
gravel	31%
cobble	56%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 10 Pool - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	5
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	2
Medium	.25 - .50	N	2
Coarse	.50 - 1	D	12
Very Coarse	1 - 2	S	17
Very Fine	2 - 4		11
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	5
Very Coarse	32 - 45	S	4
Very Coarse	45 - 64		2
Small	64 - 90	C	7
Small	90 - 128	O	13
Large	128 - 180	B	11
Large	180 - 256	L	4
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



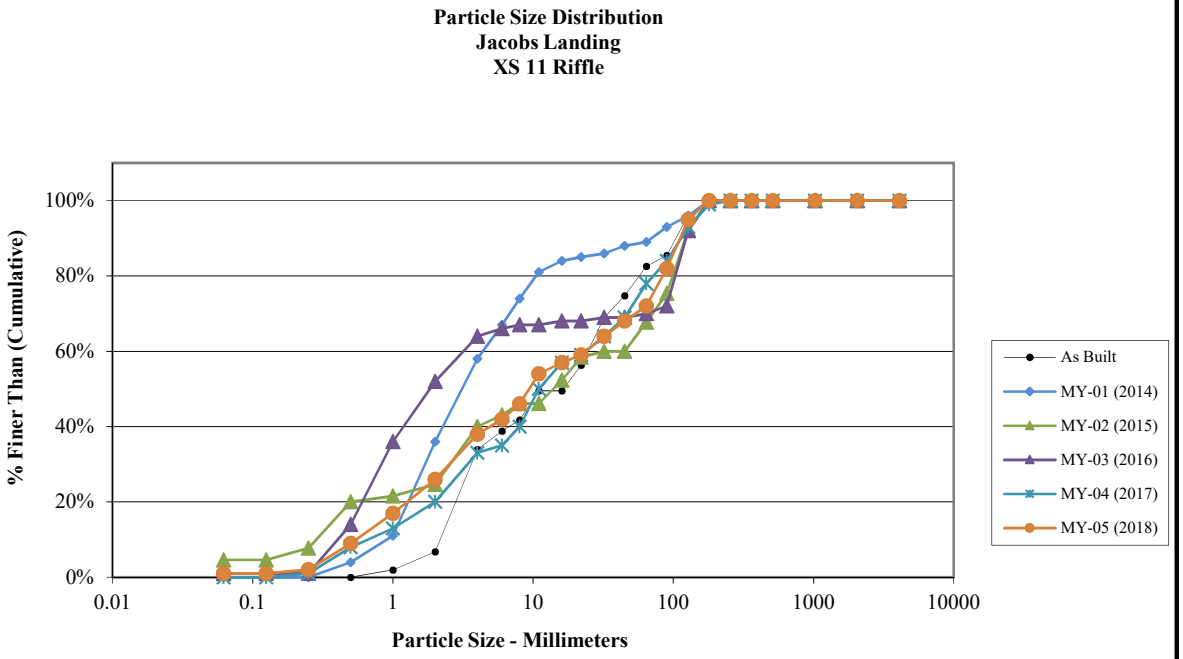
Size (mm)	
D16	0.75
D35	1.8
D50	9.4
D65	64
D84	120
D95	170

Size Distribution	
mean	9.5
dispersion	12.6
skewness	0.00

Type	
silt/clay	5%
sand	33%
gravel	27%
cobble	35%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 11 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	1
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	8
Very Coarse	1 - 2	S	9
Very Fine	2 - 4		12
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	8
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	5
Very Coarse	32 - 45	S	4
Very Coarse	45 - 64		4
Small	64 - 90	C	10
Small	90 - 128	O	13
Large	128 - 180	B	5
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



Size (mm)	
D16	0.92
D35	3.4
D50	9.4
D65	35
D84	95
D95	130

Size Distribution	
mean	9.3
dispersion	10.2
skewness	0.00

Type	
silt/clay	1%
sand	25%
gravel	46%
cobble	28%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Table 10a. T1 Baseline Stream Data Summary
Jacob's Landing Stream Restoration Site, DMS Project # 95024

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	6.5			9.1	4	6.9				1	11.5	12.2	10.1	11.0	12.1	3
Floodprone Width (ft)	1			26	4	23				1	25	70	40	56	71	3
Bankfull Mean Depth (ft)	0.9			1.8	4	1.1				1	1.0	1.0	0.8	0.8	0.8	3
Bankfull Max Depth (ft)	1.1			2.8	4	1.6				1	1.5	1.6	1.2	1.3	1.4	3
Bankfull Cross-Sectional Area (ft^2)	8.6			12.1	4	7.4				1	11.2	12.6	7.9	8.8	10.0	3
Width/Depth Ratio	3.7			9.6	4	6.4				1	12.0	12.0	12.9	13.8	14.6	3
Entrenchment Ratio	1.5			3.3	4	3.4				1	2.2	4.9	3.7	5.1	5.9	3
Bank Height Ratio	1.6			2.2	4	1.0				1	1.0	1.0	1.0	1.0	1.0	3
Pattern																
Channel Beltwidth (ft)	13			26	2	14	26		38	2	25	50	25	38	50	
Radius of Curvature (ft)	6			30	2	12	19		25	2	20	45	20	33	45	
Rc:Bankfull width (ft/ft)	0.7			4.6	2	1.7	2.7		3.6	2	2.0	4.0	2.0	3.0	4.0	
Meander Wavelength (ft)	75			110	2	43	73		102	2	65	125	65	95	125	
Meander Width Ratio	1.4			4.0	2	2	3.8		5.5	2	1.9	3.5	1.9	3.0	3.5	
Profile																
Riffle Length (ft)													11	22	32	21
Riffle Slope (ft/ft)	0.007			0.043	2	0.011			0.025	2	0.007	0.012	0.001	0.013	0.026	21
Pool Length (ft)						16			23		12	30	6	18	38	23
Pool Spacing (ft)						28			57		20	75	30	56	79	23
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	0% / 24% / 76% / 0% / 0% / 0%												0% / 25% / 52% / 23% / 0% / 0%			
d16 / d35 / d50 / d84 / d95 (mm)	1 / 5 / 7 / 10 / 17 / 25												5 / 15 / 22 / 38 / 94 / 143			
Additional Reach Parameters																
Channel length (ft)	1,330										1,305		1,305			
Drainage Area (SM)	0.40					0.16					0.40		0.40			
Rosgen Classification	G4					E4					C4		C4			
Sinuosity	1.07-1.15					1.18					1.09-1.12		1.09-1.12			
Water Surface Slope (ft/ft)	0.009-0.014					0.0070					0.007-0.010		0.007			

Table 10b. T1A Baseline Stream Data Summary																
Jacob's Landing Stream Restoration Site, DMS Project # 95024																
Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	7.7				1	6.9				1	8.5					
Floodprone Width (ft)	15				1	23				1	19					
Bankfull Mean Depth (ft)	0.8				1	1.1				1	0.7					
Bankfull Max Depth (ft)	1.2				1	1.6				1	1.2					
Bankfull Cross-Sectional Area (ft^2)	6.4				1	7.4				1	6.2					
Width/Depth Ratio	9.3				1	6.4				1	12.0					
Entrenchment Ratio	1.9				1	3.4				1	2.2					
Bank Height Ratio	2.2				1	1.0				1	1.0					
Pattern																
Channel Beltwidth (ft)	20			75	1	14	26		38	2	19	24				
Radius of Curvature (ft)	8			24	1	12	19		25	2	10	25				
Rc:Bankfull width (ft/ft)	1			3.1	1	1.7	2.7		3.6	2	1.2	2.9				
Meander Wavelength (ft)	25			50	1	43	73		102	2	50	55				
Meander Width Ratio	2.6			9.7	1	2	3.8		5.5	2	2.2	2.8				
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)	0.013			0.019	1	0.011			0.025	2	0.010	0.012				
Pool Length (ft)						16			23		7	14				
Pool Spacing (ft)						28			57		22	34				
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%																
d16 / d35 / d50 / d84 / d95 (mm)																
Additional Reach Parameters																
Channel length (ft)	294										178		178			
Drainage Area (SM)	0.21					0.40					0.21		0.21			
Rosgen Classification	E4					B4c					B4c/C4		B4c/C4			
Sinuosity	2.10					1.20					1.11					
Water Surface Slope (ft/ft)	0.023					0.013					0.017					

Table 10c. T2 Baseline Stream Summary																
Jacob's Landing Stream Restoration Site, DMS Project # 95024																
Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	8.8			12.3	4	6.9				1	10.4	11.6	10.4	10.9	12.0	5
Floodprone Width (ft)	17			20	4	23				1	23	50	27	32	42	5
Bankfull Mean Depth (ft)	1.0			1.0	4	1.1				1	0.9	1.0	0.8	0.8	0.9	5
Bankfull Max Depth (ft)	1.3			1.8	4	1.6				1	1.4	1.5	1.2	1.3	1.4	5
Bankfull Cross-Sectional Area (ft^2)	9.2			11.7	4	7.4				1	9.1	11.1	8.8	9.2	9.7	5
Width/Depth Ratio	8.4			12.9	4	6.4				1	12.0	12.0	11.8	12.9	15.2	5
Entrenchment Ratio	1.4			2.3	4	3.4				1	2.2	4.3	2.6	3.2	4.2	5
Bank Height Ratio	1.5			4.7	4	1.0				1	1.0	1.0	1.0	1.0	1.0	5
Pattern																
Channel Beltwidth (ft)	10			60	2	14	26		38	2	25	50	25	38	50	
Radius of Curvature (ft)	8			35	2	12	19		25	2	20	45	20	33	45	
Rc:Bankfull width (ft/ft)	0.9			3.9	2	1.7	2.7		3.6	2	2.0	4.0	2.0	3.0	4.0	
Meander Wavelength (ft)	65			130	2	43	73		102	2	60	130	60	95	130	
Meander Width Ratio	1.1			6.8	2	2	3.8		5.5	2	2.2	4.8	2.2	4.0	4.8	
Profile																
Riffle Length (ft)													14	22	36	33
Riffle Slope (ft/ft)	0.003			0.011	2	0.011			0.025	2	0.006	0.017	0.004	0.016	0.041	33
Pool Length (ft)						16			23	2	8	35	7	18	35	31
Pool Spacing (ft)						28			57	2	30	95	42	59	107	31
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	6% / 25% / 68% / 1% / 0% / 0%												0% / 6% / 58% / 32% / 3% / 0%			
d16 / d35 / d50 / d84 / d95 (mm)	1 / 2 / 3 / 6 / 12 / 24												16 / 30 / 44 / 65 / 109 / 144			
Additional Reach Parameters																
Channel length (ft)	2,935										2,641		2,641			
Drainage Area (SM)	0.31					0.16					0.31		0.31			
Rosgen Classification	E4, F4					E4					C4		C4			
Sinuosity	1.09-1.45					1.18					1.16-1.31		1.16-1.31			
Water Surface Slope (ft/ft)	0.007-0.010					0.0007					0.009-0.0100		0.009			

Table 10d. T2A Baseline Stream Data Summary																
Jacob's Landing Stream Restoration Site, DMS Project # 95024																
Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	6.6				1	6.9				1	6.5					
Floodprone Width (ft)	11				1	23				1	14					
Bankfull Mean Depth (ft)	0.5				1	1.1				1	0.5					
Bankfull Max Depth (ft)	1.1				1	1.6				1	0.9					
Bankfull Cross-Sectional Area (ft^2)	3.4				1	7.4				1	3.5					
Width/Depth Ratio	12.8				1	6.4				1	12.0					
Entrenchment Ratio	1.7				1	3.4				1	2.2					
Bank Height Ratio	6.3				1	1.0				1	1.0					
Pattern																
Channel Beltwidth (ft)	8			15	1	14	26		38	2	8	15				
Radius of Curvature (ft)	10			12	1	12	19		25	2	10	25				
Rc:Bankfull width (ft/ft)	1.5			1.8	1	1.7	2.7		3.6	2	1.5	3.8				
Meander Wavelength (ft)	50			63	1	43	73		102	2	50	63				
Meander Width Ratio	1.2			2.3	1	2	3.8		5.5	2	1.2	2.3				
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)	0.010			0.017	1	0.011			0.025	2	0.010	0.012				
Pool Length (ft)						16			23	2	4	15				
Pool Spacing (ft)						28			57	2	22	42				
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%																
d16 / d35 / d50 / d84 / d95 (mm)																
Additional Reach Parameters																
Channel length (ft)	465										465		465			
Drainage Area (SM)	0.06					0.40					0.06		0.06			
Rosgen Classification	G4					B4c					B4c/C4		B4c/C4			
Sinuosity	1.16					1.20					1.13					
Water Surface Slope (ft/ft)	0.019					0.013					0.014					

Table 11. Cross-Section Morphology Data Tables
Jacob's Landing Stream Restoration Site, DMS Project # 95024

Dimension and Substrate	Cross-Section 1 (T1-Riffle) Station 12+29							Cross-Section 2 (T1-Riffle) Station 17+79							Cross-Section 3 (T1-Pool) Station 19+25							Cross-Section 4 (T1-Riffle) Station 21+36							Cross-Section 5 (T2-Riffle) Station 52+53						
Baseline Bankfull Elevation	795.8							792.4							791.3							789.9							813.3						
	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+
Bankfull Width (ft)	10.8	10.6	10.1	12.8	11.6	12.2		12.1	13.3	12.4	12.8	12.1	11.6		15.5	13.7	14.8	30.2	21.0	38.6		10.1	11.0	9.9	10.4	10.3	11.1		10.4	10.3	10.4	11.4	11.5	11.4	
Floodprone Width (ft)	40.0	40.9	40.9	41.8	41.3	44.4		71.0	69.7	72.1	74.0	70.7	77.3		-	-	-	-	-	-		58.0	59.1	59.7	60.7	59.6	61.2		27.0	26.5	26.2	26.8	26.9	27.3	
Bankfull Mean Depth (ft)	0.8	0.8	0.8	0.7	0.7	0.7		0.8	0.8	0.8	0.8	0.8	0.9		1.2	1.3	1.2	0.6	0.9	0.5		0.8	0.7	0.8	0.8	0.8	0.7		0.9	0.9	0.9	0.8	0.8	0.8	
Bankfull Max Depth (ft)	1.3	1.4	1.4	1.4	1.3	1.4		1.4	1.4	1.5	1.5	1.5	1.6		2.8	3.0	2.8	1.6	3.0	1.4		1.2	1.3	1.4	1.4	1.4	1.5		1.3	1.4	1.4	1.4	1.4	1.6	
Bankfull Cross-Sectional Area (ft^2)	8.5	8.5	8.5	8.5	8.5	8.5		10.0	10.0	10.0	10.0	10.0	10.0		18.1	18.1	18.1	18.1	18.1	18.1		7.9	7.9	7.9	7.9	7.9	7.9		9.0	9.0	9.0	9.0	9.0	9.0	
Total Cross-Sectional Area (ft^2)	8.5	8.8	8.3	4.6	4.1	2.0		10.0	10.8	10.2	7.6	8.0	6.6		18.1	17.1	17.1	6.5	16.3	5.2		7.9	8.6	6.3	5.1	7.0	6.6		9.0	10.5	10.0	8.1	8.5	6.4	
Bankfull Width/Depth Ratio	13.7	13.2	11.9	19.2	15.8	17.5		14.6	17.6	15.3	16.4	14.6	13.5		-	-	-	-	-	-		12.9	15.2	12.3	13.7	13.3	15.7		12.0	11.7	12.1	14.5	14.6	14.5	
Bankfull Entrenchment Ratio	3.7	3.9	4.1	3.3	3.6	3.6		5.9	5.2	5.8	5.8	5.9	6.7		-	-	-	-	-	-		5.7	5.4	6.1	5.8	5.8	5.5		2.6	2.6	2.5	2.3	2.3	2.4	
Bankfull Bank Height Ratio	1.0	1.0	0.9	0.7	0.7	0.7		1.0	0.8	0.8	0.8	1.0	0.8		-	-	-	-	-	-		1.0	1.0	0.9	0.8	0.9	0.8		1.0	1.0	1.1	1.0	0.9	1.0	
d50 (mm)	2.1	1.4	27	1.1	1.1	1.1		28	12	11	0.8	0.9	0.7		-	-	-	-	-	-		35	44	56	27	2.7	13		47	63	61	3.7	5.5	32	
	Cross-Section 6 (T2-Riffle) Station 56+18							Cross-Section 7 (T2-Pool) Station 60+09							Cross-Section 8 (T2-Riffle) Station 63+84							Cross-Section 9 (T2-Riffle) Station 66+63							Cross-Section 10 (T2-Pool) Station 68+61						
Baseline Bankfull Elevation	809.5							806.4							801.4							797.8							796.5						
	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+
Bankfull Width (ft)	10.6	11.5	11.0	12.4	11.7	11.5		13.3	13.0	14.5	12.8	11.8	10.1		10.7	11.8	10.1	10.7	10.2	9.6		10.8	13.3	13.3	13.5	12.1	14.6		12.5	15.1	15.5	15.0	15.1	16.2	
Floodprone Width (ft)	29.0	32.0	33.3	32.8	33.7	36.7		-	-	-	-	-	-		30.0	27.9	28.3	28.9	28.3	27.4		42.0	44.0	44.2	43.2	43.4	44.9		-	-	-	-	-	-	
Bankfull Mean Depth (ft)	0.8	0.8	0.8	0.7	0.8	0.8		1.0	1.1	1.0	1.1	1.2	1.4		0.9	1.0	1.0	0.9	1.0	1.0		0.9	0.7	0.7	0.7	0.8	0.6		1.2	1.0	0.9	1.0	1.0	0.9	
Bankfull Max Depth (ft)	1.3	1.4	1.5	1.4	1.4	1.6		1.9	1.8	2.0	2.0	1.9	1.9		1.3	1.6	1.7	1.6	1.6	1.6		1.2	1.4	1.3	1.3	1.4	1.5		1.8	1.9	2.1	1.9	1.9	2.3	
Bankfull Cross-Sectional Area (ft^2)	8.8	8.8	8.8	8.8	8.8	8.8		13.8	13.8	13.8	13.8	13.8	13.8		9.7	9.7	9.7	9.7	9.7	9.7		9.2	9.2	9.2	9.2	9.2	9.2		14.5	14.5	14.5	14.5	14.5	14.5	
Total Cross-Sectional Area (ft^2)	8.8	8.8	7.9	6.3	7.3	6.0		13.8	17.0	13.9	13.5	16.1	15.9		9.7	11.8	13.2	10.4	11.6	12.2		9.2	8.0	7.6	6.3	8.2	6.3		14.5	17.7	17.6	15.6	15.5	13.9	
Bankfull Width/Depth Ratio	12.8	15.0	13.7	17.4	15.4	15.0		-	-	-	-	-	-		11.8	10.2	10.6	11.8	10.7	9.4		12.7	19.3	19.3	19.8	15.9	23.3		-	-	-	-	-	-	
Bankfull Entrenchment Ratio	2.7	2.8	3.0	2.6	2.9	3.2		-	-	-	-	-	-		2.8	2.8	2.8	2.7	2.8	2.9		3.9	3.3	3.3	3.2	3.6	3.1		-	-	-	-	-	-	
Bankfull Bank Height Ratio	1.0	1.0	1.0	0.9	1.0	0.9		-	-	-	-	-	-		1.0	1.1	0.9	1.1	1.1	1.1		1.0	0.9	0.8	0.9	1.0	0.9		-	-	-	-	-	-	
d50 (mm)	49	60	45	6.9	2.0	3.6		-	-	-	-	-	-		66	40	100	61	45	50		41	37	29	44	100	80		-	-	-	-	-	-	

	Cross-Section 11 (T2-Riffle) Station 72+48						
Baseline Bankfull Elevation	793.5						
	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	12.0	11.7	11.4	16.1	19.2	13.3	
Floodprone Width (ft)	51.4	52.2	51.8	52.2	53.3	53.3	
Bankfull Mean Depth (ft)	0.8	0.8	0.8	0.6	0.5	0.7	
Bankfull Max Depth (ft)	1.4	1.5	1.4	1.4	1.7	1.6	
Bankfull Cross-Sectional Area (ft^2)	9.5	9.5	9.5	9.5	9.5	9.5	
Total Cross-Sectional Area (ft^2)	9.5	9.6	9.7	5.9	6.4	7.6	
Bankfull Width/Depth Ratio	15.2	14.5	13.8	27.4	38.8	18.7	
Bankfull Entrenchment Ratio	4.2	4.5	4.5	3.2	2.8	4.0	
Bankfull Bank Height Ratio	1.0	0.9	1.0	0.9	0.9	0.9	
d50 (mm)	16	3.1	14	1.8	11	9.4	

Table 11b. Stream Reach Morphology Data Tables
Jacob's Landing Stream Restoration Site, DMS Project # 95024
Reach: T1 (2,389 ft.)

Parameter	MY01 (2014)						MY02 (2015)						MY03 (2016)						MY04 (2017)						MY05 (2018)					
Dimension	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	10.6	11.6	11.0	13.3	1.5	3.0	9.9	10.8	10.1	12.4	1.4	3	10.4	12.0	12.8	12.8	1.4	3	10.3	11.3	11.6	12.1	0.9	3	11.1	11.6	11.6	12.2	0.6	3
Floodprone Width (ft)	40.9	56.6	59.1	69.7	14.6	3.0	40.9	57.6	59.7	72.1	15.7	3	41.8	58.8	60.7	74.0	16.2	3	41.3	57.2	59.6	70.7	14.8	3	44.4	61.0	61.2	77.3	16.5	3
Bankfull Mean Depth (ft)	0.7	0.8	0.8	0.8	0.0	3.0	0.8	0.8	0.8	0.8	0.0	3	0.7	0.8	0.8	0.8	0.1	3	0.7	0.8	0.8	0.8	0.1	3	0.7	0.8	0.7	0.9	0.1	3
Bankfull Max Depth (ft)	1.3	1.4	1.4	1.4	0.1	3.0	1.4	1.4	1.4	1.5	0.1	3	1.4	1.4	1.4	1.5	0.1	3	1.3	1.4	1.4	1.5	0.1	3	1.4	1.5	1.5	1.6	0.1	3
Bankfull Cross-Sectional Area (ft^2)	7.9	8.8	8.5	10.0	1.1	3.0	7.9	8.8	8.5	10.0	1.1	3	7.9	8.8	8.5	10.0	1.1	3	7.9	8.8	8.5	10.0	1.1	3	7.9	8.8	8.5	10	1.1	3
Total Cross-Sectional Area (ft^2)	8.6	9.4	8.8	10.8	1.2	3.0	6.3	8.3	8.3	10.2	2.0	3	4.6	5.8	5.1	7.6	1.6	3	4.1	6.4	7.0	8.0	2.0	3	2	5.1	6.6	6.6	2.7	3
Width/Depth Ratio	13.2	15.3	15.2	17.6	2.2	3.0	11.9	13.2	12.3	15.3	1.9	3	13.7	16.4	16.4	19.2	2.8	3	13.3	14.6	14.6	15.8	1.3	3	13.5	15.6	15.7	17.5	2.0	3
Entrenchment Ratio	3.9	4.8	5.2	5.4	0.8	3.0	4.1	5.3	5.8	6.1	1.1	3	3.3	5.0	5.8	5.8	1.4	3	3.6	5.1	5.8	5.9	1.3	3	3.6	5.3	5.5	6.7	1.6	3
Bank Height Ratio	0.8	0.9	1.0	1.0	0.1	3.0	0.8	0.9	0.9	0.9	0.1	3	0.7	0.8	0.8	0.8	0.1	3	0.7	0.9	0.9	1.0	0.2	3	0.7	0.8	0.8	0.8	0.1	3
Pattern																														
Channel Beltwidth (ft)	25.0	38.0		50.0																										
Radius of Curvature (ft)	20.0	33.0		45.0																										
Rad. of Curv. : Bankfull Width (ft/ft)	2.0	3.0		4.0																										
Meander Wavelength (ft)	65.0	95.0		125.0																										
Meander Width Ratio	1.9	3.0		3.5																										
Profile																														
Riffle Length (ft)	3.0	34.0	32.0	85.0	16.1	21.0	10.9	31.1	31.9	44.6	10.1	21	4.3	27.5	28.9	66.5	14.6	22	6.5	26.4	25.3	52.0	13.6	18	8.8	24.4	24.3	40.2	9.6	12
Riffle Slope (ft/ft)	0.01	0.02	0.01	0.05	0.01	20	0.006	0.01	0.01	0.03	0.007	21	0.0002	0.01	0.01	0.04	0.009	22	0.001	0.02	0.01	0.04	0.01	18	0.002	0.0168	0.012	0.036	0.012	12
Pool Length (ft)	4.0	13.0	10.0	27.0	7.4	14.0	4.0	9.7	8.7	21.5	4.4	17	5.3	11.3	11.0	22.8	5.1	18	5.8	13.5	10.5	31.0	8.1	18	4.9	9.3	5.5	17.5	7.1	3
Pool Max Depth (ft)	3.0	3.0		3.0		1	2.8	2.8		2.8		1	1.6	1.6		1.6		1	3.0	3.0		3.0		1	1.4	1.4		1.4		1
Pool Spacing (ft)	41.0	83.0	62.0	233.0	60.4	13.0	36.9	74.5	56.2	231.1	51.6	16	16.1	71.6	67.6	196.6	45.7	17	14.4	67.8	60.0	253.8	50.5	17	280.2	398.8	398.8	517.5	167.8	2
Additional Reach Parameters																														
Channel Thalweg Length (ft)	1,305						1,305						1,305						1,305						1,305					
Sinuosity	1.09-1.12						1.09-1.12						1.09-1.12						1.09-1.12						1.09-1.12					
Water Surface Slope (ft/ft)	0.0068						0.0066						0.0070						0.0072						0.0071					
Bankfull Slope (ft/ft)	0.0068						0.0064						0.0067						0.0068						0.0071					
Rosgen Classification	C4						C4						C4						C4						C4					
SC% / Sa% / G% / C% / B% / Be%	29%/22%/36%/14%/0%/0%						11%/22%/35%/32%/0%/0%						4%/55%/29%/12%/0%/0%						2%/62%/28%/8%/0%/0%						4%/65%/9%/0%/0%					
d16/d35/d50 / d84 / d95	7/10/14/49/88						7/11/24/104/128						1/2/8/14/46/98						0.36/0.74/1.4/11.5/20/67						0.3/0.7/3.9/22/80					
% of Reach with Eroding Banks	0%						1%						0%						0%						0%					

Table 11c. Stream Reach Morphology Data Tables
Jacob's Landing Stream Restoration Site, DMS Project # 95024
Reach: T2 (2,084 ft.)

Parameter	MY01 (2014)						MY02 (2015)						MY03 (2016)						MY04 (2017)						MY05 (2018)					
Dimension	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	10.3	11.7	11.7	13.3	1.1	5	10.1	11.2	11.0	13.3	1.3	5	10.7	12.8	12.4	16.1	2.1	5	10.2	12.9	11.7	19.2	3.6	5	9.6	12.1	11.5	14.6	1.9	5
Floodprone Width (ft)	26.5	36.5	32.0	52.2	11.1	5	26.2	36.8	33.3	51.8	10.9	5	26.8	36.8	32.8	52.2	10.7	5	26.9	37.1	33.7	53.3	11.1	5	27.3	37.9	36.7	53.3	11.3	5
Bankfull Mean Depth (ft)	0.7	0.8	0.8	1.0	0.1	5	0.7	0.8	0.8	1.0	0.1	5	0.6	0.7	0.7	0.9	0.1	5	0.5	0.8	0.8	1.0	0.2	5	0.6	0.8	0.8	1.0	0.1	5
Bankfull Max Depth (ft)	1.4	1.5	1.4	1.6	0.1	5	1.3	1.5	1.4	1.7	0.2	5	1.3	1.4	1.4	1.6	0.1	5	1.4	1.5	1.4	1.7	0.1	5	1.5	1.6	1.6	1.6	0.04	5
Bankfull Cross-Sectional Area (ft^2)	8.8	9.2	9.2	9.7	0.4	5	8.8	9.2	9.2	9.7	0.4	5	8.8	9.2	9.2	9.7	0.4	5	8.8	9.2	9.2	9.7	0.4	5	8.8	9.2	9.2	9.7	0.4	5
Total Cross-Sectional Area (ft^2)	8.0	9.7	9.6	11.8	1.5	5	7.6	9.7	9.7	13.2	2.2	5	5.9	7.4	6.3	10.4	1.9	5	6.4	8.4	8.2	11.6	2.0	5	6	7.7	6.4	12.2	2.6	5
Width/Depth Ratio	8.0	9.7	9.6	11.8	1.5	5	7.6	9.7	9.7	13.2	2.2	5	5.9	7.4	6.3	10.4	1.9	5	6.4	8.4	8.2	11.6	2.0	5	6.0	7.7	6.4	12.2	2.6	5
Entrenchment Ratio	10.2	14.1	14.5	19.3	3.5	5	10.6	13.9	13.7	19.3	3.3	5	11.8	18.2	17.4	27.4	6.0	5	10.7	19.1	15.4	38.8	11.2	5	9.4	16.2	15	23.3	5.2	5
Bank Height Ratio	2.6	3.2	2.8	4.5	0.8	5	2.5	3.2	3.0	4.5	0.8	5	2.3	2.8	2.7	3.2	0.4	5	2.3	2.9	2.8	3.6	0.5	5	2.4	3.1	3.1	4.0	0.6	5
Pattern																														
Channel Beltwidth (ft)	25.0	38.0		50.0																										
Radius of Curvature (ft)	20.0	33.0		45.0																										
Rad. of Curv. : Bankfull Width (ft/ft)	2.0	3.0		4.0																										
Meander Wavelength (ft)	60.0	95.0		130.0																										
Meander Width Ratio	2.2	4.0		4.8																										
Profile																														
Riffle Length (ft)	5.0	14.0	17.0	24.0	5.9	15	7.8	32.4	30.4	61.6	11.5	27	6.2	23.1	21.6	46.8	8.9	32	8.1	24.4	23.6	40.5	7.3	31	14.2	32.0	26.2	87.6	18.1	26
Riffle Slope (ft/ft)	0.007	0.02	0.02	0.05	0.01	14	0.001	0.02	0.02	0.03	0.006	27	0.002	0.02	0.02	0.04	0.007	32	0.000	0.02	0.02	0.04	0.01	31	0.001	0.015	0.014	0.041	0.009	26
Pool Length (ft)	4.1	15.8	14.7	26.9	6.5	29	5	13	12	28	6	25	3.5	13.3	11.8	29.5	5.8	30	7.6	15.6	13.1	27.4	6.0	31	5.7	12.1	10.182	24.7	5.158	31
Pool Max Depth (ft)	1.8	1.9		1.9		2	2.0	2.1		2.1		2	1.9	2.0		2.0		2	1.9	1.9		1.9		2	1.9	2.1		2.3		2
Pool Spacing (ft)	31.8	61.8	54.4	160.9	29.0	28	42.7	69.5	59.9	173.7	34.2	24	41.9	60.1	55.9	127.6	18.5	29	33.8	57.9	56.0	128.2	17.2	30	42.084	57.9	54.311	101.9	12.69	30
Additional Reach Parameters																														
Channel Thalweg Length (ft)	2,641						2641						2641						2,641						2,641					
Sinuosity	1.16-1.31						1.16-1.31						1.16-1.31						1.16-1.31						1.16-1.31					
Water Surface Slope (ft/ft)	0.0106						0.0107						0.0104						0.0104						0.0105					
Bankfull Slope (ft/ft)	0.0109						0.0106						0.0100						0.0103						0.0103					
Rosgen Classification	C4						C4						C4						C4						C4					
SC% / Sa% / G% / C% / B% / Be%	29%/22%/36%/14%/0%/0%						6%/10%/46%/38%/0%/0%						7%/35%/27%/30%/0%/0%						0/%29%/36%/32%/0%/2%						3%/27%/36%/33%/0%/1%					
d16 / d35 / d50 / d84 / d95	12/21/32/46/83/127						14/26/38/105/134						0.4/6/17/45/98/140						3.7/17/29/57/107/193						1.4/11/27/100/156					
% of Reach with Eroding Banks	0%						0%						0%						0%						0%					

Appendix E

Hydrologic Data

Table 12. Verification of Bankfull Events Jacob's Landing Stream Restoration Site, DMS Project # 95024			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo Number**
4/19/2015	4/19/2015	On-site automatic gauge	N/A
10/3/2015	10/3/2015	On-site automatic gauge	N/A
11/9/2015	11/9/2015	On-site automatic gauge	N/A
Unkown	12/17/2015	Wrack lines and flattened vegetation observed at bankfull	1 - 2
12/23/2015	12/23/2015	On-site automatic gauge	N/A
12/30/2015	12/30/2015	On-site automatic gauge	N/A
2/23/2016	2/23/2016	On-site automatic gauge (T1 only)	N/A
5/16/2016	5/16/2016	On-site automatic gauge (T1 only)	N/A
5/25/2016	5/25/2016	On-site automatic gauge (T1 only)	N/A
6/14/2016	6/14/2016	On-site automatic gauge (T1 only)	N/A
10/8/2016	10/8/2016	On-site automatic gauge (T1 only)	N/A
6/5/2017	6/5/2017	On-site automatic gauge	N/A
6/13/2017	6/13/2017	On-site automatic gauge	N/A
6/19/2017	6/19/2017	On-site automatic gauge (T1 only)	N/A
6/20/2017	6/20/2017	On-site automatic gauge (T1 only)	N/A
9/1/2017	6/20/2017	On-site automatic gauge (T1 only)	N/A
2/7/2018	2/7/2018	On-site automatic gauge (T1 only)	N/A
9/16/2018	9/16/2018	On-site automatic gauge	N/A
10/11/2018	10/11/2018	On-site automatic gauge	N/A
11/12/2018	11/12/2018	On-site automatic gauge (T1 only)	N/A

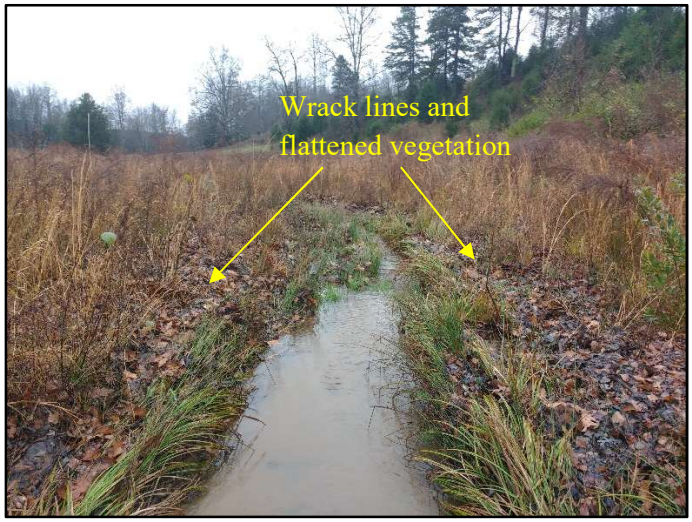


Photo 1. Bankfull indicators T1, 12/17/2015

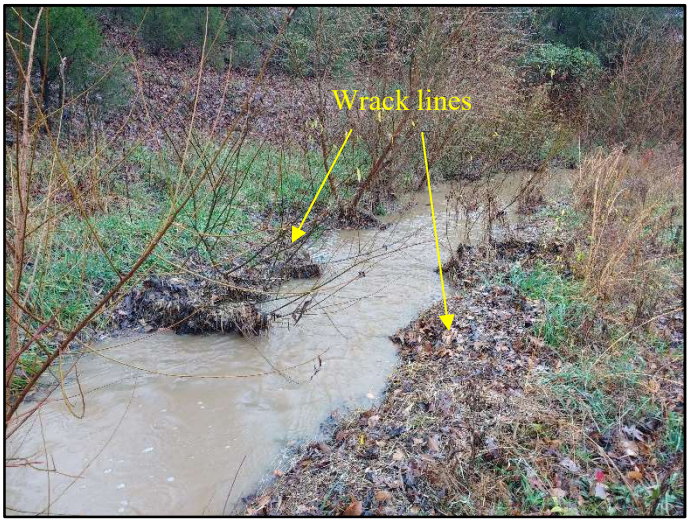
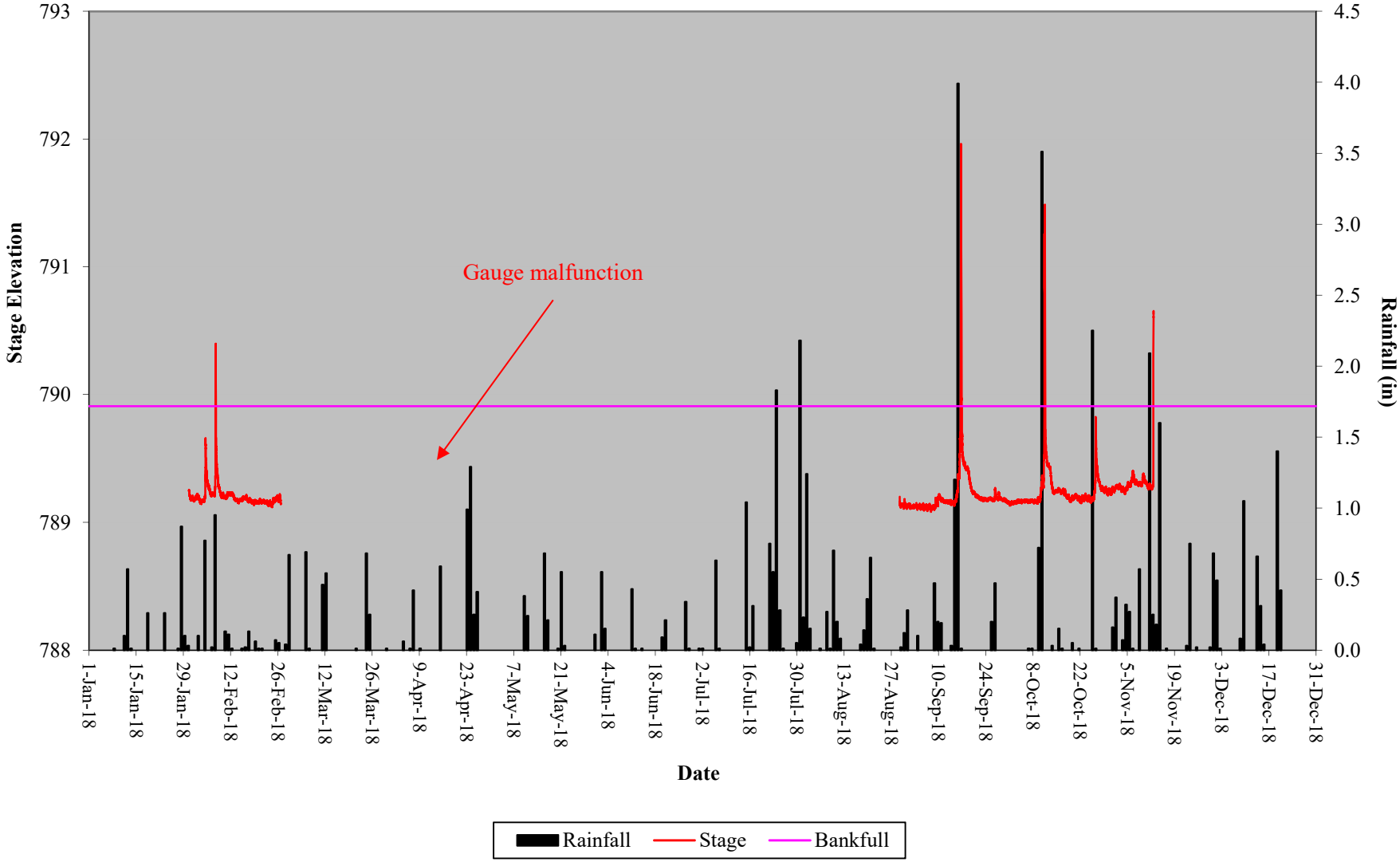
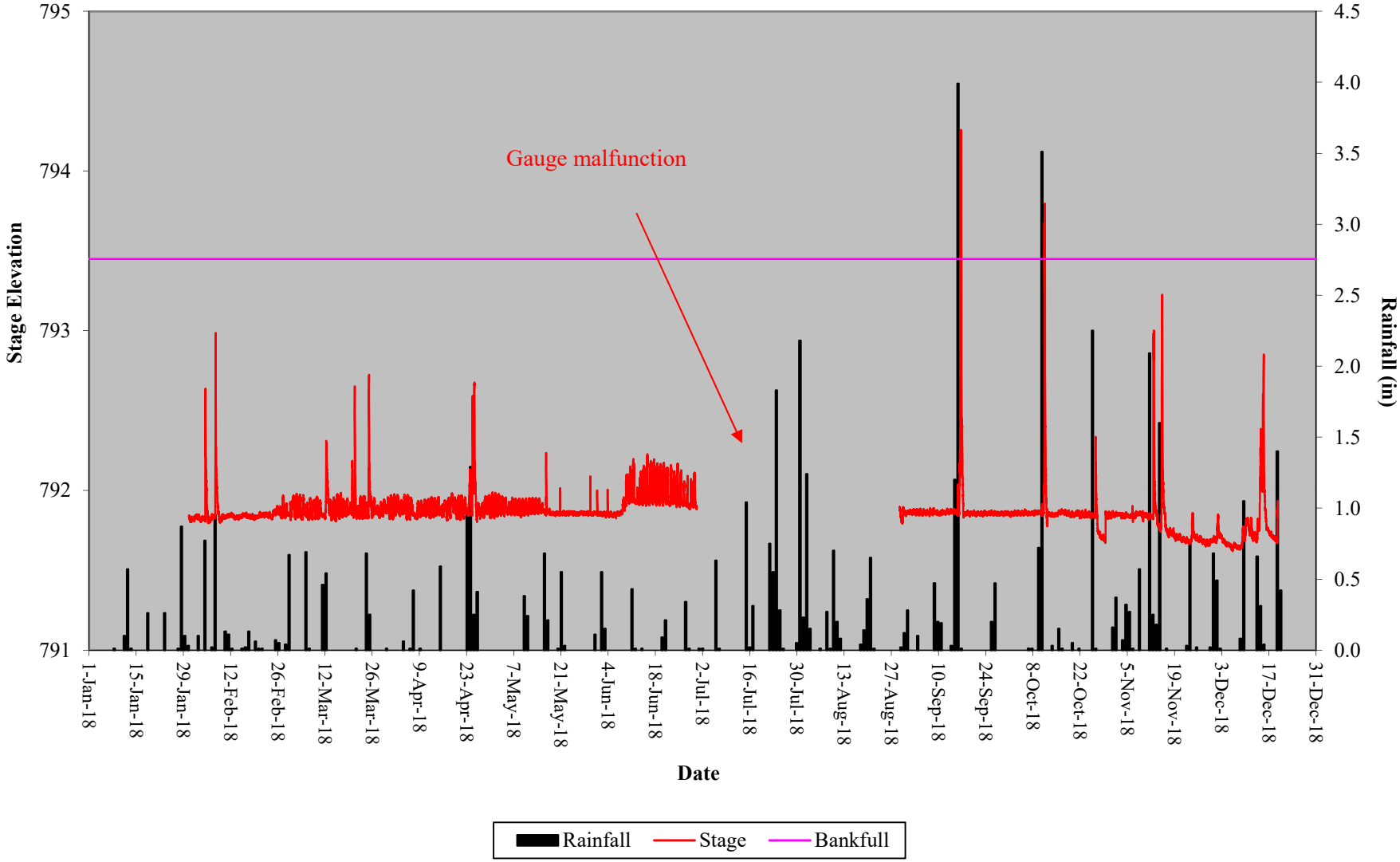


Photo 2. Bankfull indicators T2, 12/17/2015

Jacob's Landing Restoration Site
Stage Hydrograph
Stream Gauge 1



Jacob's Landing Restoration Site
Stage Hydrograph
Stream Gauge 2



Appendix F

Additional Information

KCI ASSOCIATES OF NORTH CAROLINA, PA

ENGINEERS • SCIENTISTS • SURVEYORS • CONSTRUCTION MANAGERS

Landmark Center II, Suite 220 4601 Six Forks Road Raleigh, NC 27609 (919) 783-9214 (919) 783-9266 Fax

May 22, 2014

Mr. Todd Tugwell
Regulatory Division
Wilmington District
U.S. Army Corps of Engineers
11405 Falls of Neuse Road
Wake Forest, NC 27587

And:

Mr. Tim Baumgartner
Deputy Director
NC DENR
Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699

Subject: Jacob's Landing (95024) Stream Restoration Project
Request for Mitigation Plan Amendment

Dear Mr. Tugwell and Mr. McDonald,

This letter is in response to the discussions at an Interagency Review Team (IRT) meeting attended by KCI on May 13, 2014. During this meeting KCI presented a request to modify the allocation of stream mitigation credits on the Jacob's Landing stream restoration project. Citing procedural reasons, the IRT requested that KCI submit a formal request to reallocate credits. This letter will serve as that request.

Request

KCI requests the following changes to the credit table provided in the *Jacob's Landing Stream Restoration Site - Final Mitigation Plan* dated September 2012 (requested changes shown in red).

Reach	Mitigation Type	Priority Approach	Existing Linear Footage	Designed Linear Footage	Mitigation Units
T1-1	Restoration	P2	326	303	303
T1-2	Enhancement II	-	158	109*	44
T1-3	Restoration	P2	846	893	893
T1A	Restoration	P2	294	178	178
T2-1	Restoration	P2	1,800	1,581*	1,581
T2-2	Restoration	P2	1,135	1,060*	1,060
T2A	Restoration	P2	465	465	465
Total Stream Enhancement I			0	0	0
Total Stream Enhancement II			158	109	44
Total Stream Restoration			4,866	4,015	4,480
Total Mitigation Units					4,524

Justification

The 465 linear feet of stream channel associated with reach T2-A was identified during the Proposal Stage (including an IRT site walk) as Enhancement Level 1 at a 1.5:1 ratio. As a matter of practice, KCI attempts to be consistent with the credit-types requested in the Proposal during the assessment and the design stages of the project. During the assessment and design stage for Reach T2-A, a more aggressive restoration approach was determined to be needed. This was primary due to the confinement of the valley, the difficulty of access, the absence of a functional floodplain and the poor condition of the valley walls leading down to the stream. These reasons and others resulted in ultimate decision to completely change the stream type from a G-type channel to a C/B-type channel. This approach was in fact a restoration approach, although it never was properly identified as such in the Mitigation Plan. The approach included the following restoration initiatives:

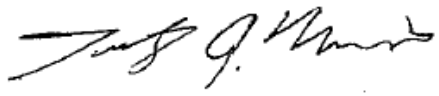
1. Channel type changed from a G4 channel to a C4/B4 channel by installing a typical riffle cross section with a 3.6' bankfull bench and a 0.9' bank height.
2. Adjusted thalweg and centerline (planform) slightly throughout the reach to allow for the incorporation of the bankfull bench. Bench location and width varied from cross section depending on condition of valley and the ability to accommodate the full bankfull width given the valley condition.
3. Installed significant number of structures (5 step pools, 8 riffle grade controls, 8 riffle enhancements) to stabilize the profile and create in-stream habitat.
4. Added bedform diversity and stabilized the planform.
5. Stabilized the valley walls and contributing drainage features.

All of the items mentioned above support the reallocation of credit type to restoration (or enhancement at a higher ratio). KCI requests that the IRT support the correction of the 1.5:1 Enhancement I ratio

proposed for Reach 2A in the Final Mitigation Plan to 1:1 ratio. KCI can provide amended copies of the Mitigation Plan, if desired.

We hope you find this information appropriate in order to move forward with your decision. If you have further questions or comments, feel free to contact me at 919-278-2511 or tim.morris@kci.com .

Sincerely,



Timothy J. Morris
Senior Environmental Scientist

cc: Joe Pfeiffer, KCI (email)
Adam Spiller (email)
Tim Baumgartner, EEP (email)

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

September 2, 2014

Regulatory Division

Re: Request for Modification to the Jacob's Ladder and Jacob's Landing Mitigation Sites (USACE AIDs 2012-01007 and 2012-01006)

Mr. Tim Baumgartner
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

Please reference the North Carolina Interagency Review Team (IRT) meeting of May 13, 2014, during which we discussed the Jacob's Ladder and Jacob's Landing stream mitigation projects. The discussion dealt with a request by NCEEP to the U.S. Army Corps of Engineers, Wilmington District (District) to modify a reach within each project resulting in a change in the mitigation approach and associated credit.

During the IRT meeting, we asked that a written request be submitted to provide information on the specifics of each project modification so that the IRT could review the requests and provide comment back to us. Two letters dated May 22, 2014, were prepared by the project provider (KCI, Inc.) and distributed to the IRT. The following responses were received from the IRT agency members:

1. Travis Wilson, North Carolina Wildlife Resources Commission, 5/29/2014:
   A switch from enhancement to restoration should have been addressed earlier during design. As I understood it during the presentation most of the design elements outlined in the modification request were incorporated under the enhancement level and only slight changes occurred during construction, and I don't want to establish a practice where the IRT is constantly reviewing requests from providers on a credit hunt to cover contractual deficiencies. However, with that said, I agree the improvements on the two subject reaches are consistent with a restoration approach, and if successful it will provide a restoration level of uplift. WRC does not object to the modification request.

2. Eric Kulz, North Carolina Division of Water Resources, 5/29/2014:
   The approaches described in the mitigation plans for the referenced reaches were fairly non-quantitative and appeared to represent an Enhancement I approach, which was approved by the IRT. The activities conducted appeared consistent with the descriptions of mitigation measures proposed in the approved mitigation plans. Again, the mitigation plans were not quantitative in nature, and E1 spans a wide variety of mitigation treatments.

During the analysis phase of these projects, if the provider and EEP felt the initial assessment and proposal were incorrect/inappropriate, consultation with the IRT and re-review of the project stream conditions and mitigation approaches should have been requested and approval of revisions sought (note process taken with the Pancho bank site).

Minor adjustments often occur during construction and are expected, and are described in the as-built report. Linear footage/acreage of mitigation and associated credits are then normally finalized. However, in this case changing the name of the mitigation approach and associated credit after construction does not appear warranted as the activities conducted appear to be fairly consistent with what was described in the approved mitigation plans.

In addition to the responses above, we conducted a review of the information submitted and other information available regarding the two projects, including the mitigation plans for the projects. In the May 22nd request letters for the two projects, the explanation for the additional credit request was based on the fact that a more aggressive restoration approach was determined to be needed during the assessment and design stages of the two projects. The new approach for the streams on both projects was similar, in that it included such activities as adjusting the thalweg and centerline of the streams, installing a significant number of structures, incorporating bankfull benches, and adding bedform diversity.

In the case of both Jacob's Ladder and Jacob's Landing, the IRT reviewed the projects in the field in August, 2011, and agreed to the mitigation approach described in the respective mitigation plans, which were finalized in September, 2012. As noted by Mr. Kulz' comments, the work that was done and is now the basis for the request for additional credit appears to be fairly consistent with what was proposed in the mitigation plan. In the case of Jacob's Ladder, the mitigation plan states that for Tributary T2-1 "Enhancement will include shaping the banks, creating a bankfull bench, creating a more stable and heterogeneous stream bed, and replanting the riparian buffer to achieve a mix of native tree species." For Jacob's Landing, the mitigation plan states that for Tributary T2A "This reach will be enhanced by shaping the banks to creating a bankfull bench, and installing grade control structures to gradually drop the bed elevation down. The reach will be stabilized by replanting the riparian buffer to achieve a mix of native tree species." Despite this fact, if the amount of functional uplift resulting from the work is sufficient to be credited at a 1:1 ratio, we do not want to penalize these projects for failing to identify an appropriate credit ratio up front in the mitigation plan.

Another concern that arises from these requests is the way in which the changes to mitigation plan and credit yield were handled. As stated in the documentation submitted to the IRT, the need for a more aggressive approach was identified during the assessment and design stages of the mitigation process. This implies that the need to modify the approaches and associated credit structure for these tributaries was known well before construction yet not brought to the IRT's attention until the as-built stage of the project. Any modification to a project that results in a change to the mitigation approach substantial enough to warrant a different credit amount must be approved by the District prior to implementing that modification. In this case, the IRT was not notified of the change until the as-built stage of the project.

Lastly, the information submitted in support of the requested change is not consistent. The final credit amounts presented during the IRT meeting do not match the credit amounts listed in the supporting information that was submitted after the meeting. Specifically, Jacob's Landing was shown

to have 4,528 credits (SMUs) in the presentation and 4,524 credits in the supporting letter dated May 22, 2014. Similarly, Jacob's Ladder was shown to have 5,231 credits in the presentation and 5,203 credits in the supporting letter. In order to fully resolve this issue, please explain the discrepancy and identify the correct amount of credit to be generated by the two projects.

To conclude, it is our intention to make sure that the amount of credit generated by mitigation projects, as expressed by the mitigation ratio, is supported by the level of uplift resulting from the work. In the case of these two projects, we agree that the uplift provided by the mitigation activities conducted in the two reaches in question may be credited at a 1:1 ratio. However, for future projects, changes such as this that result in a modification to the amount of credit must be approved in advance so that the District and IRT has the opportunity to comment and agree with the proposed approach. For all NCEEP projects that were instituted after the approval of the Instrument on July 28, 2010, such modifications should be approved in accordance with the streamlined review process outlined in Section 332.8(g)(2) of the Federal Mitigation Rule, unless the district engineer determines those changes are of a significant nature and must be processed through the normal procedures. In cases where such modifications are time-sensitive (e.g., construction is on-going), we will endeavor to expedite the review and approval to the extent allowable under the Rule.

Thank you for working with us to address these issues. Please contact me if you have any questions about this letter, or if there is any additional information you need. I can be contacted at telephone (919) 846-2564.

Sincerely,

Todd Tugwell
Special Projects Manager

Enclosures

Electronic Copies Furnished:
Mr. Tim Morris, KCI, Inc.
NCIRT Distribution List