Mitigation Project Name	**Tributaries of Wicker Branch Stream Restoration Site**	**County**	**Union**	**USACE Action ID**	2013-01680
DMS ID	**95022**	**Date Project Instituted**	**7/13/2011**	**NCDWR Permit No**	2013-0957
River Basin	**Yadkin**	**Date Prepared**	**8/27/2018**		
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 Year (Wetland)			
Potential Credits (Mitigation Plan)		**2,539.670**													1,390.000	426.667	723.000
Potential Credits (As-Built Survey)		**2,539.667**															
1 (Site Establishment)	**N/A**				N/A	N/A	**N/A**				**N/A**		N/A	N/A	10.00%	10.00%	10.00%
2 (Year 0 / As-Built)	**30%**	761.900			2016	2/1/2016	**30%**				**30%**		N/A	N/A	139.000	42.667	72.300
3 (Year 1 Monitoring)	**10%**	253.967			2016	4/25/2016	**10%**				**10%**		N/A	N/A			
4 (Year 2 Monitoring)	**10%**	253.967			2017	10/20/2017	**15%**				**15%**		N/A	N/A			
5 (Year 3 Monitoring)	**10%**	148.367			2018	8/27/2018	**20%**				**20%**		N/A	N/A	1,390.000	426.667	723.000
5 (Year 3 Monitoring) - Not Released		105.600			2018	Not Released	**20%**				**20%**		N/A	N/A	50.00%	50.00%	50.00%
6 (Year 4 Monitoring)	**10%**				2019		**10%**				**10%**		N/A	N/A	695.000	213.333	361.500
7 (Year 5 Monitoring)	**15%**				2020		**15%**				**15%**		N/A	N/A			
Stream Bankfull Standard	**15%**						**N/A**				**N/A**		N/A	N/A			
Total Credits Released to Date		**1,418.200**													834.000	222.700	361.500

DEBITS (released credits only) **105.6** **33.300**

			Ratios	1	1.5	**2.75242**	5	1	3	2	5	1	3	2	5	1	3	2	5
				Stream Restoration	**Stream Enhancment 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 / acres)				**1,390.000**	**640.000**	**1,990.000**													
As-Built Amounts (mitigation credits)				**1,390.000**	**426.667**	**723.000**													
Released Amounts (feet / acres)				**834.000**	**334.050**	**995.000**													
Released Amounts (credits)				**834.000**	**222.700**	**361.500**													
NCDWR Permit	**USACE Action ID**	**Project Name**																	
2000-0234	N/A	Mill Creek Development		23.340		15.580													
2007-1551	2007-02970-313	Christenbury Four Corners		16.670															
2007-1441	2009-00706	Ridge Road Apartments		104.470															
2008-1126	2008-02168-360	Barnhardt Road Subdivision		272.520	41.220														
2009-0859	2009-1556	Charlotte Pipe and Foundry			150.780	410.720													
2003-0815	2003-30972	NCDOT TIP B-3422 - Bridge 42 on SR 1002, Cabarrus Co		20.600		170.700													
2007-0646	2007-01949-313	Wellington Chase		118.400	64.000	199.000													
2000-0234	N/A	Mill Creek Development		139.000		105.180													
2005-1068	2004-31226	Crisco Road Industrial Park			24.990														
2007-0646	2007-01949-313	Wellington Chase			39.000	93.800													
2000-0234	N/A	Mill Creek Development		42.363															
2005-1068	2004-31226	Crisco Road Industrial Park		0.200															
2007-0646	2007-01949-313	Wellington Chase		96.437	14.060														
Remaining Amounts (feet / acres)				**0.000**	**0.000**	**0.020**													
Remaining Amounts (credits)				**0.000**	**0.000**	**0.007**													

Contingencies (if any): None

Signature of Wilmington District Official Approving Credit Release

9/20/18

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 DMS (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 10% reserve of credits is to be held back until the bankfull event performance standard has been met

YEAR 4 of 5 Monitoring Report
Tributaries of Wicker Branch Stream Restoration
Union County, North Carolina
DMS Project Number: 95022
Contract No: 003982
USACE Action Id No: SAW 2013-01680

Yadkin River
03040105

Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Data Collection Period October 2018
Submitted: January 2019

YEAR 4 of 5 Monitoring Report

Tributaries of Wicker Branch Stream Restoration
Union County, North Carolina
DMS Project Number: 95022
Contract No: 003982
USACE Action Id No: SAW 2013-01680

Yadkin River
03040105

Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared by:

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Raleigh, NC 27607
Phone: 919-854-6200
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January 2019

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919 854 6200 tel
919 854-6259 fax

January 7, 2019

Harry Tsomides
North Carolina Department of Environmental Quality
Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: Year 4 (2018) Monitoring Report the Tributaries of Wicker Branch Project (DMS Project # 95022)

Dear Mr. Tsomides,

Please find enclosed four copies of the Year 4 Monitoring Report for the Tributaries of Wicker Branch Project. Also included is a thumb drive containing the Digital Data submission files. This report has been finalized following your review comments dated December 17, 2018. The following changes have been made to the draft report based on your comments (in italics).

Table 2

- *Indicates project monitoring data were collected October 2018; is this for bath stream and vegetatian? If so please indicate, if not please provide the distinct dates.*
- *Year 4 delivery date is wrong (Jan 2018).*
- *Delivery date for Invasives cannot be in the future (2019); please clarify in the table each invasives control event, both planned and completed.*

Table 2 has been updated to reflect that both stream and vegetation data was collected in October. Year 4 delivery date is January 2109 and the Invasive treatment was completed in 2018. Additionally, proposed invasive treatments for 2019 have been added.

Table 10 - Was there a bank full event during Hurricane Florence? If so, please capture this in the table.

Table 10 has been updated to include the bankfull event that occurred during Hurricane Florence. The transducer graphs have also been updated to show all 2018 data through October 8, 2018.

Silted-in segments – Any stream sections site-wide that appear to be more of a wetland than a stream, need ta be discussed and clarified with regard to LF, and whether or not they are currently listed as asset-generating reaches.

A section titled – Tributary 3 Stream Mitigation Units that address this has been added.

If you have any questions regarding this Monitoring Report, please feel free to give me a call.

Regards,

Ron Johnson
Project Manger
AECOM Technical Services of North Carolina, Inc.

AECOM
701 Corporate Center Drive
Suite 475
Raleigh, North Carolina 27609
www.aecom.com

919 854 6200 tel
919 854 6259 fax

Memorandum

To	Harry Tsomides, DMS Project Manager	Page	1
CC			
Subject	Tributaries of Wickers Branch – 10/16/2018 Site Visit Comments		
From	Ron Johnson		
Date	January 23, 2019		

This memorandum is to respond to observations and comments from the October 5, 2018 site visit performed by DMS Property (Jeffery Horton) and NCDEQ Stewardship) Ed Hajnos) and provided to AECOM via an email dated December 19, 2018 as well as a your site visit on October 16, 2018 and provided in an email dated October 26, 2018 and letter dated December 17, 2018.

Invasives – Please continue treatments, including privet which is still abundant on UT1b; other areas have honeysuckle which is choking out the planted trees. Some cattails; china berry, etc.

AECOM will continue to treat the privet along UT-1b. Areas with extensive growth of honeysuckle will also be treated this spring. China berry trees will be physically cut. The cattails are confined to a relatively small wet area. It is not anticipated that they will spread from that area. The cattails will eventually be shaded out as the overstory develops. However, AECOM will treat the cattails with a herbicide and plant willow livestakes to help initiate the process.

Lack of proper easement marking (loose/crooked signage, lack of signs/posts in between distant corners, lack of corner posts altogether, poor visibility of low posts along easement edges, accuracy of some corner/line locations). The site needs to be marked to stewardship standards before the project closes out.

AECOM will replace/update the existing easement posts and signage with a combination of wooden posts and taller t-posts to meet DMS standards.

Erosion - recent storm-induced damage on UT1b. AECOM indicates planned repair for 2019. Please confirm.

AECOM will be repairing the erosion that has occurred at the log sill toward the lower end of Tributary 1B. Geotextile matting will be placed in the scour area and the hole backfilled with soil and rock. A log sill will be installed in the floodplain immediately upstream of the scour hole to redirect flows during flood events to help alleviate stress on the area.

Please confirm transducer locations are accurately mapped on the CCPV.

Transducer locations have been confirmed and updated locations are shown on the CCPV that was submitted with the MY 4 report.

<u>4-wheeler paths</u> and minor access road incursions, Reach 1B.

AECOM will evaluate the areas to determine if they are still being used by 4-wheelers. The access roads were present in the wooded areas of the easement when the easements were purchased and are slowly becoming overgrown. Additional signage will be installed in the access roads to notify 4-wheelers that a restricted buffer is present. AECOM will also discuss the use of 4-wheelers in the easement with the landowner.

<u>Stream mapping</u> – It appears trib 4 may be migrating out of the easement before reentering it; this will need to be analyzed and rectified if necessary since any streams outside the easement will not yield assets.

This should not be an issue with asset generation. The very upper portion of Tributary 4 (shown in black) is not included in the asset calculations. As shown on the figure to the left only the lower 631 feet of Tributary 4 is generating credits (highlighted in green).

The Asset map submitted with the MY4 report was updated to more accurately reflect which portions of Tributaries 3 and 4 are generating assets.

<u>Easement encroachment</u> – Clipping of crossing corners. What is being done to rectify this? This was noted in the MY03 report as an issue in progress with the landowner. What is the current status?

During project development AECOM established 3 equipment crossing to allow for access to the adjacent fields by the farmer that leases the land from the landowner. These crossings were established at the top of Tributary 1A, top of Tributary 2, and at the bottom of Tributary 3. Historically clipping has occurred at all three crossings. Following discussions with the farmer and the installation of additional signage clippage at Tributary 3 is no longer occurring.

There has been some clippage at the northeast corner of Tributary 1A. This has been due to lack of adequate signage and the farmer not knowing/aware of where the corner was. AECOM had difficulty installing adequate signage in this area due to the hardness of ground. A wooden post was installed in this area in the Fall of 2018 and should eliminate the encroachment. The post will be “updated” with

a taller post this winter/spring when other boundary markers are upgraded.

The crossing at the top of Tributary 2 remains problematic. A 35 wide easement was established at this crossing during the early stages of site development. When the easement was established AECOM assumed that the edge of the property was the edge of the treeline. The easement boundary was established in CAD prior to surveying the easement in the field. When the easement was finally surveyed and marked in the field it became apparent that there was not enough room between the edge of the easement and the treeline for the farmer to cross the easement with his equipment. The photo below depicts that combines that the farmer utilizes to harvest crops on the property .

The above photo depicts the location of the corner of the easement at the top of Tributary 2 in relation to the treeline. The Yellow Line is the far (northeast) corner of the easement and the wood post with the sign is he northwest corner. There is sufficient room at the northeast corner but not at the southeast corner. The photo below shows the farm equipment crossing the easement.

Expanding (or clearing) the crossing to the property line to allow for full use of the crossing would require removal of several large trees.

AECOM would like permission to modify the easement to allow adequate room for the equipment. We would work with the farmer to determine the exact distance but anticipate that it would look something like the photo above. The above photo shows reducing the length of the easement by about 35 feet on one side and maintaining it on the other. This would reduce the easement by about 1530 square feet or 0.035 acre. It should be noted that the easement in this area is not actually buffering an asset. Tributary 2 is an ephemeral feature that does not generate any stream credits.

Another option would be to not physically change the easement but just allow the area to continue to be cleared by the farmer. It would remain grassed or overgrown but no trees would end up growing on it. AECOM would like to discuss these options with DMS personnel in depth to determine a possible solution.

Table of Contents

APPENDICIES

1.0 PROJECT SUMMARY

The Tributaries of Wicker Branch Stream Restoration Project is located in Union County, North Carolina in the Yadkin River Basin, (HUC 03040105081010), and within a North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS) Targeted Local Watershed (TLW). It is also located within the watershed of Lanes Creek, a 303d-listed stream and Water Supply Watershed.

The project site consists of four headwater stream channels that flow through agricultural land and prior to restoration efforts were devoid of riparian vegetation. Past and present agricultural use of the land had severely impacted and degraded the channels. The project goals address stressors identified in the TLW and include the following:

- Improved water quality in Wicker Branch.
- Improve aquatic habitat in the tributary channels.
- Provide aesthetic value, wildlife habitat, and bank stability through the creation of a riparian zone.
- Create a contiguous wildlife corridor, with connection of some isolated adjacent natural habitats to larger downstream forested tracts.
- Provide shading and biomass input to the stream and mast for wildlife when vegetation is mature.

These objectives were achieved through restoring, enhancing, and preserving 4020 feet of perennial and intermittent stream channel. The riparian areas were also planted with native vegetation to improve habitat and protect water quality. The project reaches consist of Tributary 1A (Priority 1 Restoration), Tributary 1B (Enhancement Level II including invasive species control), Tributary 2 (Preservation), Tributary 3 (Enhancement Levels I and II), and Tributary 4 (Enhancement Level II)(See **Table 1** in **Appendix A** and **Figure 2** in **Appendix A**).

Tributary 2 was determined to be unsuitable for mitigation credits during a site visit with the USACE in August, 2011. It was requested by the USACE that a 30 foot buffer and conservation easement be acquired to provide riparian habitat connectivity between the restored segments of Tributary 1A and upstream wooded areas.

Project success will be determined by monitoring channel stability and vegetation within the easement. Success criteria have been outlined in the 2013 Mitigation Plan and include a stable dimension, pattern, and profile documented through the surveying of cross-sections and longitudinal profiles. Vegetation monitoring plots will have a minimum of 260 stems per acre after 5 years.

Project design was completed in December 2013 and the project constructed in September and October 2014. Planting was complete in March 2015 (See **Table 2** in **Appendix A**).

Herbaceous vegetation is well established though out the easement. The vegetation monitoring plots show an average density of 430 stems per acre down from baseline planting of 684 stems per acre but still well above the 320 stems per acre at end of year 3 and 260 stems per acre at year 5. Two plots do not meet the vegetation success criteria. Plots 6 and 10 are at 202 and 243 stems per acre respectively. A number of volunteer woody stems were observed this year

throughout the easement. Volunteer species included elm, box elder, persimmon, oaks, sweetgum, pine, willows, elderberry, and redbud.

Chinese privet (*Ligustrum sinense*) is present in the buffer along Tributary 1B. The area was treated twice in 2018. Scattered privet still remains and spot treating of the floodplain will occur through 2019. Several areas of dense honeysuckle (*Lonicera japonica*) have developed in isolated areas on Tributary 1 and 3. These areas will also be treated in 2019. There are also scattered chinaberry (*Melia azedarach)* trees along the edges of Tributary 1 and 3. These trees will be removed.

The restored stream channels appear to be stable with no areas of bank erosion observed. During construction in 2014 a headcut at the bottom of Tributary 1B was stabilized with a log sill and stone. Floodplain flows during bankfull events has starting to erode the bank around the left bank side of the sill and will need to be repaired in 2019.

The adjacent fields were planted in soybeans in 2018. Additional signage installed in the spring of 2016 was augmented in 2017. Only minor encroachment at the crossings of Tributary 1 and 2 is occurring and AECOM will continue to work with the landowner and the current farmer to address these minor encroachments. The areas of encroachment are shown on **Figure 3** in **Appendix B**.

Hydrology

AECOM is currently monitoring the stream flow on Tributaries 1 and 3 using Onset HOBO pressure transducers. Transducers are installed in two separate pools on each of the tributaries for a total of 4 locations. On Tributary 1A a transducer is located on the downstream end of the project and a second is located above the confluence with Tributary 2. On Tributary 3 one transducer is located on the downstream end and a second is located in a pool just below the wetland at the beginning of the Enhancement I reach. The locations of the transducers are shown on Figure 3 Current Condition Plan View in Appendix B.

The transducers are suspended in the pool at a set elevation and use pressure to measure the depth of water over (above) the transducer. The elevation of the transducer is known, as is the elevation of the head of the riffle and the top of the bank (for bankfull flow). When the elevation of the water level in the pool above the transducer exceeds the elevation of the head of the riffle, then it is assumed that flow is occurring. The data for the transducers (which monitor flow) is presented in graphs that can be found in Appendix E.

Tributary 1 had continuous flow in both the upper and lower reach beginning on January 29, 2018 and continuing through April 8 in the upper section beginning on January 13 and countinuing until April 24 on the lower reach. Except during storm events the depth of flow at the head of the riffle is on the order of 0.5 inches or less. Tributary 3 had continuous flow beginning on January 12, 2018 and continuing through May 6, 2018 in the upper section and in the lower section flow began on January 9 and continued until May 5. Flow was typically about 1 inch in depth.

A bankfull event was recorded by the transducers on January 29, 2018 and confirmed through visual observation of rack lines and debris in the floodplain during a February 6, 2018 site vist.

A second bankfull event occurred on April 25 and a third during Hurricane Florence on August 16.

Tributary 3 Stream Mitigation Units

The project as described in the Mitigation Plan is projected to generate 2539.65 SMUs through a mixture of Restoration, Enhancement I, and Enhancement II. During the Interagency Review Team (IRT) site visit in April 2017 it was noted that the upper reach located between two wetland areas was silted in and lacked a distinct channel. This reach is 264 feet in length and has been proposed as Enhancement II at a Mitigation Ratio of 2.5:1. This length was projected to generate 105.6 SMUs.

During the October 2018 monitoring it was observed that a channel was starting to reform in this reach. The channel will continued to be monitored to see if a channel continues to reform and to what extent (length).

2.0 METHODOLOGY

Vegetation survival, channel stability, and wetland hydrology were monitored on the project site. Post restoration monitoring will occur for a minimum of five years or until success criteria are met.

2.1 VEGETATION

Eleven vegetation plots were established and assess for the baseline vegetation monitoring. The Carolina Vegetative Survey-EEP Protocol Level 2 methodology was used to sample vegetation on October 14 and 15, 2015 (Lee et al. 2006, http://cvs.bio.unc.edu/methods.htm).

2.2 STREAM ASSESSMENT

Twelve permanent monitoring cross-sections have been established on the site as follows:

- Tributary 1A (1,390 feet) – 4 riffle and 3 pool cross-sections
- Tributary 3 (640 feet) – 2 riffle and 1 pool cross-sections
- Tributary 4 (631 feet) – 2 riffle cross-sections

Wolman pebble counts were conducted on each cross-section. Particle sizes less than 2.0 millimeters (mm) were determined by touch using the following guidelines:

- Silt – Smooth feeling (not gritty)
- Fine sand – Slightly gritty texture
- Coarse sand – Very gritty texture

Multiple parameters were located including top of bank, thalweg, and water surface. Pool and riffle features were called out to calculate feature slopes and lengths. The survey was performed with a survey grade GPS (Trimble TCS3 with an R8 Model 3 GNSS receiver).

2.3 VISUAL ASSESSMENT

A visual assessment of the stream was performed to assess the bank (lateral stability), bed (vertical stability), the easement boundary, and site vegetation.

2.4 DIGITAL PHOTOS

Digital photos of each of the vegetation plots and each cross-section were also taken as seen in **Appendix B**.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, T.R. Wentworth. 2006. *CVS-EEP Protocol for RecordingVegetation Version 4.0*.

APPENDIX A – General Figures and Tables

Figure 1: Vicinity Map

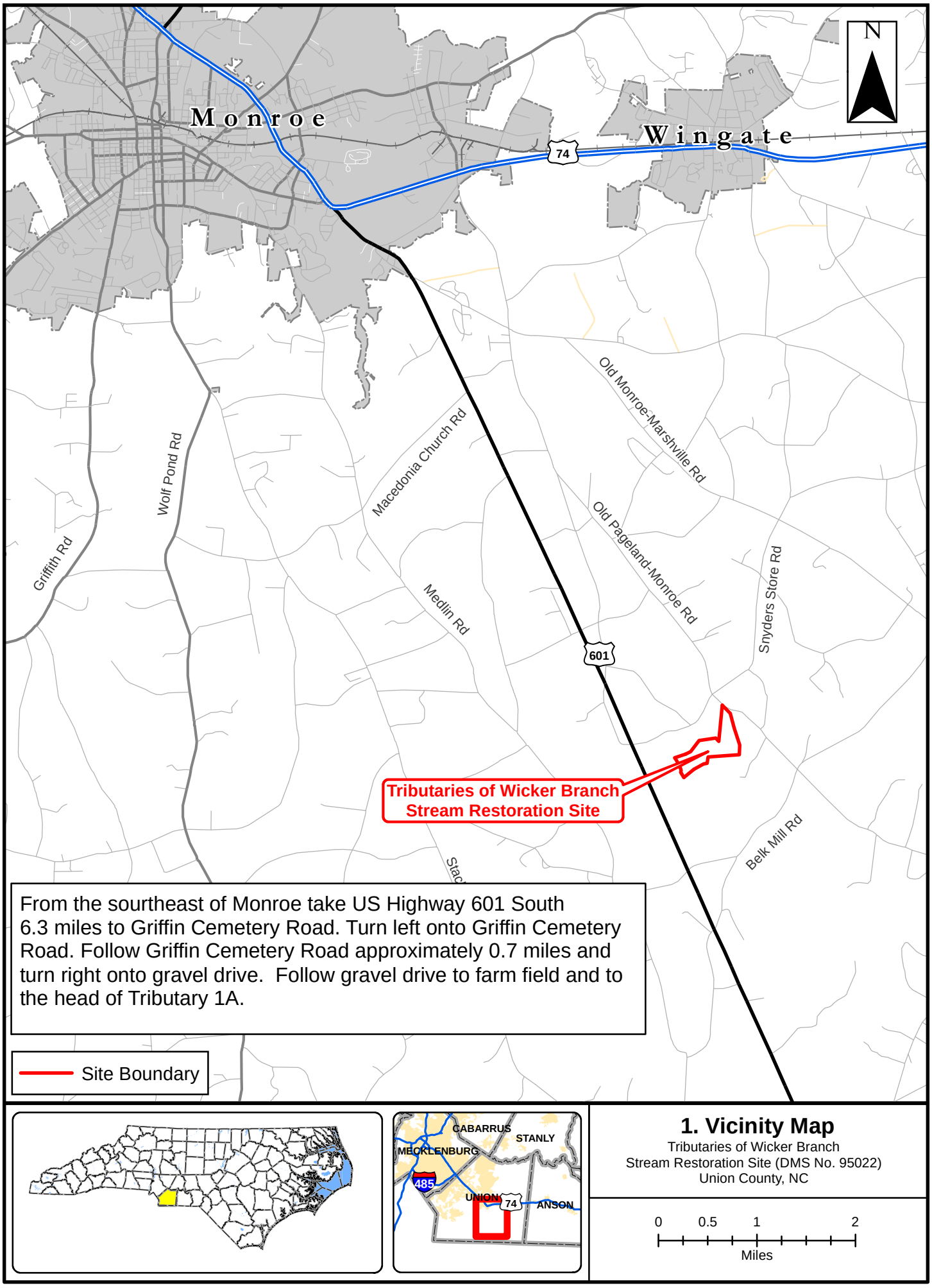
Figure 2: Stream Assets Map

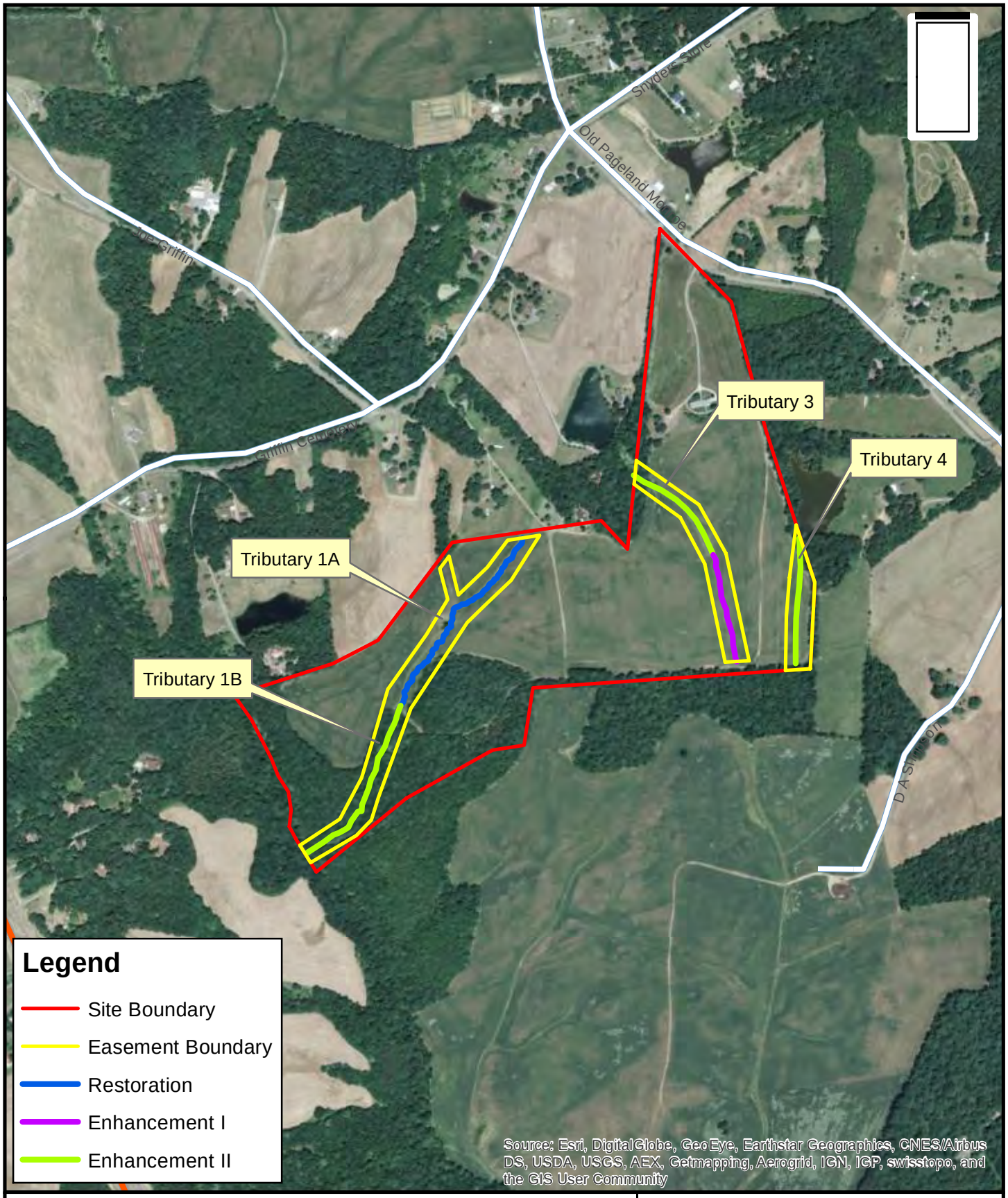
Table 1: Project Components and Mitigation Credits

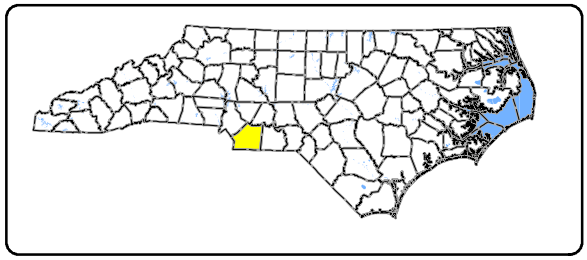
Table 2: Project Activity and Reporting History

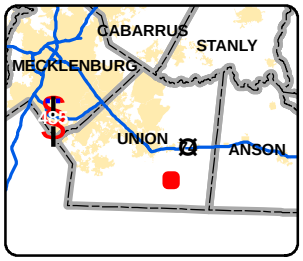
Table 3: Project Contacts

Table 4: Project Baseline Information and Attribute


N
Monroe
Wingate
74
Old Monroe-Marshville Rd
Macedonia Church Rd
Wolf Pond Rd
Griffith Rd
Old Pageland-Monroe Rd
Snyders Store Rd
Medlin Rd
601
Belk Mill Rd
Tributaries of Wicker Branch
Stream Restoration Site
From the sourtheast of Monroe take US Highway 601 South 6.3 miles to Griffin Cemetery Road. Turn left onto Griffin Cemetery Road. Follow Griffin Cemetery Road approximately 0.7 miles and turn right onto gravel drive. Follow gravel drive to farm field and to the head of Tributary 1A.
Site Boundary
CABARRUS
STANLY
MECKLENBURG
485
UNION
74
ANSON
1. Vicinity Map
Tributaries of Wicker Branch
Stream Restoration Site (DMS No. 95022)
Union County, NC
0
0.5
1
2
Miles







2. Stream Assets Map

Tributaries of Wicker Branch
Stream Restoration Site (DMS No. 95022)
Union County, NC

0 250 500 1,000
Feet

Table 1. Project Components and Mitigation Credits
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Offset	Phosphorous Offset
Type	R	RE	R	RE	R	RE			
Totals	2539.67	0							

Project Components

Project Component	Stationing/Location	Existing Footage	Approach	Restoration or Restoration Equivalent	Restoration Footage	Mitigation Ratio	SMUs by Reach
Tributary 1A		1293	Restoration	Restoration	1390	1:1	1390.00
Tributary 1B		1095	Enhancement II	Enhancement II	1095	3:1	365.00
Tributary 2		330	N/A	N/A	330	N/A	0.00
Tributary 3		264	Enhancement II	Enhancement II	264	2.5:1	105.60
Tributary 3		640	Enhancement I	Enhancement I	640	1.5:1	426.67
Tributary 4		631	Enhancement II	Enhancement II	631	2.5:1	252.40

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	1390					
Enhancement						
Enhancement I	640					
Enhancement II	1990					
Creation						
Preservation						
High Quality Preservation						

Table 2. Project Activity and Reporting History Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	Dec-13	Dec-13
Final Design – Construction Plans	Mar-14	Mar-14
Construction	Nov-14	Nov-14
Permanent seed applied to entire site	Nov-14	Nov-14
Plantings for entire site	Mar-15	Mar-15
Mitigation Plan (Year 0 Monitoring – baseline)	May-15	Jan-16
Year 1 Monitoring - Vegetation and Stream Channel	Oct-15	Mar-16
Year 2 Monitoring - Vegetation and Stream Channel	Oct-16	Dec-16
Invasives Control	Oct-17	Oct-17
Year 3 Monitoring -Vegetation and Stream Channel	Oct-17	Feb-18
Invasives Control	July/Spt-18	July/Spt-18
Year 4 Monitoring Vegetation and Stream Channel	Oct-18	Jan-19
Invasives Control - proposed	May-19	
Year 5 Monitoring -Vegetation and Stream Channel		

Table 3. Project Contact Table Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022	
Owner NCDEQ - Division of Mitigation Services	Harry Tsomides NCDEQ - Division of Mitigation Services 5 Ravenscroft Drive, Suite 102 Asheville, NC 28801 (828) 545-7057
Designer AECOM of North Carolina, Inc.	Ron Johnson, Project Manager 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 (919) 854-6210
Landowner Richard Simpson	3308 Old Pageland Monroe Rd. Monroe, NC 28112 704-506-5184
Construction Contractor	Riverworks 6105 Chapel Hill Road Raleigh, NC 27607
Planting Contractor	Efird's Landscaping 42759 Greenview Drive Albemarle, NC 38001 (704) 985-6559
Seeding Contractor	Riverworks
Invasives Contractor	Habitat Assessment & Restoration Professionals Charlotte, North Carolina
Monitoring Performer AECOM of North Carolina, Inc.	701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 919-760-4000

Table 4. Project Baseline Information and Attributes Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022					
Project Information					
Project Name	Tributaries of Wicker Branch				
Project County	Union				
Project Area (acres)	15.49				
Project Coordinates (lat/long)	34.8946849, -80.4472082				
Project Watershed Summary					
Physiographic Province	Carolina Slate Belt - Piedmont				
Project River Basin	Yadkin-Pee Dee				
USGS HUC for Project	3040105081010				
NCDWQ Sub-basin for Project	3/7/2014				
Project Drainage Area (acres)	173				
Project Drainage Area Percentage of Impervious Area	2% to 3%				
CGIA Land Use Classification	Cultivated/Managed Herbaceous Cover				
Reach Summary Information (Pre-restoration)					
Parameters	**Trib 1A**	**Trib 1B**	**Trib 2**	**Trib 3**	**Trib 4**
Length of Reach (feet)	1293	1095	330	1184	631
Valley Classification	Type II	Type II	Type II	Type II	Type II
Drainage area (acres)	71.5	94.5	17.6	32.7	29.8
NCDWQ Stream ID Score	38.5	38.5	27	43	31.5
NCDWQ Water Quality Classification	WS-V	WS-V	WS-V	WS-V	WS-V
Morphological Description	B4c, G4c, F4	C4/F4	N/A	F/B6c/F6	N/A*
Evolutionary Trend	G→F→C	N/A	N/A	G→F→C	N/A
Underlying Mapped Soils	Cid channery silt loam	Chewacla silt loam	Cid channery silt loam, Badin channery silt loam	Cid channery silt loam	Cid channery silt loam, Goldston-Badin complex
Drainage Class	Moderately well drained/ somewhat poorly drained	Somewhat poorly drained	Moderately well drained/ somewhat poorly drained, well drained	Moderately well drained/ somewhat poorly drained	Somewhat poorly drained to excessively drained
Soil Hydric Status	No	Yes	No	No	No
Slope	1.30%	1.00%	1.70%	1.40%	1.00%
FEMA Classification	Zone X	Zone X	Zone X	Zone X	Zone X
Native Vegetation	None	Mesic Mixed Hardwoods	None	None	None
Percent Composition of Exotic Invasive Vegetation	0	50 % Understory	0	0	0

Regulatory Considerations		
Regulation	**Applicable**	**Resolved**
Waters of the US – Section 404	Yes	Yes
Waters of the US – Section 401	Yes	Yes
Endangered Species Act	Yes	Yes
Historic Preservation Act	No	N/A
CZMA/CAMA	No	N/A
FEMA Floodplain Compliance	No	N/A
Essential Fisheries Habitat	No	N/A

APPENDIX B – VISUAL ASSESSMENT DATA

Figure 3: Current Condition Plan View

Table 5: Visual Stream Morphology Stability Assessment

Table 6: Vegetation Condition Assessment

Photos: Stream Stations

Photos: Vegetation Plots

Tributary 4

Figure 3c

Tributary 3

Existing Unimproved Road

Driveway

Tributary 1A

Figure 3a

Tributary 1B

Figure 3b

Tributary 2

Wicker Branch

Wicker Branch

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geogr

N

Year 4 Conditions

- Photo Locations
- Invasives
- Enchroachment
- Vegetation Problem Area

Vegetation Plots

- Criteria Met
- Criteria Not Met

Legend

- Existing Wetlands
- Level Spreader
- Cross Sections
- Stream
- Equipment Crossing
- Easement Boundary
- Log Sill

0 50 100

Scale in Feet

Existing Condition Plan View

Tributaries of Wicker Branch Stream Restoration

Union County, NC

DMS Project No. 95022

FIGURE 3

Tributary 1A

XS-1

XS-2

XS-5

XS-6

VP - 1

VP - 2

VP - 3

VP - 4

0+00

1+00

2+00

3+00

4+00

5+00

6+00

7+00

8+00

9+00

10+00

11+00

12+00

Transducer 1

Transducer 2

Photo Monitoring Point 1

Photo Monitoring Point 6

Photo Monitoring Point 2

Cattails and honeysuckle

Tributary 2

XS-3

XS-4

Tributary 1A

N

Year 4 Conditions

- Stationing
- Photo Locations
- Crest Gauge
- Transducer
- Invasives
- Enchroachment

Vegetation Plots

- Criteria Met
- Criteria Not Met

Legend

- Existing Wetlands
- Culvert
- Unimproved Road
- Level Spreader
- Stream
- Easement Boundary
- Cross Sections
- Equipment Crossing
- Log Sill

0 50 100

Scale in Feet

Existing Condition Plan View

Tributaries of Wicker Branch Stream Restoration
Union County, NC
DMS Project No. 95022

FIGURE 3a

Wicker Branch

Privet scattered through floodplain

Scour around log sill

Tributary 1B

XS-5

XS-6

XS-7

11+00

12+00

13+00

14+00

15+00

16+00

17+00

18+00

19+00

20+00

21+00

22+00

23+00

24+00

Crest Gauge

Transducer 1

VP - 4

Tributary 1A

Year 4 Conditions

- Stationing
- Photo Locations
- Crest Gauge
- Transducer
- Invasives
- Enchroachment

Vegetation Plots

- Criteria Met
- Criteria Not Met

Legend

- Existing Wetlands
- Culvert
- Unimproved Road
- Level Spreader
- Stream
- Easement Boundary
- Cross Sections
- Equipment Crossing
- Log Sill

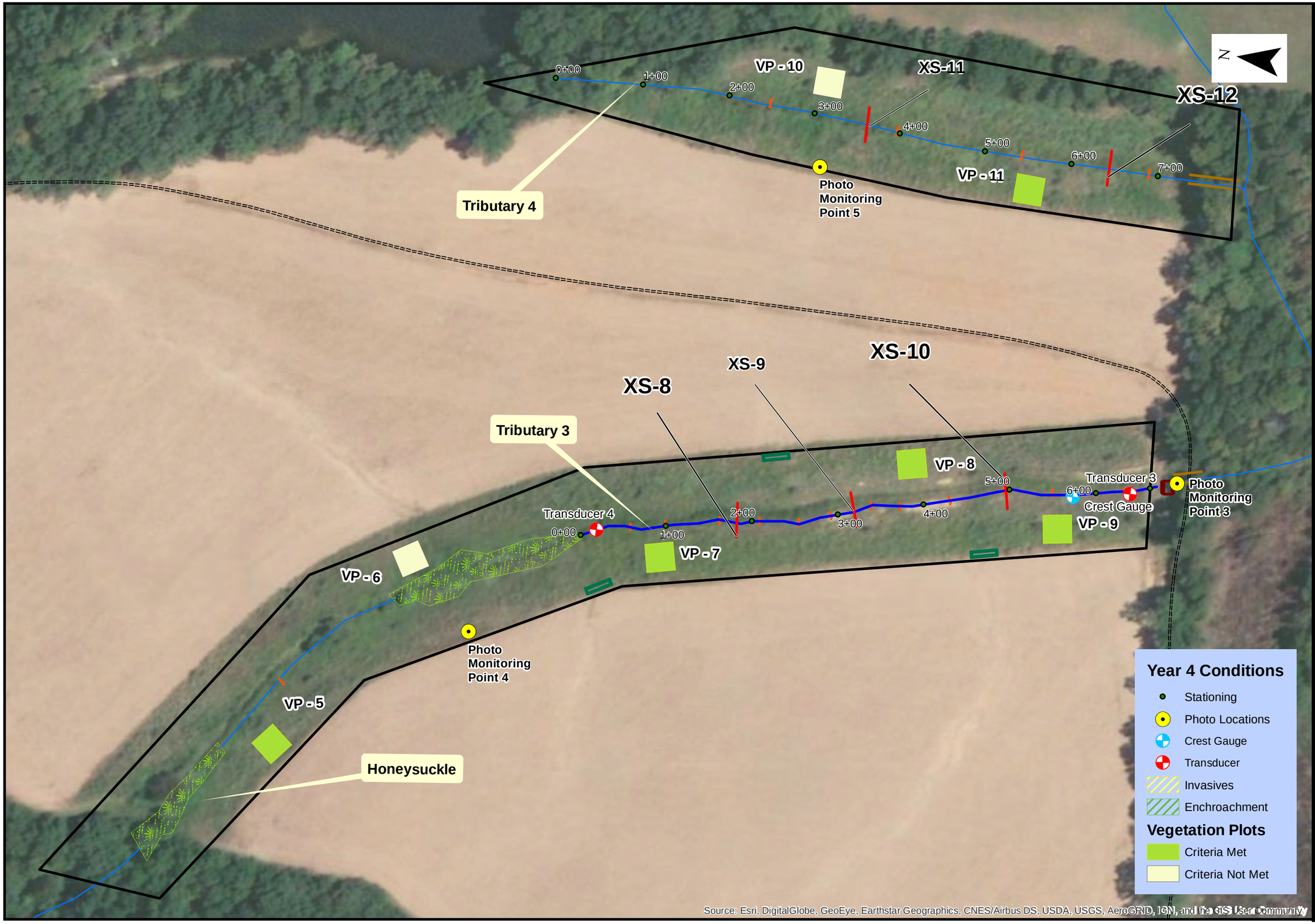
0 50 100

Scale in Feet

Existing Condition Plan View

Tributaries of Wicker Branch Stream Restoration
Union County, NC
DMS Project No. 95022

FIGURE 3b



Existing Condition Plan View

Tributaries of Wicker Branch Stream Restoration
Union County, NC
DMS Project No. 95022

FIGURE 3C

Table 5. Visual Stream Morphology Stability Assessment
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Reach ID Tributary 1
Assessed Length 2485

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	50	50			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	49	49			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	49	49			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	50	50			100%			
		2. Thalweg centering at downstream of meander (Glide)	50	50			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	32	33			97%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	33	33			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	33	33			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)	33	33			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	33	33			100%			

Table 5. Visual Stream Morphology Stability Assessment
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Reach ID	**Tributary 3**
Assessed Length	**904**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	12	12			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	12	12			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	12	12			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	12	12			100%			
		2. Thalweg centering at downstream of meander (Glide)	12	12			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	13	13			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	13	13			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	13	13			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)	13	13			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	13	13			100%			

Table 5. Visual Stream Morphology Stability Assessment
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Reach ID Tributary 4
Assessed Length 630

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

Table 6. Vegetation Condition Assessment
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Planted Acreage 11.57

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Area
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Beige dot pattern	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 acres	Red Hatch	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 acres	N/A	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2] **15.49**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Presence of Chinese privet and honeysuckle	1000 SF	Yellow Hatch	1	0.80	5.2%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Green Hatch	2	0.04	0.3%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will there25fore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Vegetation Monitoring Plot 1 – 10/9/2017

Vegetation Monitoring Plot 4 – 10/9/2017

Vegetation Monitoring Plot 2 – 10/9/2017

Vegetation Monitoring Plot 5 – 10/9/2017

Vegetation Monitoring Plot 3 – 10/9/2017

Vegetation Monitoring Plot 6 – 10/9/2017

Vegetation Monitoring Plot 7 – 10/9/2017

Vegetation Monitoring Plot 10 – 10/9/2017

Vegetation Monitoring Plot 8 – 10/9/2017

Vegetation Monitoring Plot 11 – 10/9/2017

Vegetation Monitoring Plot 9 – 10/9/2017

Cross Section 1 (looking upstream) – 10/4/17

Cross Section 4 (looking upstream) – 10/4/17

Cross Section 2 (looking upstream) – 10/4/17

Cross Section 5 (looking upstream) – 10/4/17

Cross Section 3 (looking upstream) – 10/4/17

Cross Section 6 (looking upstream) – 10/4/17

Cross Section 7 (looking upstream) – 12/13/17

Cross Section 10 (looking upstream) – 10/4/17

Cross Section 8 (looking upstream) – 10/4/17

Cross Section 11 (looking upstream) – 10/4/17

Cross Section 9 (looking upstream) – 10/4/17

Cross Section 12 (looking upstream) – 10/4/17

Photo Monitoring Point 1 – 10/3/2017

Photo Monitoring Point 2 – 10/3/2017

Photo Monitoring Point 3 – 10/3/2017

Photo Monitoring Point 4 – 10/3/2017

Photo Monitoring Point 5 – 10/3/2017

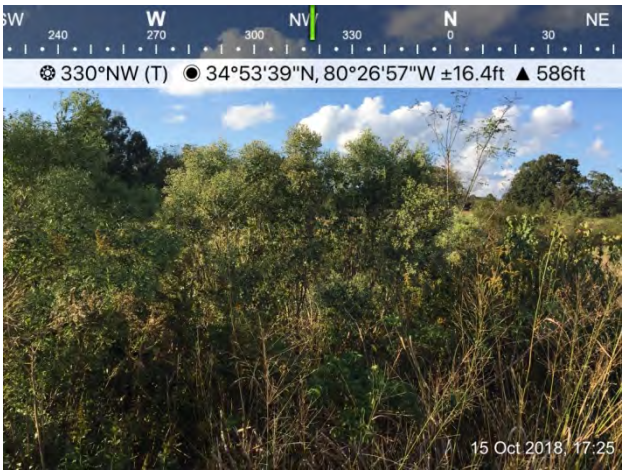


Photo Monitoring Point 6 – 10/3/2017

APPENDIX C: VEGETATION PLOT DATA

Table 7: Vegetation Plot Counts and Densities

Table 7. Vegetation Plot Stem Count Summary
DMS Project Code 95022. Project Name: Tributaries of Wicker Branch

			Current Plot Data (MY4 2018)																							
			95022-01-0001			95022-01-0002			95022-01-0003			95022-01-0004			95022-01-0005			95022-01-0006			95022-01-0007			95022-01-0008		
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																								
Acer negundo var. negundo	boxelder	Tree									1															
Acer rubrum	red maple	Tree																		8						5
Carya	hickory	Tree												2												
Celtis laevigata	sugarberry	Tree									1															
Celtis occidentalis	common hackberry	Tree												2												2
Cercis canadensis	eastern redbud	Tree	1	1	1	2	2	2	3	3	3	4	4	4	2	2	3				3	3	3	1	1	1
Cornus alternifolia	alternateleaf dogwood	Tree															2									
Cornus amomum	silky dogwood	Shrub	4	4	4							2	2	2	2	2	2				1	1	1			
Diospyros virginiana	common persimmon	Tree	1	1	1				1	1	1													3	3	3
Juniperus virginiana	eastern redcedar	Tree																								1
Liquidambar styraciflua	sweetgum	Tree			2						2			4			1						1			
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	1				2	2	2	3	3	3				1	1	1			
Pinus taeda	loblolly pine	Tree			1												1									
Platanus occidentalis	American sycamore	Tree																								
Populus deltoides	eastern cottonwood	Tree																								2
Prunus serotina	black cherry	Tree																								
Quercus	oak	Tree																								
Quercus alba	white oak	Tree	3	3	3	3	3	3	2	2	2	1	1	1	5	5	5	3	3	3	6	6	6	4	4	4
Quercus falcata	southern red oak	Tree	4	4	4										1	1	1	1	1	1				1	1	1
Rhus copallinum	flameleaf sumac	shrub																								
Rhus glabra	smooth sumac	shrub												1												
Robinia pseudoacacia	black locust	Tree	1	1	1	1	1	1										1	1	1	4	4	4			
Salix nigra	black willow	Tree											1	1												
Sambucus canadensis	Common Elderberry	Shrub	5	5	5	3	3	3	3	3	3													1	1	1
Ulmus alata	winged elm	Tree																								
Ulmus rubra	slippery elm	Tree			2						1			4												
Unknown		Shrub or Tree																								
		Stem count	20	20	25	10	10	10	9	9	14	9	10	23	13	13	18	5	5	13	15	15	16	10	10	20
		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	8	8	11	5	5	5	4	4	8	4	5	10	5	5	8	3	3	4	5	5	6	5	5	9
		Stems per ACRE	809.4	809.4	1012	404.7	404.7	404.7	364.2	364.2	566.6	364.2	404.7	930.8	526.1	526.1	728.4	202.3	202.3	526.1	607	607	647.5	404.7	404.7	809.4

			Current Plot Data (MY4 2018)									Annual Means													
			95022-01-0009			95022-01-0010			95022-01-0011			MY4 (2018)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
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															5			3						
Acer negundo var. negundo	boxelder	Tree												1												
Acer rubrum	red maple	Tree			4									17												
Carya	hickory	Tree							1	1	1	1	1	3												
Celtis laevigata	sugarberry	Tree												1												
Celtis occidentalis	common hackberry	Tree												4			1									
Cercis canadensis	eastern redbud	Tree	4	4	4	2	2	2	1	1	1	23	23	24	23	23	23	22	22	25	21	21	21	26	26	26
Cornus alternifolia	alternateleaf dogwood	Tree												2												
Cornus amomum	silky dogwood	Shrub							1	1	1	10	10	10	10	10	10	11	11	12	18	18	18	21	21	21
Diospyros virginiana	common persimmon	Tree							1	1	2	6	6	7	6	6	6	7	7	10	6	6	6	7	7	7
Juniperus virginiana	eastern redcedar	Tree												1												
Liquidambar styraciflua	sweetgum	Tree						5			2			17						13						
Liriodendron tulipifera	tuliptree	Tree	2	2	2				1	1	1	11	11	11	13	13	13	16	16	18	16	16	16	38	38	38
Pinus taeda	loblolly pine	Tree												2						2						
Platanus occidentalis	American sycamore	Tree																		1						
Populus deltoides	eastern cottonwood	Tree												2			1									
Prunus serotina	black cherry	Tree									1			1												
Quercus	oak	Tree																			1	1	1	2	2	2
Quercus alba	white oak	Tree	3	3	3	1	1	1	3	3	3	34	34	34	34	34	34	35	35	36	26	26	26	41	41	41
Quercus falcata	southern red oak	Tree										7	7	7	7	7	7	9	9	11	10	10	10	20	20	20
Rhus copallinum	flameleaf sumac	shrub																		1						
Rhus glabra	smooth sumac	shrub			5									6						1						
Robinia pseudoacacia	black locust	Tree	1	1	1	1	1	2			3	9	9	13	9	9	9	8	8	14	7	7	7	9	9	9
Salix nigra	black willow	Tree											1	1		1	1		1	4		1	1		1	1
Sambucus canadensis	Common Elderberry	Shrub				2	2	2	2	2	2	16	16	16	16	16	16	18	18	21	15	15	15	21	21	21
Ulmus alata	winged elm	Tree																		2						
Ulmus rubra	slippery elm	Tree									1			8			2									
Unknown		Shrub or Tree													1	1	1	1	1	1	1	1	1	1	1	1
		Stem count	10	10	19	6	6	12	10	10	18	117	118	188	119	120	129	127	128	175	121	122	122	186	187	187
		size (ares)	1			1			1			11			11			11			11			11		
		size (ACRES)	0.02			0.02			0.02			0.27			0.27			0.27			0.27			0.27		
		Species count	4	4	6	4	4	5	7	7	11	9	10	22	9	10	14	9	10	17	10	11	11	10	11	11
		Stems per ACRE	404.7	404.7	768.9	242.8	242.8	485.6	404.7	404.7	728.4	430.4	434.1	691.6	437.8	441.5	474.6	467.2	470.9	643.8	445.2	448.8	448.8	684.3	688	688

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

APPENDIX D: STREAM GEOMORPHOLOGY DATA

Cross-Sections

Longitudinal Profiles

Pebble Counts

Table 8: Baseline Stream Data Summary

Table 9a: Cross-Section Morphology Data

Table 9b: Stream Reach Morphology Data

Cross-section Plot Exhibit

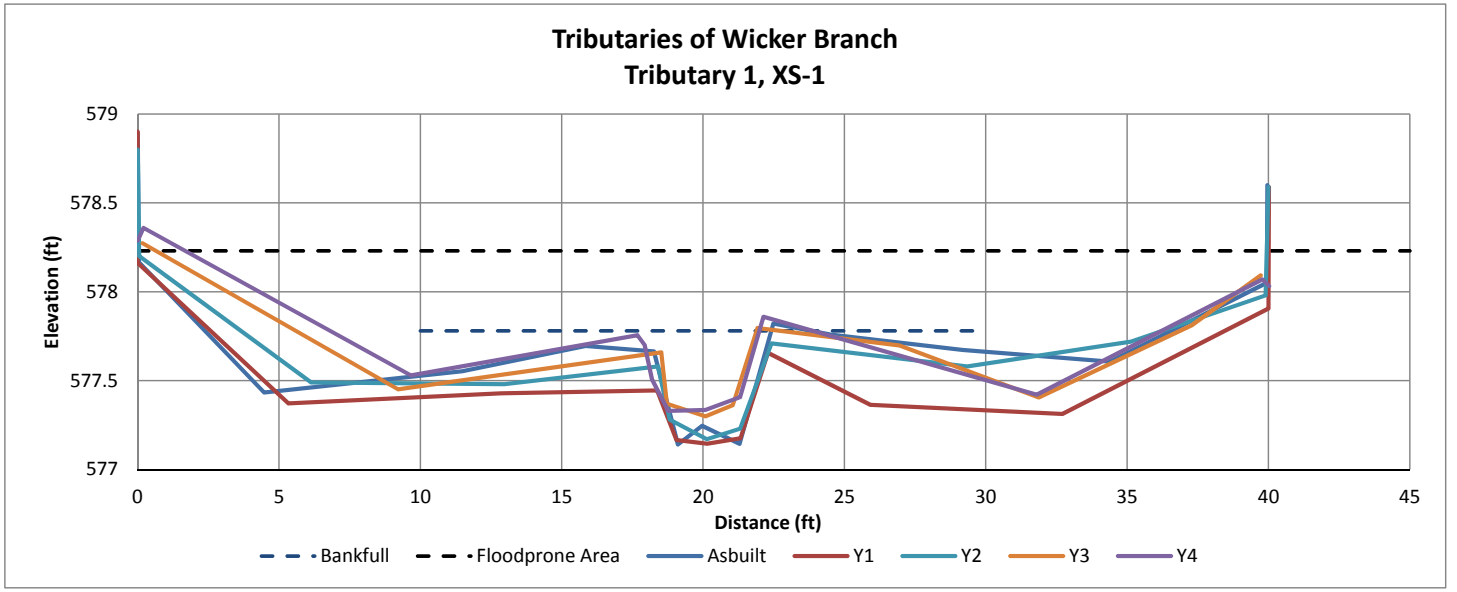
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-1, Sta. 4+65
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	578.29	LBPIN
0.21	578.36	GR
9.66	577.53	GR
17.68	577.76	GR
17.93	577.70	TOB
18.19	577.51	
18.77	577.33	TOE
20.08	577.34	TW
21.31	577.41	TOE
22.14	577.86	TOB
31.80	577.42	GR
39.79	578.07	GR
40.03	578.03	RBPIN

Summary Data

Bankfull Elevation	577.78
Bankfull Width (ft)	4.77
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.31
Bankfull Max Depth (ft)	0.45
Bankfull Cross Sectional Area (ft^2)	1.51
Bankfull Width/Depth Ratio	15.39
Bankfull Entrenchment Ratio	8.03
Low Top of Bank Depth (ft)	0.43
Bankfull Bank Height Ratio	0.96

Photo: Cross-section 1 looking upstream



Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-2, Sta. 5+05
Feature	Pool
Drainage Area (sq mi)	0.15
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	577.45	LBPIN
6.20	576.99	GR
12.55	577.14	GR
17.90	577.06	TOB
19.50	575.73	TOE
20.40	575.57	TW
21.19	575.69	TOE
23.15	576.64	TOB
29.50	576.85	GR
34.10	576.87	GR
39.71	577.35	GR
40.06	577.34	RBPIN

Summary Data	
Bankfull Elevation	576.77
Bankfull Width (ft)	8.83
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.45
Bankfull Max Depth (ft)	1.2
Bankfull Cross Sectional Area (ft^2)	3.98
Bankfull Entrenchment Ratio	19.6
Low Top of Bank Depth (ft)	5.6
Low Top of Bank Depth (ft)	1.07
Bankfull Bank Height Ratio	0.89

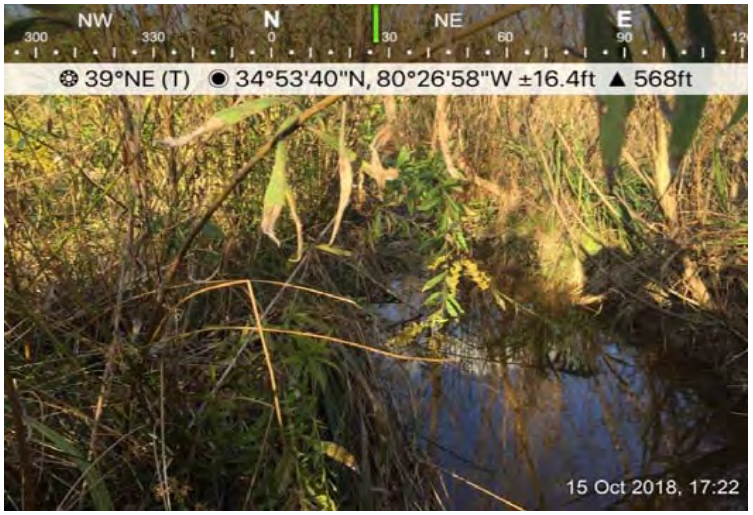
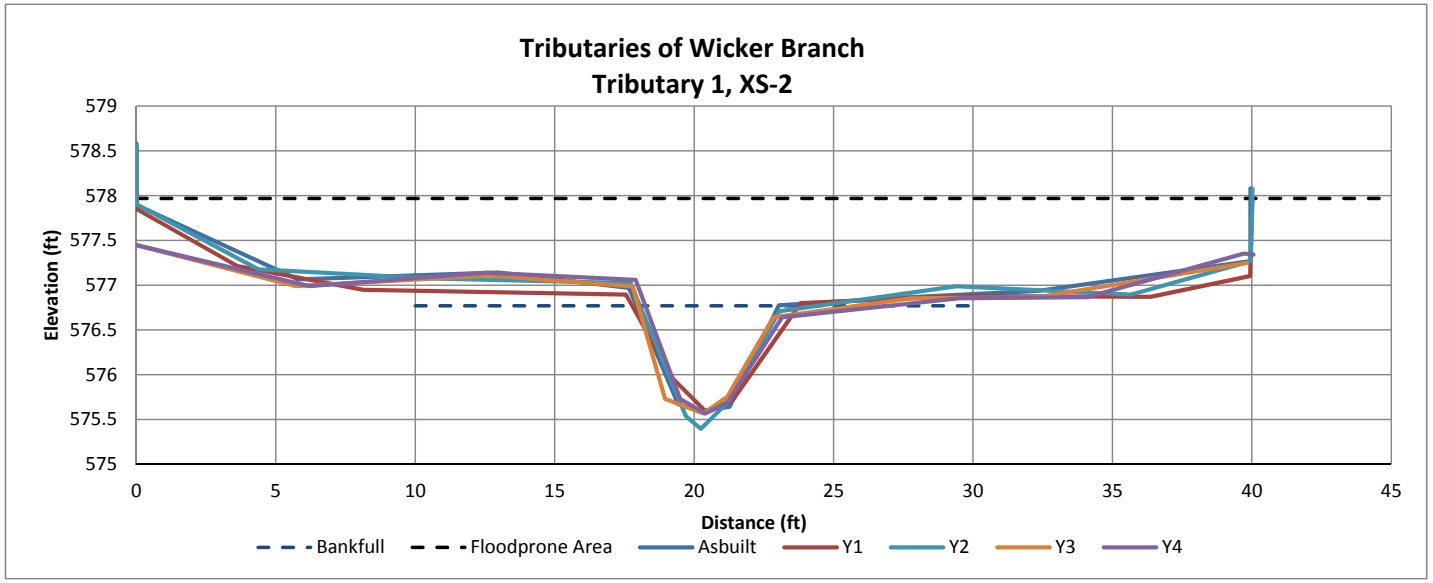


Photo: Cross-section 2 looking upstream



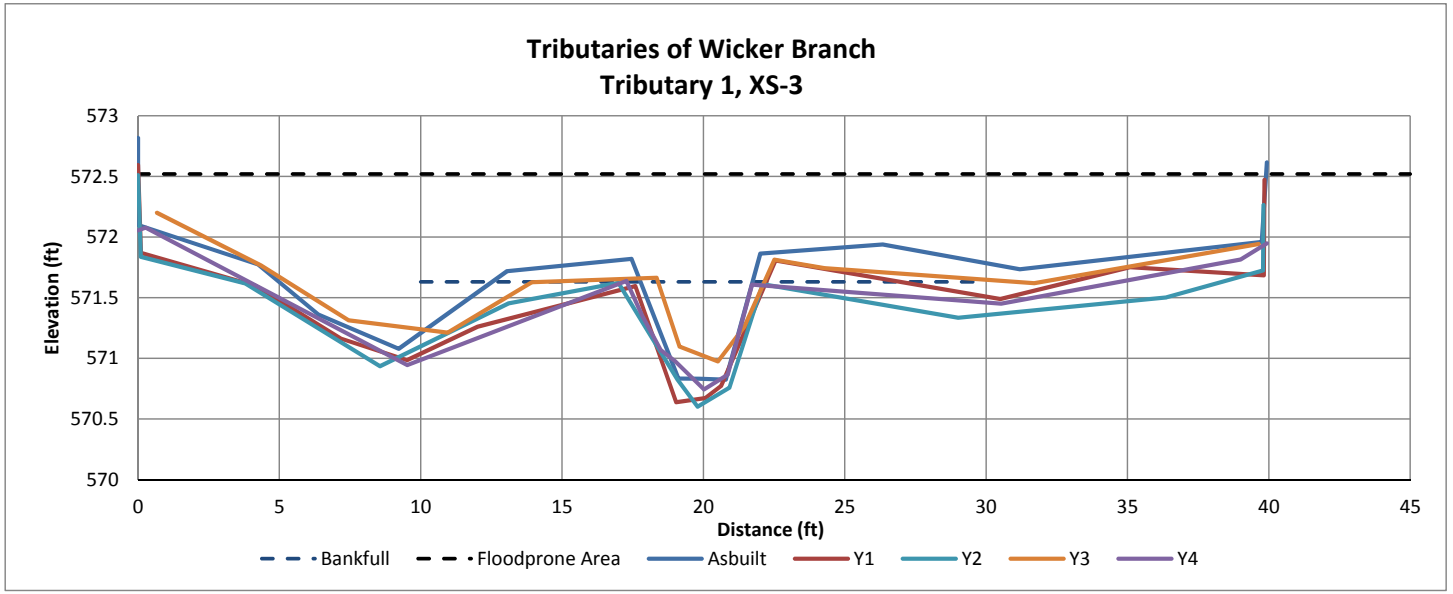
Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-3, Sta. 9+34
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	572.06	LBPIN
0.27	572.08	GR
9.52	570.95	GR
17.27	571.64	TOB
17.84	571.35	
18.49	571.07	
18.99	570.98	
20.02	570.74	TW
20.85	570.87	TOE
21.72	571.61	TOB
30.52	571.45	GR
39.00	571.82	GR
39.93	571.95	RBPIN

Summary Data	
Bankfull Elevation	571.63
Bankfull Width (ft)	11
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.28
Bankfull Max Depth (ft)	0.89
Bankfull Cross Sectional Area (ft^2)	3.08
Bankfull Width/Depth Ratio	39.29
Bankfull Entrenchment Ratio	4.5
Low Top of Bank Depth (ft)	0.89
Bankfull Bank Height Ratio	1

Photo: Cross-section 3 looking upstream



Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-4, Sta. 9+72
Feature	Pool
Drainage Area (sq mi)	0.15
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	571.94	LBPIN
0.06	571.91	GR
7.23	571.18	GR
13.49	571.03	TOB
14.38	570.42	TOE
15.39	569.72	TW
16.86	570.50	TOE
17.60	570.83	
18.77	571.27	TOB
27.32	571.04	GR
39.70	571.43	GR
40.08	571.73	RBPIN

Summary Data

Bankfull Elevation	571.14
Bankfull Width (ft)	9.6
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.38
Bankfull Max Depth (ft)	1.42
Bankfull Cross Sectional Area (ft^2)	3.72
Bankfull Width/Depth Ratio	25.2
Bankfull Entrenchment Ratio	5.2
Low Top of Bank Depth (ft)	1.31
Bankfull Bank Height Ratio	0.92

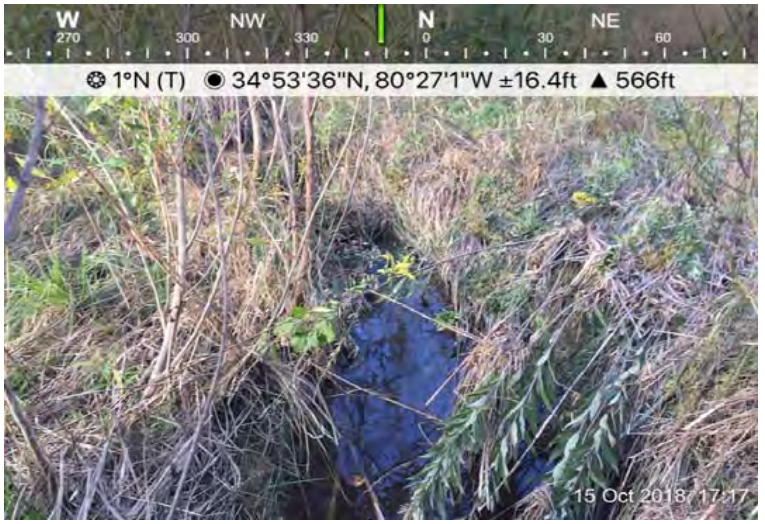
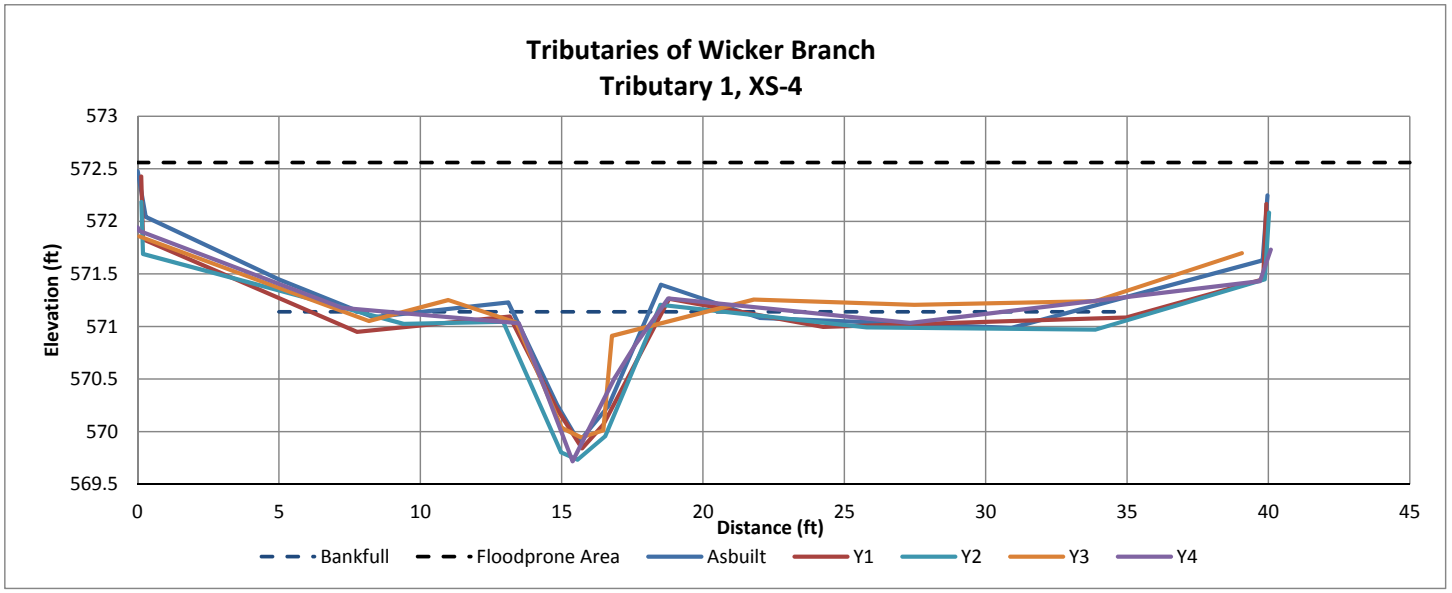


Photo: Cross-section 4 looking upstream



Cross-section Plot Exhibit

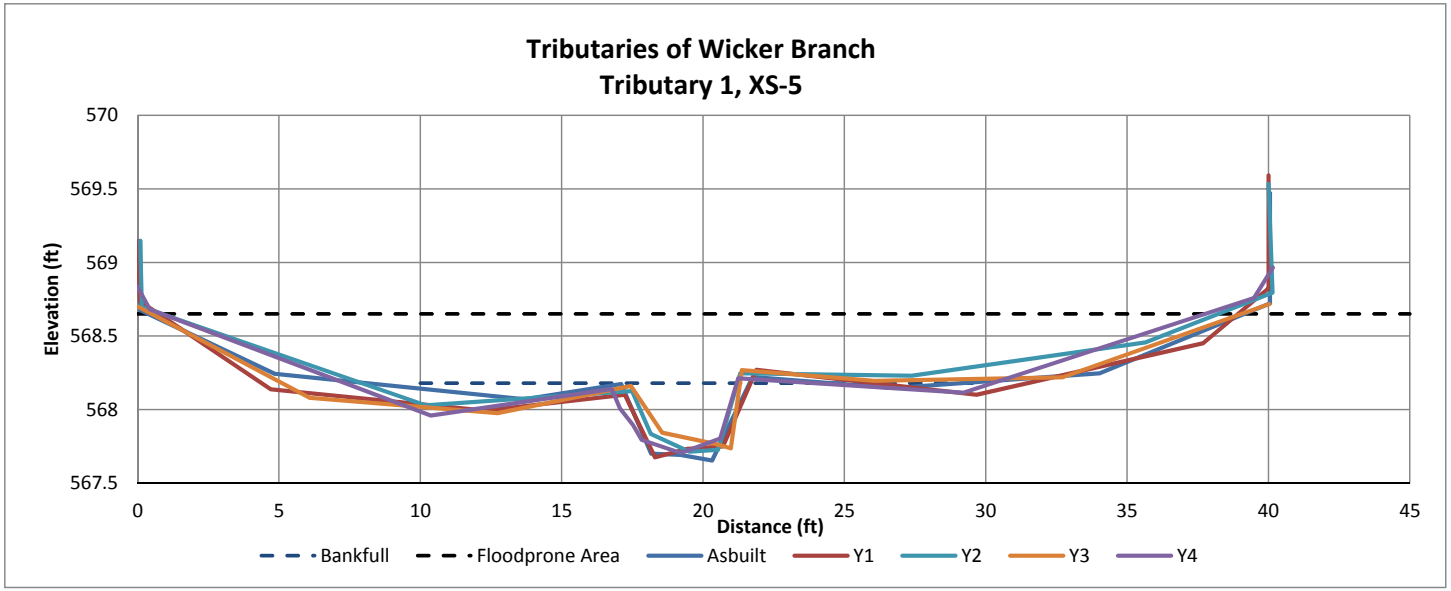
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-5, Sta. 12+10
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	568.83	LBPIN
0.43	568.68	GR
10.37	567.96	GR
16.77	568.14	TOB
17.06	568.01	TOE
17.52	567.90	
17.83	567.80	
19.21	567.71	TW
20.60	567.80	TOE
21.24	568.21	TOB
29.21	568.12	GR
39.49	568.76	GR
40.15	568.97	RBPIN

Summary Data

Bankfull Elevation	568.18
Bankfull Width (ft)	4.5
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.34
Bankfull Max Depth (ft)	0.47
Bankfull Cross Sectional Area (ft^2)	1.54
Bankfull Width/Depth Ratio	13.24
Bankfull Entrenchment Ratio	11.11
Low Top of Bank Depth (ft)	0.43
Bankfull Bank Height Ratio	0.9

Photo: Cross-section 5 looking upstream



Cross-section Plot Exhibit

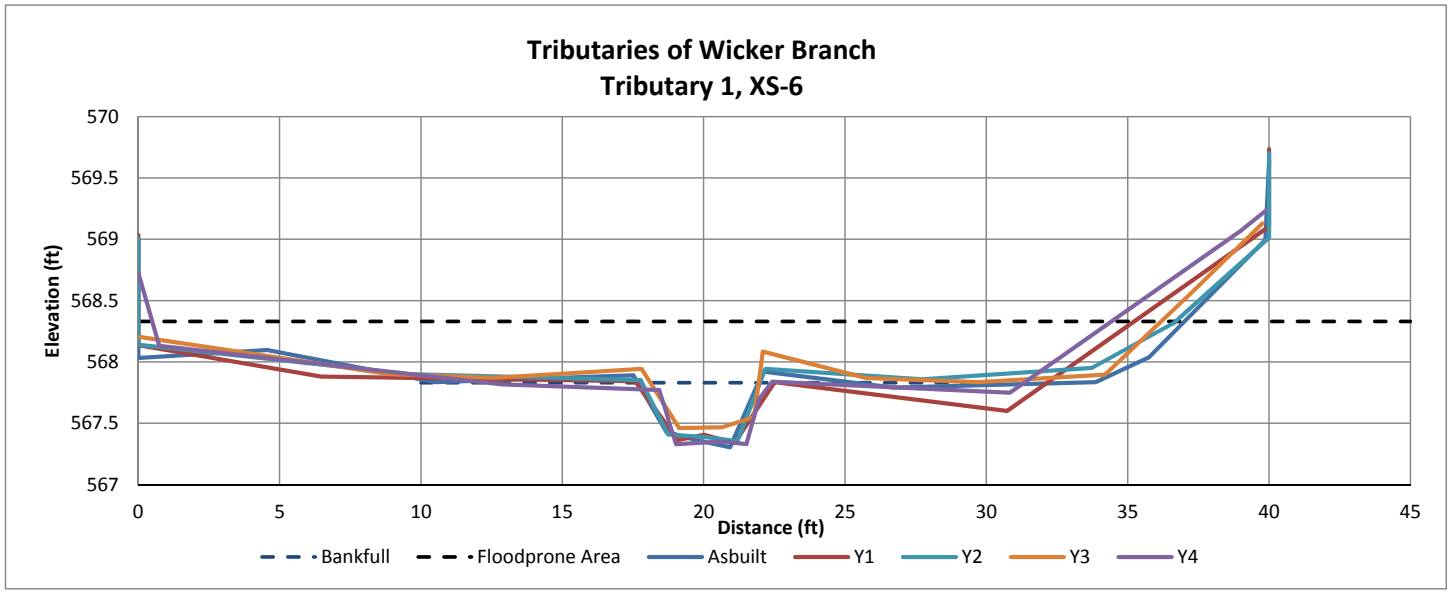
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-6, Sta. 12+37
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	568.73	LBPIN
0.74	568.13	GR
12.87	567.82	GR
18.43	567.77	TOB
19.02	567.33	TW/TOE
20.61	567.35	
21.51	567.33	TOE
21.96	567.70	
22.42	567.84	TOB
30.83	567.75	GR
39.00	569.07	GR
39.89	569.24	RBPIN

Summary Data

Bankfull Elevation	567.83
Bankfull Width (ft)	10.02
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.17
Bankfull Max Depth (ft)	0.5
Bankfull Cross Sectional Area (ft^2)	1.72
Bankfull Width/Depth Ratio	58.4
Bankfull Entrenchment Ratio	4.99
Low Top of Bank Depth (ft)	0.44
Bankfull Bank Height Ratio	0.88

Photo: Cross-section 6 looking uptream



Cross-section Plot Exhibit

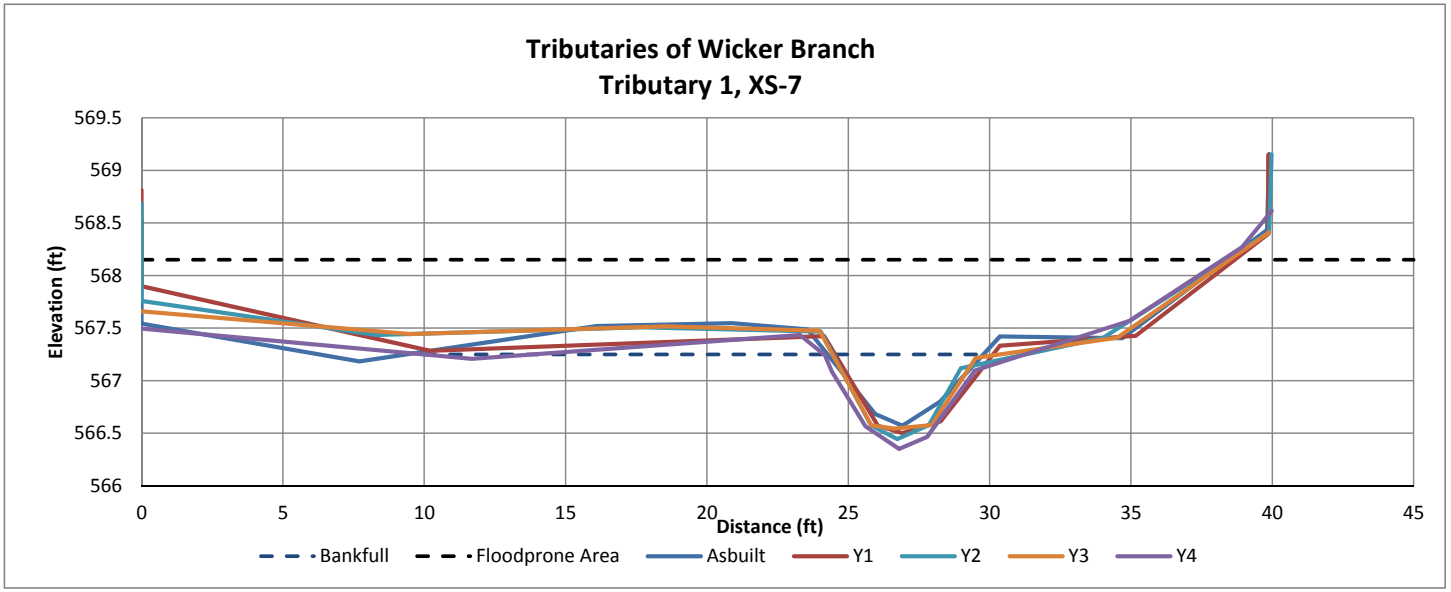
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-7, Sta. 12+72
Feature	Pool
Drainage Area (sq mi)	0.15
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	567.50	LBPIN
11.68	567.21	GR
23.28	567.44	GR
24.17	567.24	
24.42	567.09	TOB
25.61	566.57	TOE
26.80	566.35	TW
27.79	566.47	TOE
29.48	567.10	TOB
34.95	567.57	
38.93	568.27	GR
39.98	568.62	RBPIN

Summary Data

Bankfull Elevation	567.25
Bankfull Width (ft)	7.1
Floodprone Width (ft)	40
Bankfull Mean Depth (ft)	0.45
Bankfull Max Depth (ft)	0.9
Bankfull Cross Sectional Area (ft^2)	3.21
Bankfull Width/Depth Ratio	15.78
Bankfull Entrenchment Ratio	5.6
Low Top of Bank Depth (ft)	0.74
Bankfull Bank Height Ratio	0.82

Photo: Cross-section 7 looking upstream



Cross-section Plot Exhibit

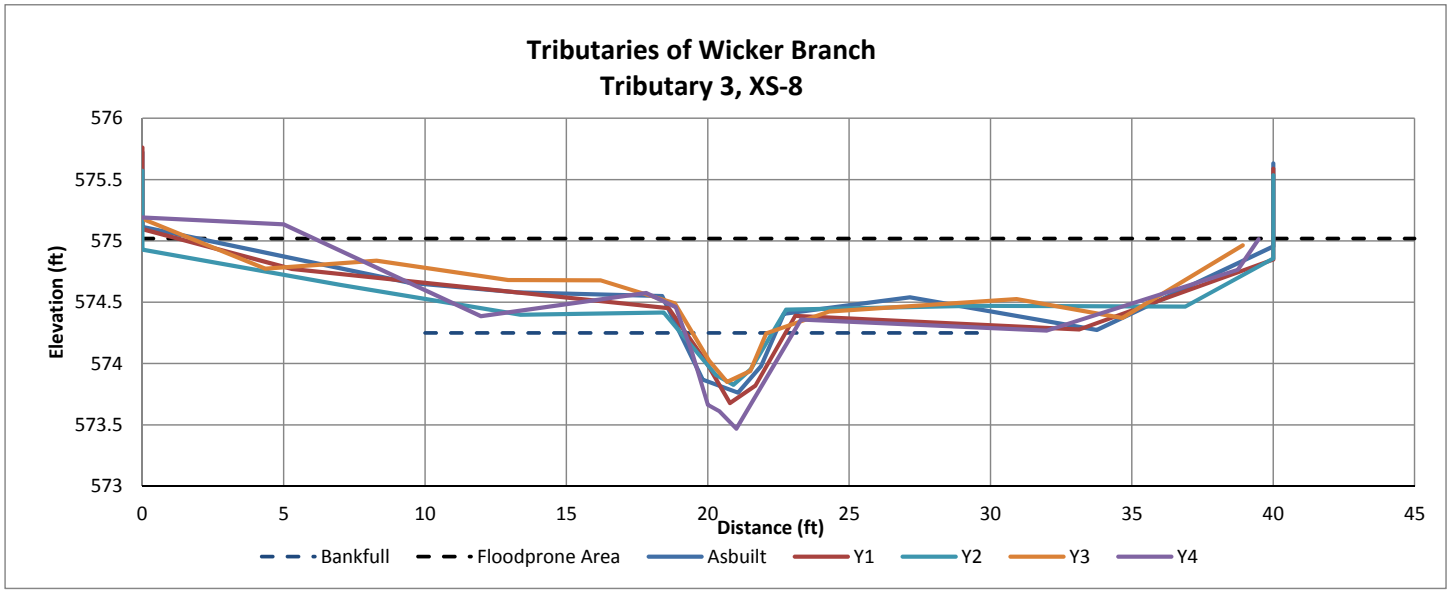
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-8, Sta. 1+83
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	575.19	LBPIN
5.00	575.14	GR
11.98	574.39	GR
17.82	574.58	GR
18.86	574.46	LTOB
19.45	574.08	
20.00	573.66	LTOE
20.41	573.61	
21.01	573.47	RTOE/TW
23.30	574.36	RTOB
31.99	574.27	GR
38.75	574.77	GR
39.48	575.01	RBPIN

Summary Data

Bankfull Elevation	574.25
Bankfull Width (ft)	3.8
Floodprone Width (ft)	40
Bankfull Mean Depth (ft)	0.44
Bankfull Max Depth (ft)	0.77
Bankfull Cross Sectional Area (ft^2)	1.66
Bankfull Width/Depth Ratio	8.59
Bankfull Entrenchment Ratio	10.57
Low Top of Bank Depth (ft)	0.89
Bankfull Bank Height Ratio	1.15

Photo: Cross-section 8 looking downstream



Cross-section Plot Exhibit

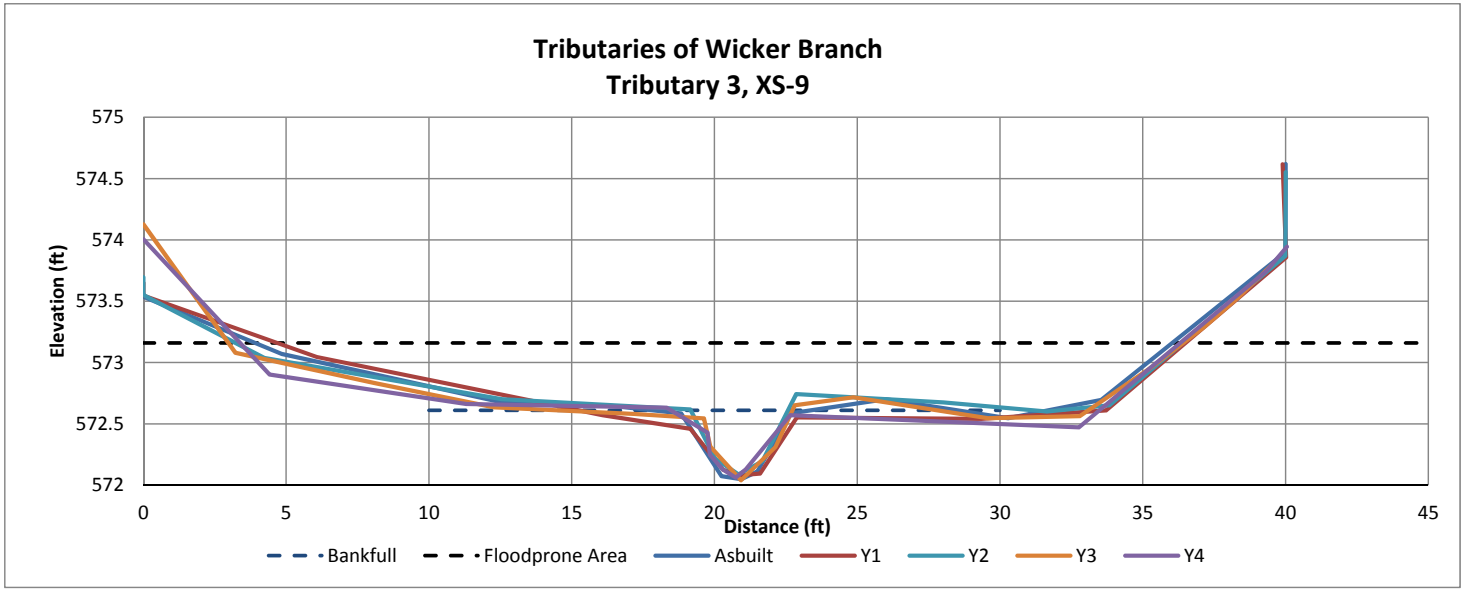
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-9, Sta 3+19
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/15/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	574.01	LBPIN
4.42	572.90	GR
11.31	572.66	GR
18.32	572.63	LTOB
19.76	572.43	
19.83	572.25	
20.28	572.13	LTOE
20.75	572.06	TW
21.10	572.13	RTOE
22.65	572.57	RTOB
32.76	572.47	GR
39.32	573.75	GR
40.05	573.95	RBPIN

Summary Data

Bankfull Elevation	572.61
Bankfull Width (ft)	4.17
Floodprone Width (ft)	33
Bankfull Mean Depth (ft)	0.27
Bankfull Max Depth (ft)	0.55
Bankfull Cross Sectional Area (ft^2)	1.16
Bankfull Width/Depth Ratio	15.44
Bankfull Entrenchment Ratio	7.89
Low Top of Bank Depth (ft)	0.51
Bankfull Bank Height Ratio	0.93

Photo: Cross-section 9 looking upstream



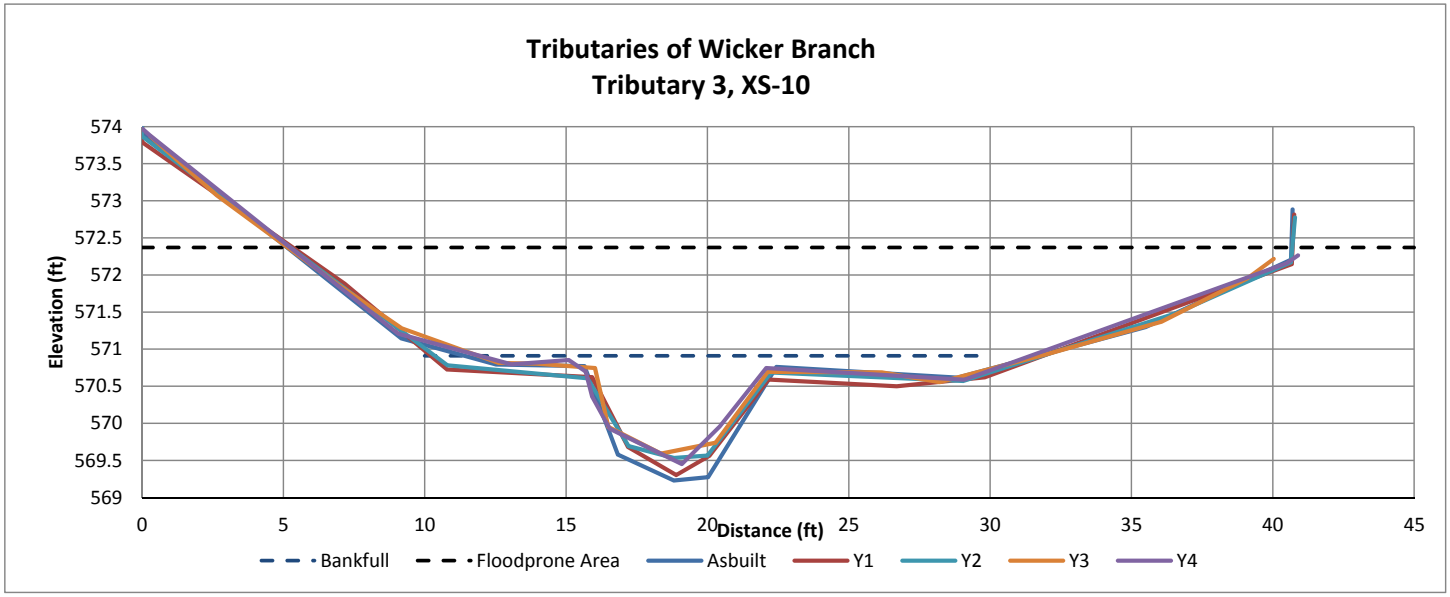
Cross-section Plot Exhibit

River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-10, Sta. 4+95
Feature	Pool
Drainage Area (sq mi)	0.05
Date	10/4/2017
Field Crew	Chris Inscore

Station	Elevation	
0	573.98	LBPIN
0.280323	573.88	GR
9.050526	571.21	GR
13.06106	570.80	GR
15.09038	570.85	GR
15.69159	570.70	GR
15.92276	570.36	TOB
16.53906	569.93	LTOE
19.09092	569.45	TW
20.43003	569.96	RTOE
22.07725	570.75	RTOB
29.08425	570.59	GR
40.48548	572.16	GR
40.89072	572.27	RBPIN

Summary Data	
Bankfull Elevation	570.91
Bankfull Width (ft)	12.03
Floodprone Width (ft)	35
Bankfull Mean Depth (ft)	0.57
Bankfull Max Depth (ft)	1.46
Bankfull Cross Sectional Area (ft^2)	6.98
Bankfull Width/Depth Ratio	21.1
Bankfull Entrenchment Ratio	2.96
Low Top of Bank Depth (ft)	1.29
Bankfull Bank Height Ratio	0.89

Photo: Cross-section 10 looking upstream



Cross-section Plot Exhibit

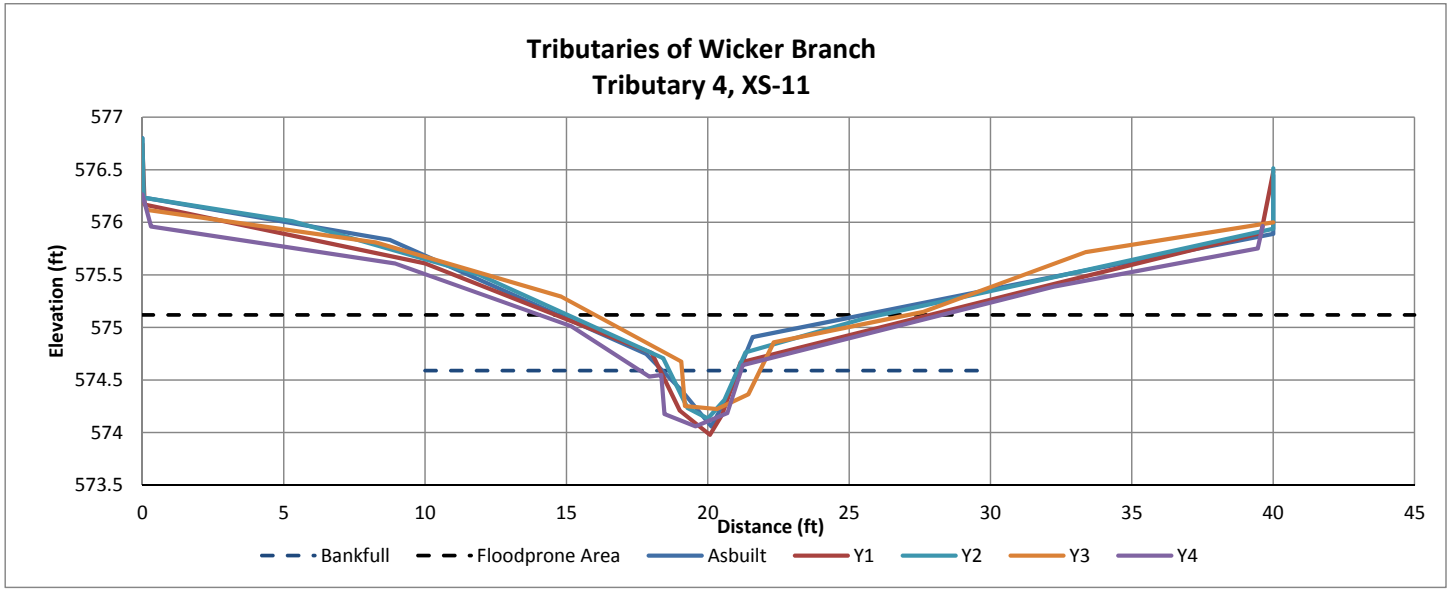
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-11, Sta. 3+61
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/9/2018
Field Crew	Chris Inscore

Station	Elevation	
0.00	576.27	LBPIN
0.31	575.96	GR
8.93	575.61	GR
15.17	575.01	GR
17.93	574.53	GR
18.35	574.55	LTOB
18.47	574.18	LTOE
19.56	574.06	TW
20.69	574.19	RTOE
21.24	574.64	RTOB
32.23	575.39	GR
39.45	575.75	GR
39.63	575.97	RBPIN

Summary Data

Bankfull Elevation	574.59
Bankfull Width (ft)	3.58
Floodprone Width (ft)	14
Bankfull Mean Depth (ft)	0.33
Bankfull Max Depth (ft)	0.53
Bankfull Cross Sectional Area (ft^2)	1.21
Bankfull Width/Depth Ratio	10.85
Bankfull Entrenchment Ratio	3.97
Low Top of Bank Depth (ft)	0.49
Bankfull Bank Height Ratio	0.93

Photo: Cross-section 11 looking upstream



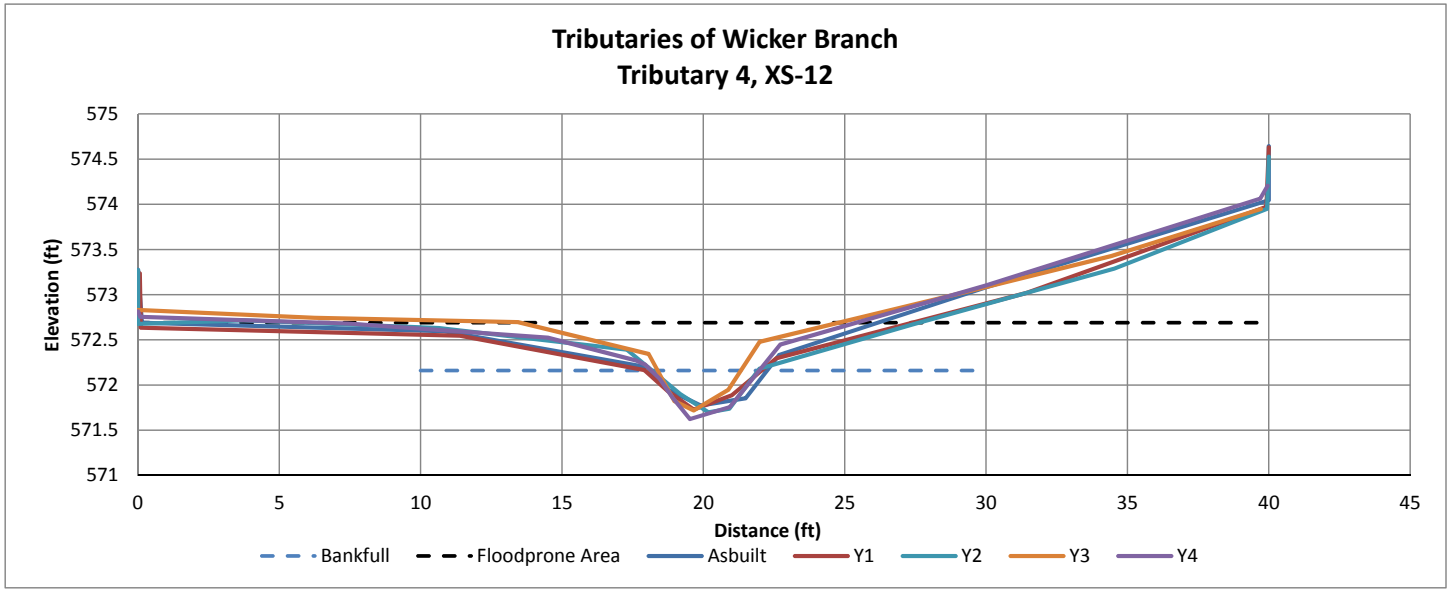
Cross-section Plot Exhibit

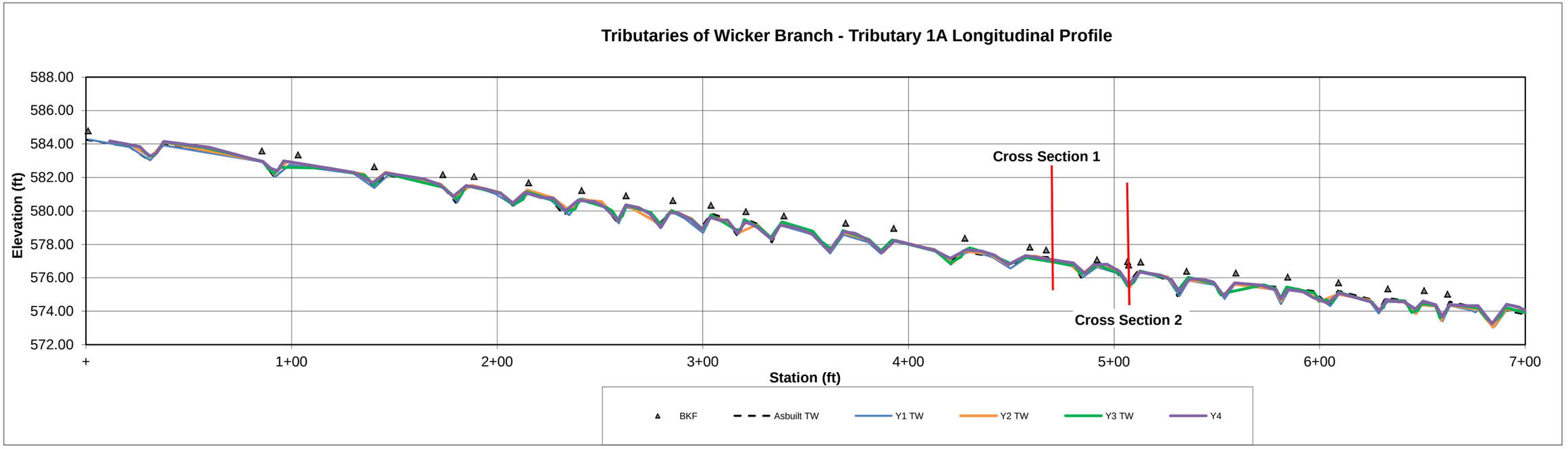
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-12, Sta. 6+42
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/9/2018
Field Crew	Chris Inscore

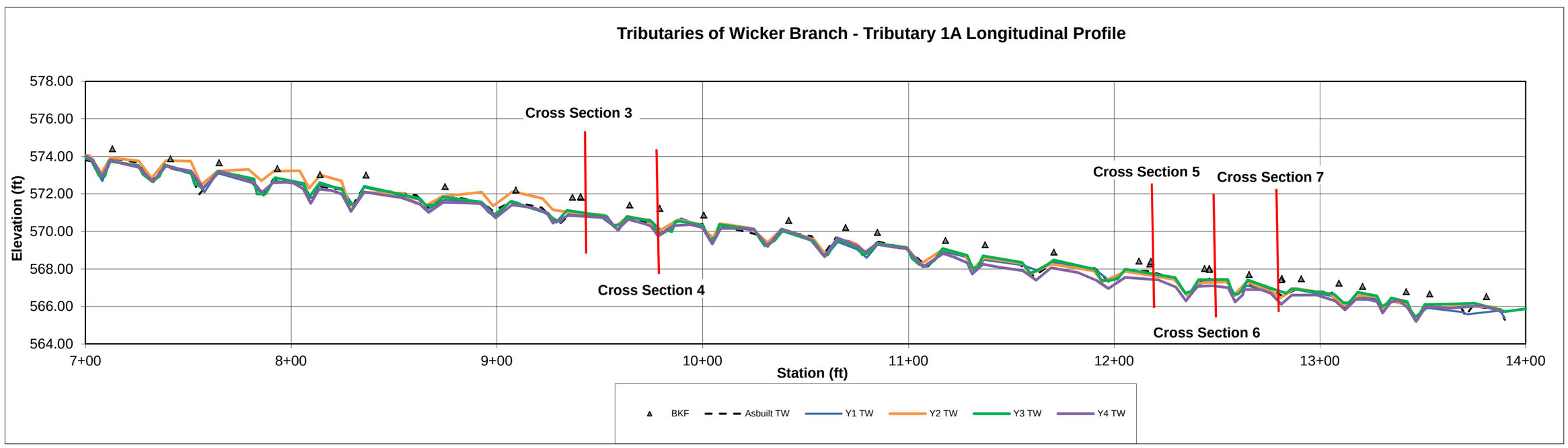
Station	Elevation	
0.00	572.82	RBPIN
0.08	572.76	GR
7.42	572.68	GR
14.49	572.53	GR
17.62	572.27	GR
17.94	572.23	RTOB
18.46	572.07	
18.90	571.87	
19.53	571.63	TW/RTOE
20.93	571.76	LTOE
22.71	572.45	LTOB
29.98	573.10	GR
39.70	574.06	GR
39.96	574.21	LBPIN

Summary Data	
Bankfull Elevation	572.16
Bankfull Width (ft)	3.81
Floodprone Width (ft)	19
Bankfull Mean Depth (ft)	0.32
Bankfull Max Depth (ft)	0.53
Bankfull Cross Sectional Area (ft^2)	1.23
Bankfull Width/Depth Ratio	11.91
Bankfull Entrenchment Ratio	5.1
Low Top of Bank Depth (ft)	0.6
Bankfull Bank Height Ratio	1.1

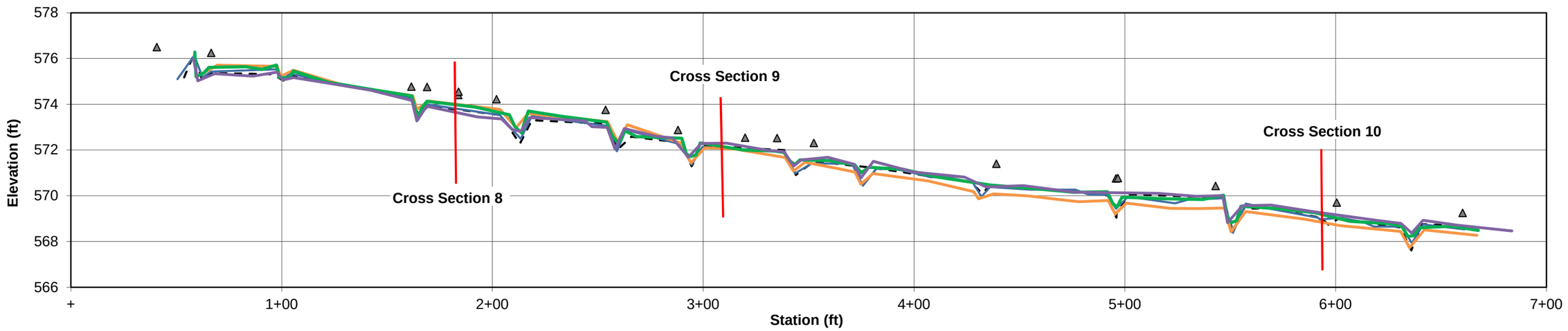
Photo: Cross-section 12 looking upstream



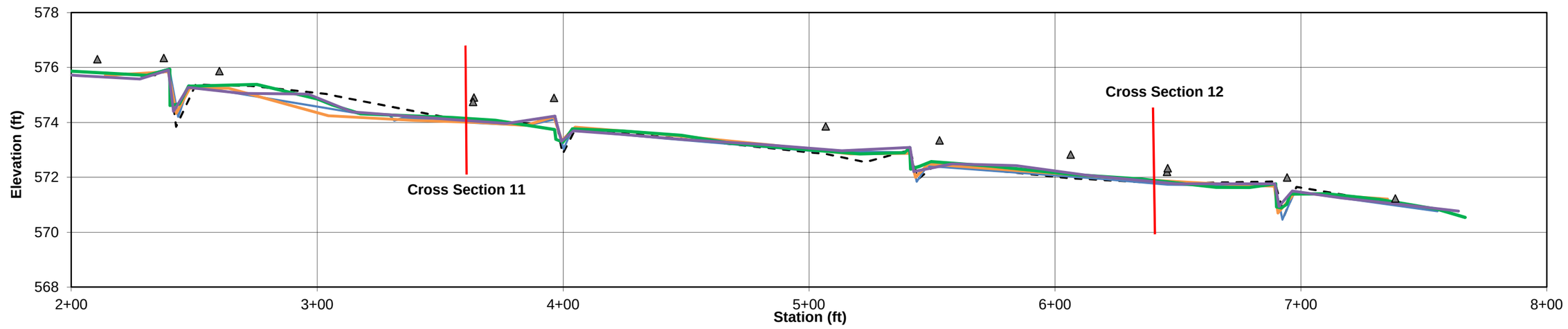

Tributaries of Wicker Branch - Tributary 1A Longitudinal Profile
588.00
586.00
584.00
582.00
580.00
578.00
576.00
574.00
572.00
Elevation (ft)
+
1+00
2+00
3+00
4+00
5+00
6+00
7+00
Station (ft)
Cross Section 1
Cross Section 2
BKF
Asbuilt TW
Y1 TW
Y2 TW
Y3 TW
Y4


Tributaries of Wicker Branch - Tributary 1A Longitudinal Profile
578.00
576.00
574.00
572.00
570.00
568.00
566.00
564.00
Elevation (ft)
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00
Station (ft)
Cross Section 3
Cross Section 4
Cross Section 5
Cross Section 6
Cross Section 7
BKF
Asbuilt TW
Y1 TW
Y2 TW
Y3 TW
Y4 TW

Tributaries of Wicker Branch - Tributary 3 Longitudinal Profile



Tributaries of Wicker Branch - Tributary 4 Longitudinal Profile

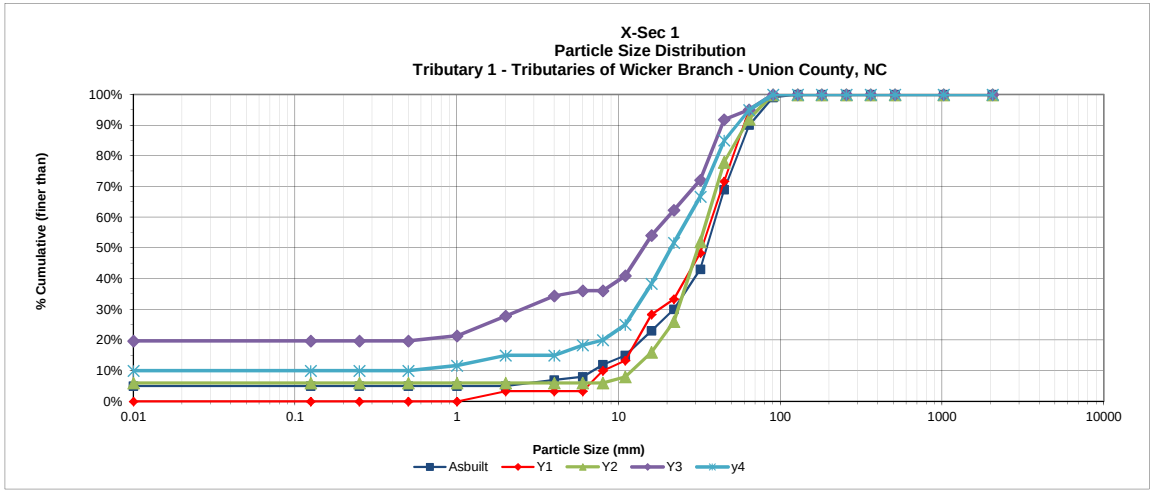


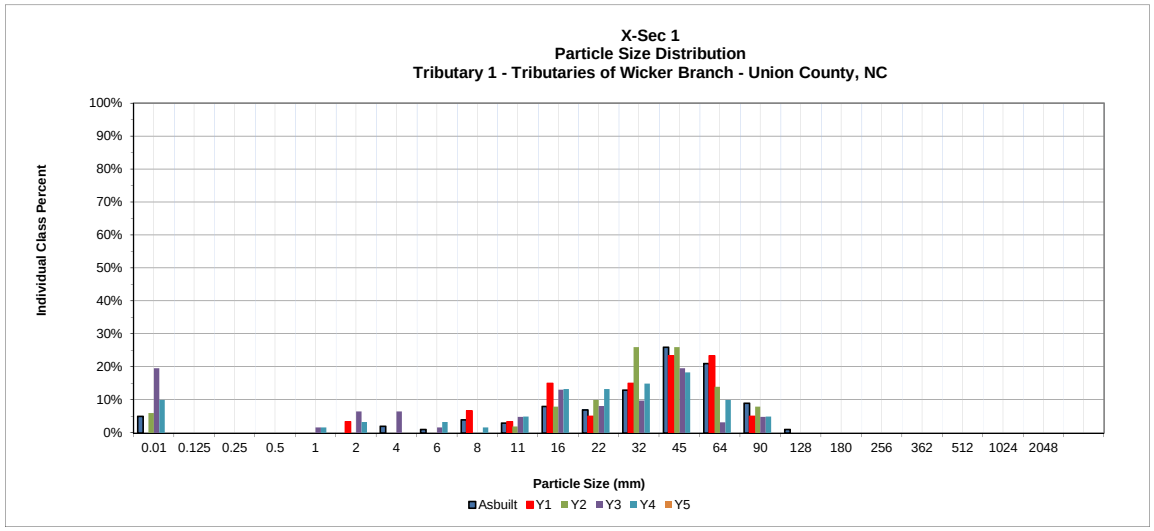
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 1
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	6	10%	10%
S	Very Fine	.062 - .125	0	0%	10%
A	Fine	.125 - .25	0	0%	10%
N	Medium	.25 - .50	0	0%	10%
D	Coarse	.50 - 1.0	1	2%	12%
S	Very Coarse	1.0 - 2.0	2	3%	15%
	Very Fine	2.0 - 4.0	4	7%	22%
G	Fine	4.0 - 5.7	2	3%	25%
R	Fine	5.7 - 8.0	1	2%	27%
A	Medium	8.0 - 11.3	3	5%	32%
V	Medium	11.3 - 16.0	8	13%	45%
E	Coarse	16.0 - 22.6	8	13%	58%
L	Coarse	22.6 - 32.0	9	15%	73%
S	Very Coarse	32.0 - 45.0	11	18%	92%
	Very Coarse	45.0 - 64.0	2	3%	95%
C	Small	64 - 90	3	5%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	21.77
D84	44
D95	64



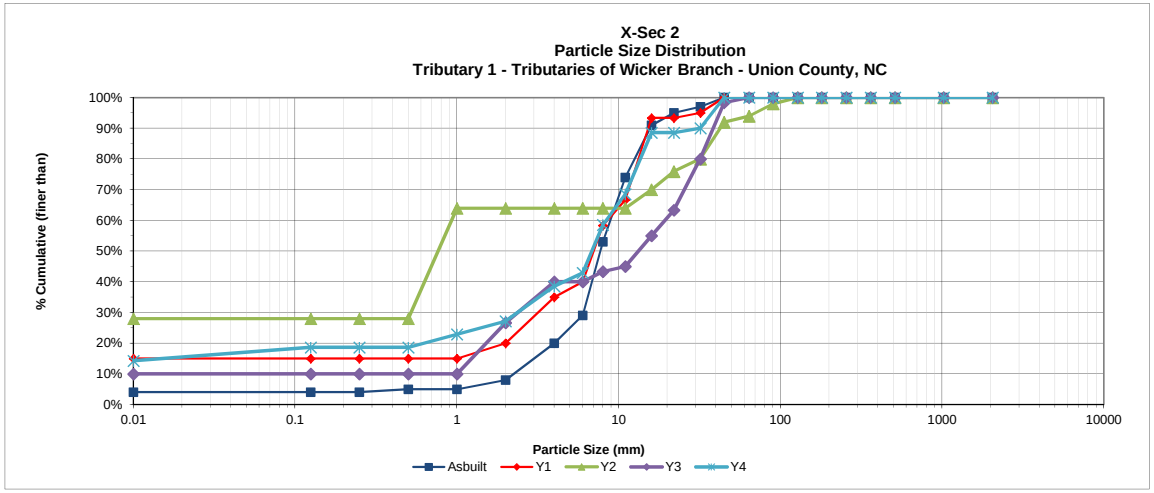


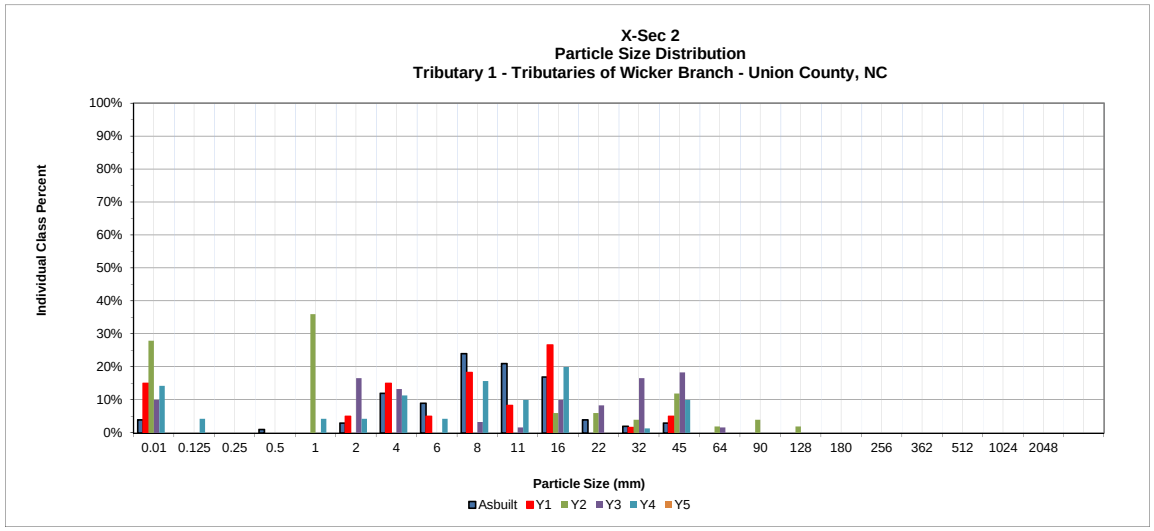
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 2
Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	10	14%	14%
S	Very Fine	.062 - .125	3	4%	19%
A	Fine	.125 - .25	0	0%	19%
N	Medium	.25 - .50	0	0%	19%
D	Coarse	.50 - 1.0	3	4%	23%
S	Very Coarse	1.0 - 2.0	3	4%	27%
	Very Fine	2.0 - 4.0	8	11%	39%
G	Fine	4.0 - 5.7	3	4%	43%
R	Fine	5.7 - 8.0	11	16%	59%
A	Medium	8.0 - 11.3	7	10%	69%
V	Medium	11.3 - 16.0	14	20%	89%
E	Coarse	16.0 - 22.6	0	0%	89%
L	Coarse	22.6 - 32.0	1	1%	90%
S	Very Coarse	32.0 - 45.0	7	10%	100%
	Very Coarse	45.0 - 64.0	0	0%	100%
C	Small	64 - 90	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			70	100%	

Summary Data	
D50	6.75
D84	15
D95	39



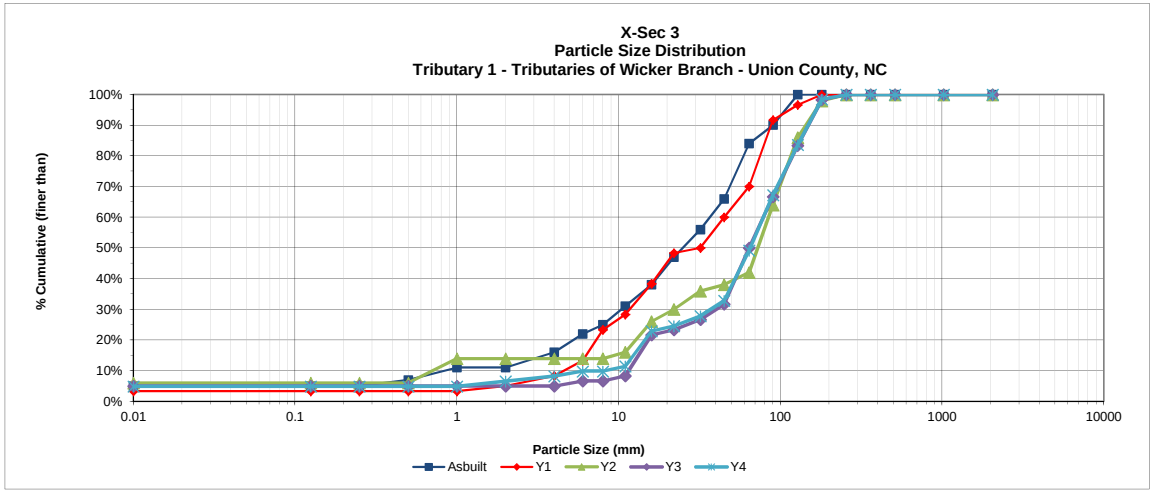


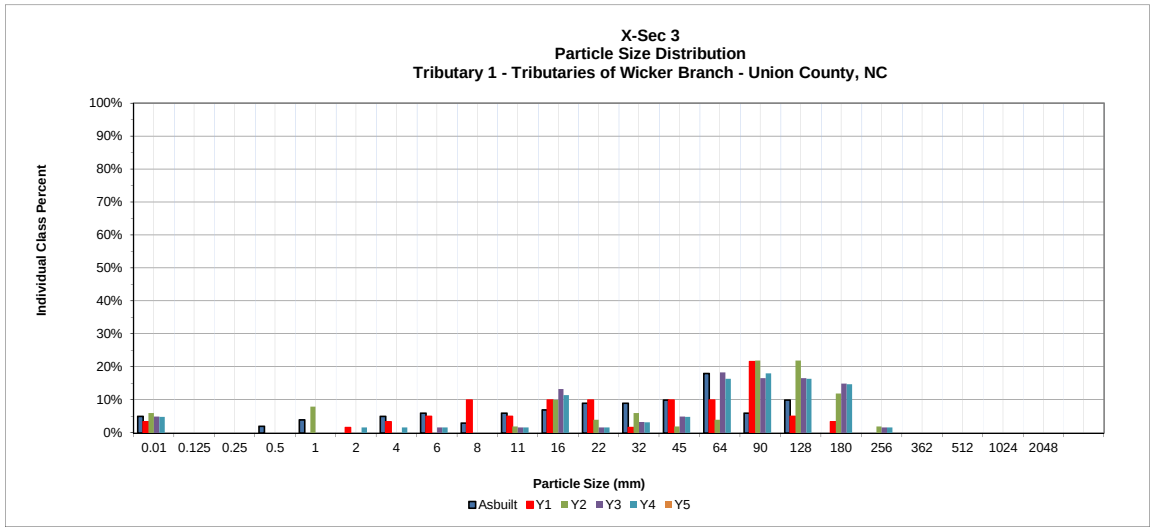
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 3
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	3	5%	5%
S	Very Fine	.062 - .125	0	0%	5%
A	Fine	.125 - .25	0	0%	5%
N	Medium	.25 - .50	0	0%	5%
D	Coarse	.50 - 1.0	0	0%	5%
S	Very Coarse	1.0 - 2.0	1	2%	7%
	Very Fine	2.0 - 4.0	1	2%	8%
G	Fine	4.0 - 5.7	1	2%	10%
R	Fine	5.7 - 8.0	0	0%	10%
A	Medium	8.0 - 11.3	1	2%	11%
V	Medium	11.3 - 16.0	7	11%	23%
E	Coarse	16.0 - 22.6	1	2%	25%
L	Coarse	22.6 - 32.0	2	3%	28%
S	Very Coarse	32.0 - 45.0	3	5%	33%
	Very Coarse	45.0 - 64.0	10	16%	49%
C	Small	64 - 90	11	18%	67%
O	Small	90 - 128	10	16%	84%
B	Large	128 - 180	9	15%	98%
L	Large	180 - 256	1	2%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			61	100%	

Summary Data	
D50	65
D84	129
D95	168



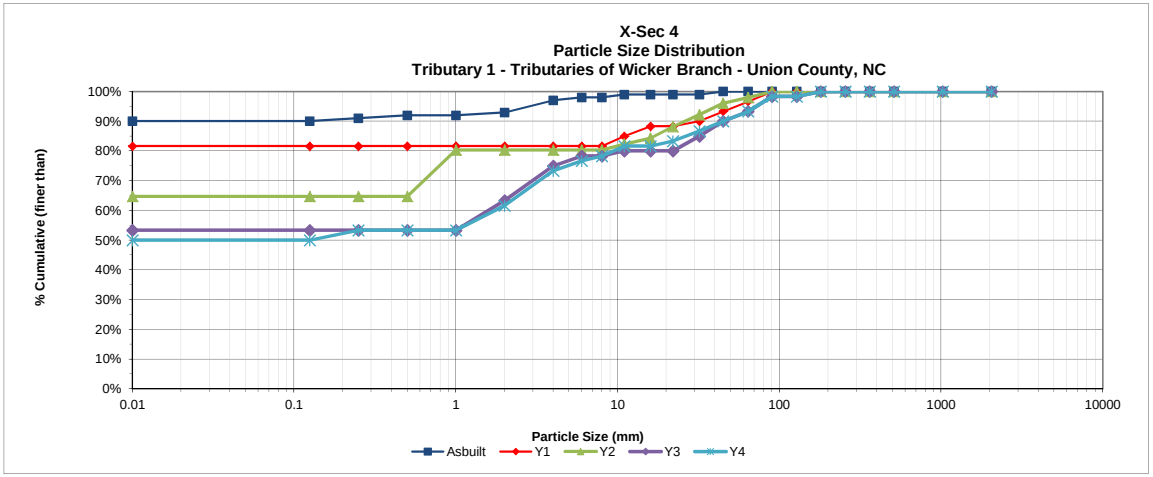


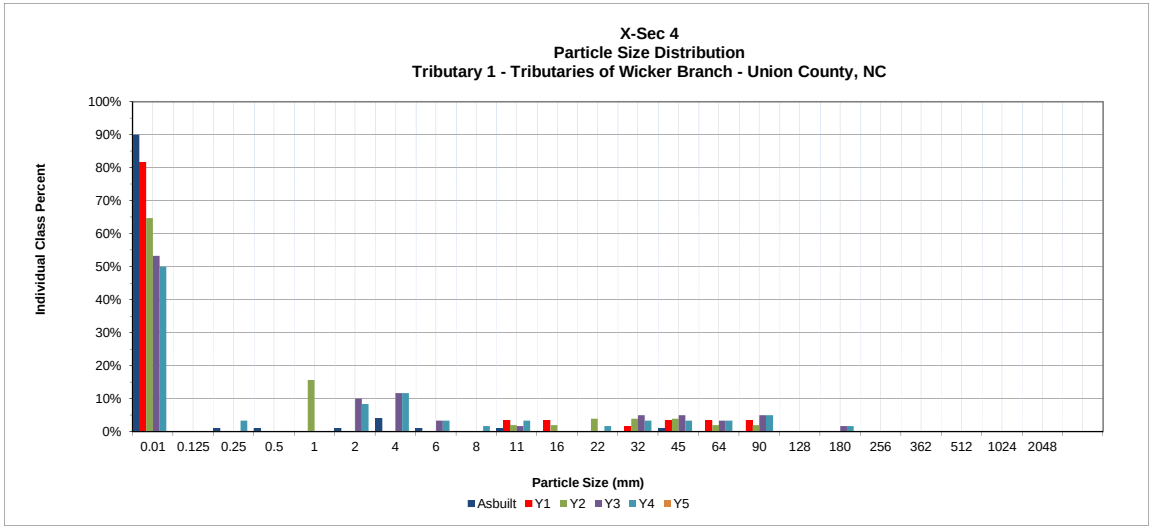
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 4
Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	30	50%	50%
S	Very Fine	.062 - .125	0	0%	50%
A	Fine	.125 - .25	2	3%	53%
N	Medium	.25 - .50	0	0%	53%
D	Coarse	.50 - 1.0	0	0%	53%
S	Very Coarse	1.0 - 2.0	5	8%	62%
	Very Fine	2.0 - 4.0	7	12%	73%
G	Fine	4.0 - 5.7	2	3%	77%
R	Fine	5.7 - 8.0	1	2%	78%
A	Medium	8.0 - 11.3	2	3%	82%
V	Medium	11.3 - 16.0	0	0%	82%
E	Coarse	16.0 - 22.6	1	2%	83%
L	Coarse	22.6 - 32.0	2	3%	87%
S	Very Coarse	32.0 - 45.0	2	3%	90%
	Very Coarse	45.0 - 64.0	2	3%	93%
C	Small	64 - 90	3	5%	98%
O	Small	90 - 128	0	0%	98%
B	Large	128 - 180	1	2%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	0.06
D84	25
D95	73



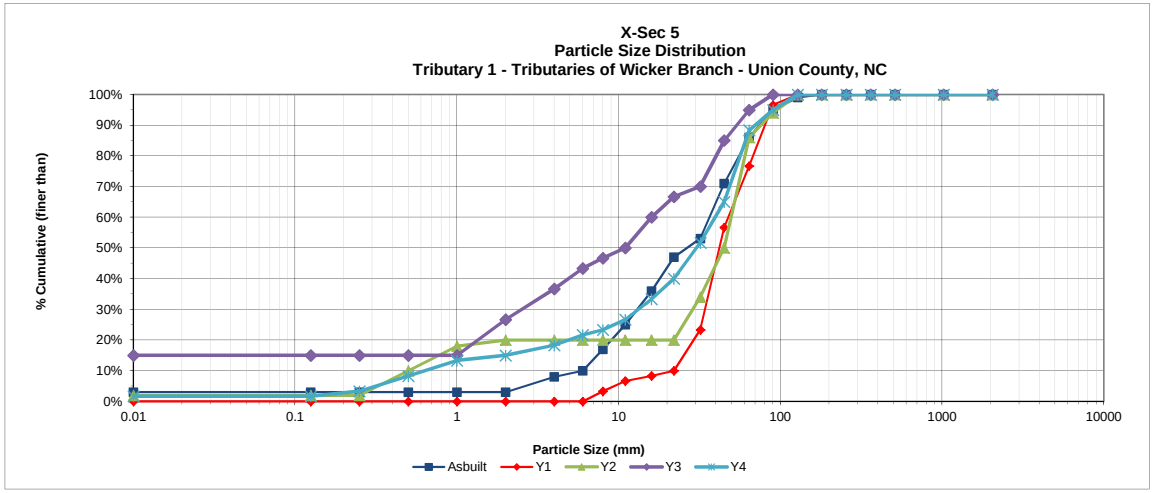


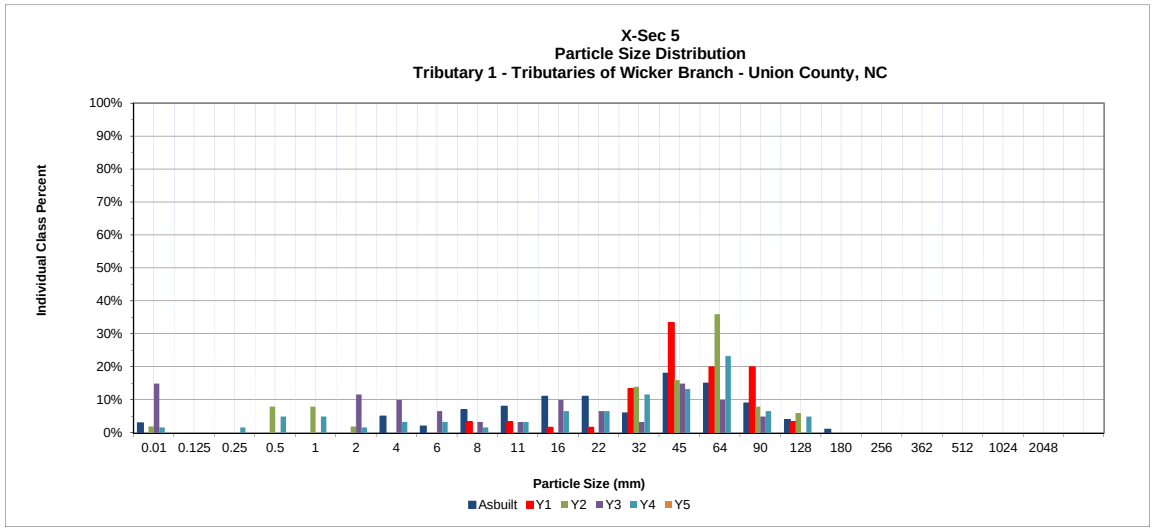
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 5
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	9	15%	15%
S	Very Fine	.062 - .125	0	0%	15%
A	Fine	.125 - .25	0	0%	15%
N	Medium	.25 - .50	0	0%	15%
D	Coarse	.50 - 1.0	0	0%	15%
S	Very Coarse	1.0 - 2.0	7	12%	27%
	Very Fine	2.0 - 4.0	6	10%	37%
G	Fine	4.0 - 5.7	4	7%	43%
R	Fine	5.7 - 8.0	2	3%	47%
A	Medium	8.0 - 11.3	2	3%	50%
V	Medium	11.3 - 16.0	6	10%	60%
E	Coarse	16.0 - 22.6	4	7%	67%
L	Coarse	22.6 - 32.0	2	3%	70%
S	Very Coarse	32.0 - 45.0	9	15%	85%
	Very Coarse	45.0 - 64.0	6	10%	95%
C	Small	64 - 90	3	5%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	30.6
D84	60
D95	90



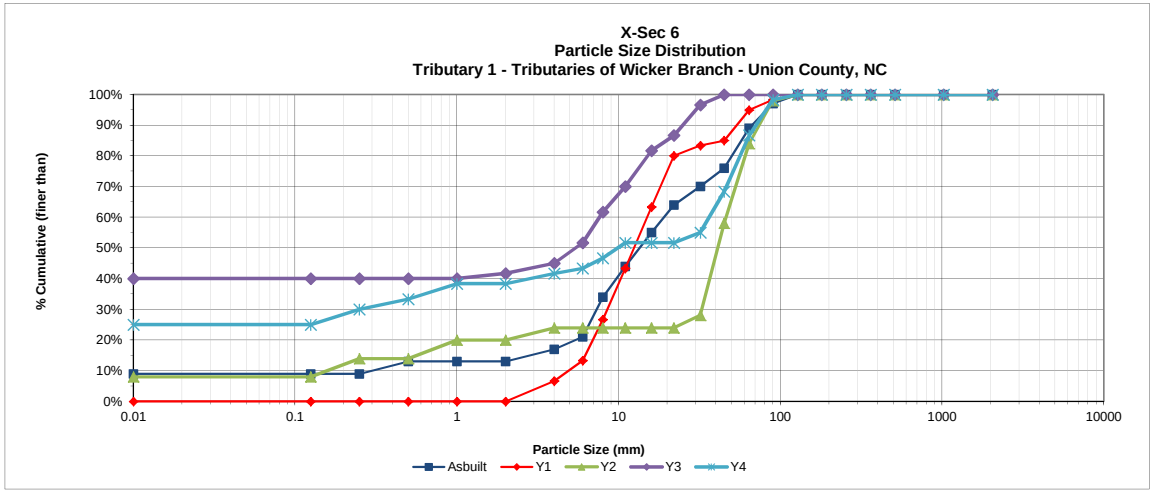


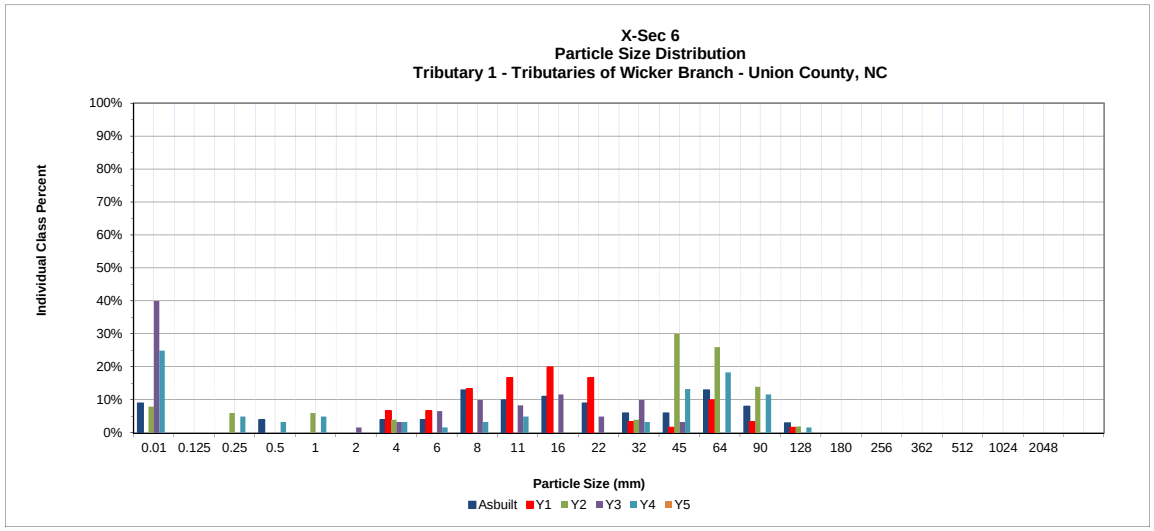
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 6
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	15	25%	25%
S	Very Fine	.062 - .125	0	0%	25%
A	Fine	.125 - .25	3	5%	30%
N	Medium	.25 - .50	2	3%	33%
D	Coarse	.50 - 1.0	3	5%	38%
S	Very Coarse	1.0 - 2.0	0	0%	38%
	Very Fine	2.0 - 4.0	2	3%	42%
G	Fine	4.0 - 5.7	1	2%	43%
R	Fine	5.7 - 8.0	2	3%	47%
A	Medium	8.0 - 11.3	3	5%	52%
V	Medium	11.3 - 16.0	0	0%	52%
E	Coarse	16.0 - 22.6	0	0%	52%
L	Coarse	22.6 - 32.0	2	3%	55%
S	Very Coarse	32.0 - 45.0	8	13%	68%
	Very Coarse	45.0 - 64.0	11	18%	87%
C	Small	64 - 90	7	12%	98%
O	Small	90 - 128	1	2%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	10
D84	61
D95	82



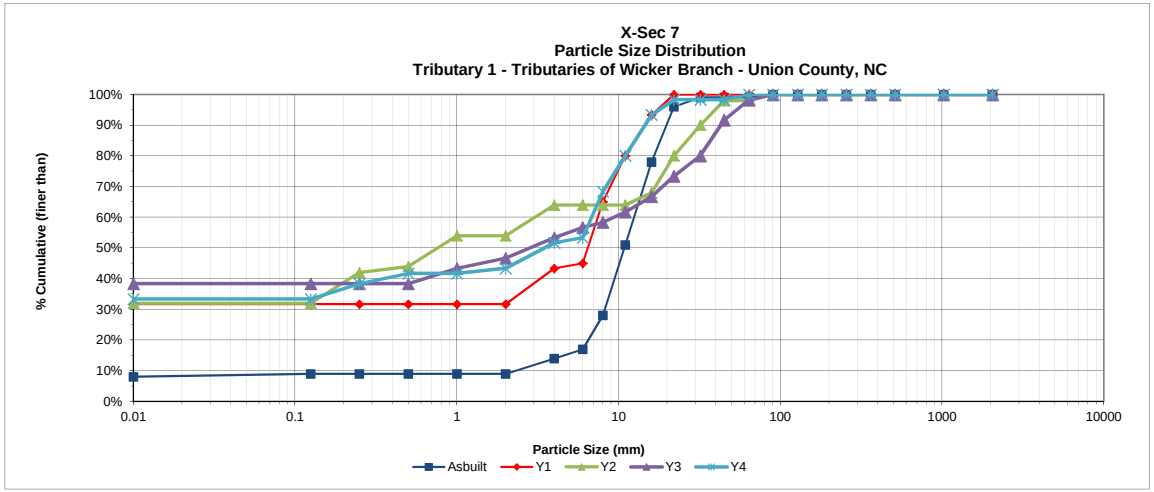


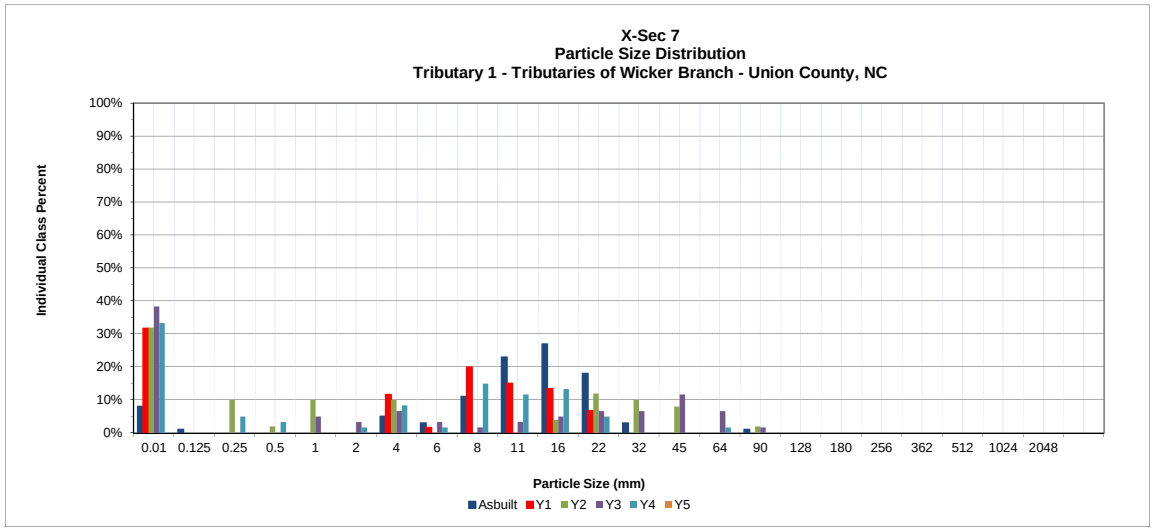
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 7
Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	20	33%	33%
S	Very Fine	.062 - .125	0	0%	33%
A	Fine	.125 - .25	3	5%	38%
N	Medium	.25 - .50	2	3%	42%
D	Coarse	.50 - 1.0	0	0%	42%
S	Very Coarse	1.0 - 2.0	1	2%	43%
	Very Fine	2.0 - 4.0	5	8%	52%
G	Fine	4.0 - 5.7	1	2%	53%
R	Fine	5.7 - 8.0	9	15%	68%
A	Medium	8.0 - 11.3	7	12%	80%
V	Medium	11.3 - 16.0	8	13%	93%
E	Coarse	16.0 - 22.6	3	5%	98%
L	Coarse	22.6 - 32.0	0	0%	98%
S	Very Coarse	32.0 - 45.0	0	0%	98%
	Very Coarse	45.0 - 64.0	1	2%	100%
C	Small	64 - 90	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	3.6
D84	13
D95	18



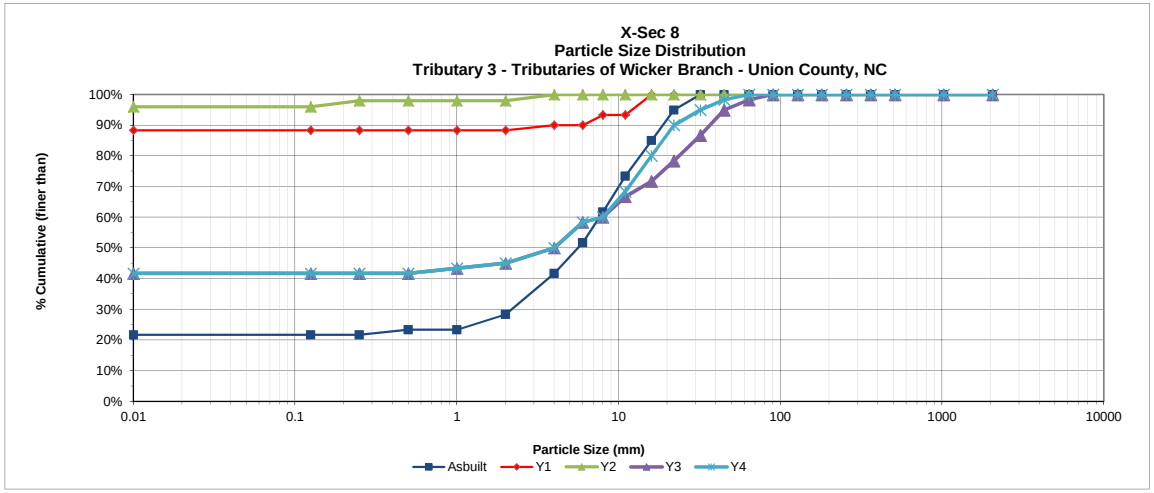


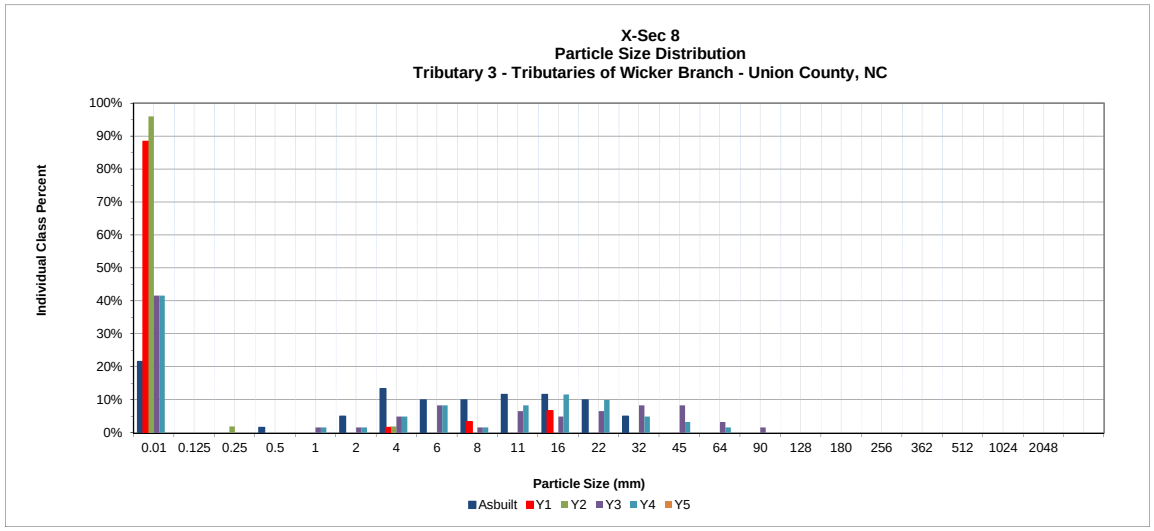
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 8
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	25	42%	42%
S	Very Fine	.062 - .125	0	0%	42%
A	Fine	.125 - .25	0	0%	42%
N	Medium	.25 - .50	0	0%	42%
D	Coarse	.50 - 1.0	1	2%	43%
S	Very Coarse	1.0 - 2.0	1	2%	45%
	Very Fine	2.0 - 4.0	3	5%	50%
G	Fine	4.0 - 5.7	5	8%	58%
R	Fine	5.7 - 8.0	1	2%	60%
A	Medium	8.0 - 11.3	5	8%	68%
V	Medium	11.3 - 16.0	7	12%	80%
E	Coarse	16.0 - 22.6	6	10%	90%
L	Coarse	22.6 - 32.0	3	5%	95%
S	Very Coarse	32.0 - 45.0	2	3%	98%
	Very Coarse	45.0 - 64.0	1	2%	100%
C	Small	64 - 90	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	4
D84	19
D95	64



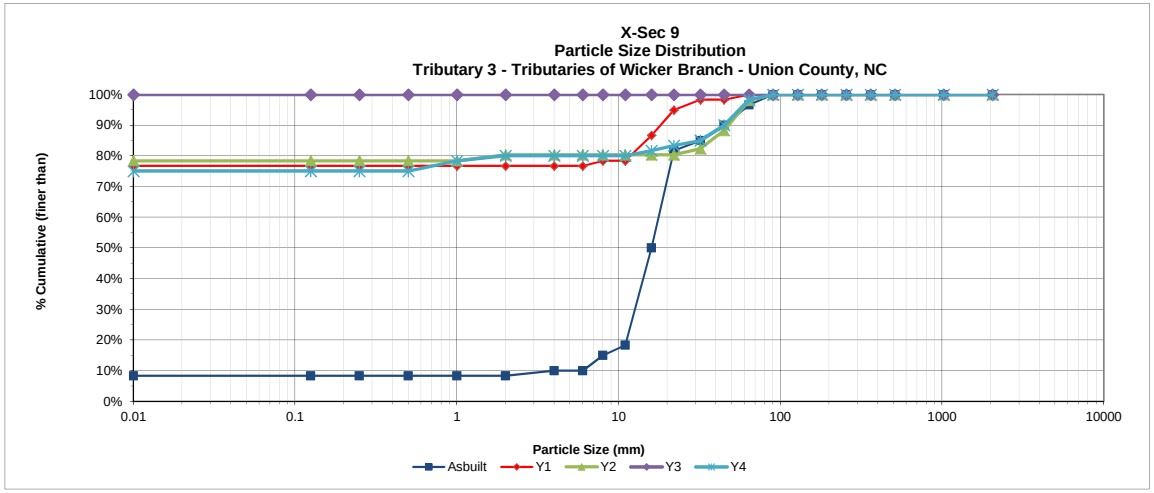


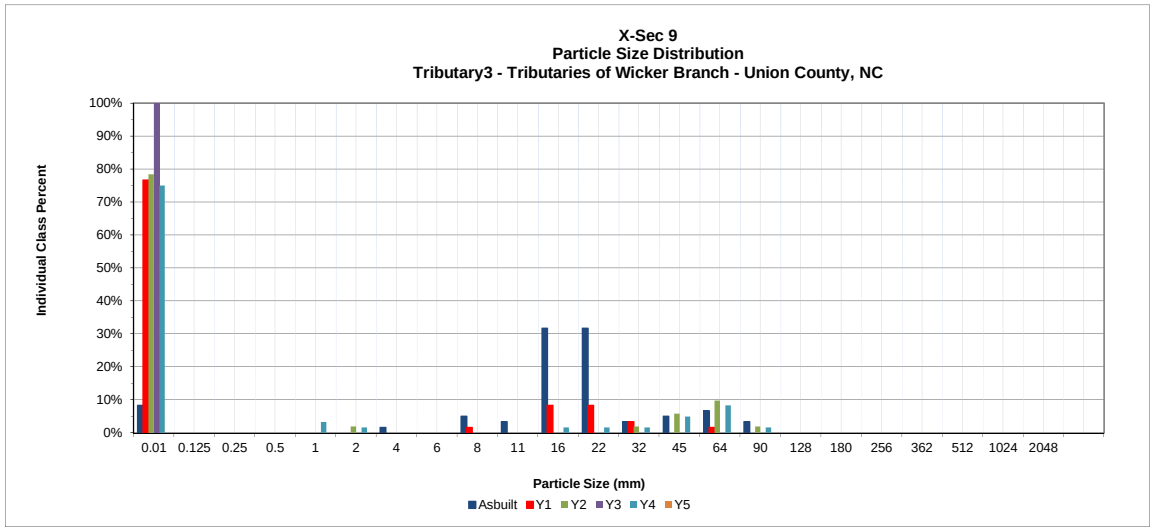
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 9
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	45	75%	75%
S	Very Fine	.062 - .125	0	0%	75%
A	Fine	.125 - .25	0	0%	75%
N	Medium	.25 - .50	0	0%	75%
D	Coarse	.50 - 1.0	2	3%	78%
S	Very Coarse	1.0 - 2.0	1	2%	80%
	Very Fine	2.0 - 4.0	0	0%	80%
G	Fine	4.0 - 5.7	0	0%	80%
R	Fine	5.7 - 8.0	0	0%	80%
A	Medium	8.0 - 11.3	0	0%	80%
V	Medium	11.3 - 16.0	1	2%	82%
E	Coarse	16.0 - 22.6	1	2%	83%
L	Coarse	22.6 - 32.0	1	2%	85%
S	Very Coarse	32.0 - 45.0	3	5%	90%
	Very Coarse	45.0 - 64.0	5	8%	98%
C	Small	64 - 90	1	2%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	0.04
D84	26
D95	56



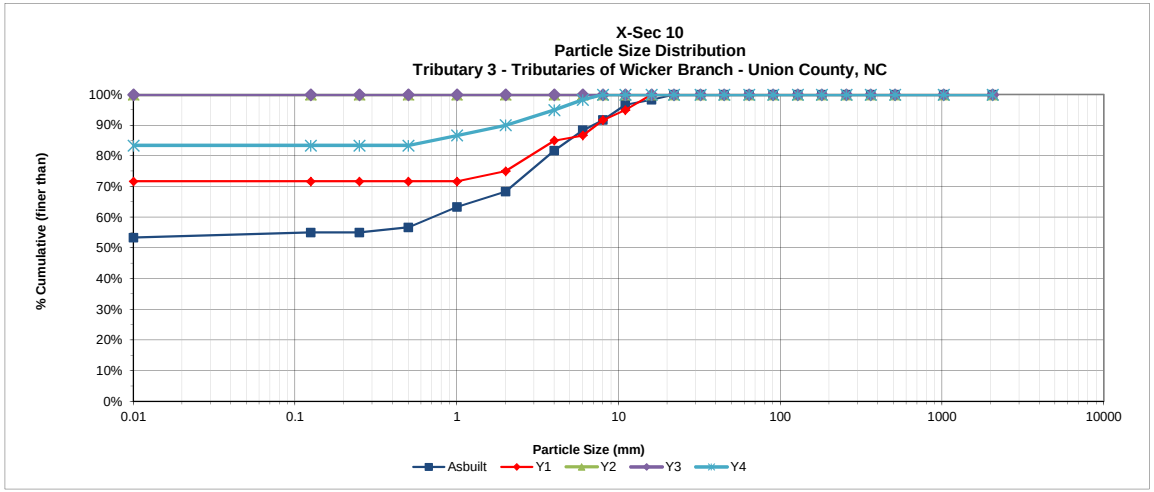


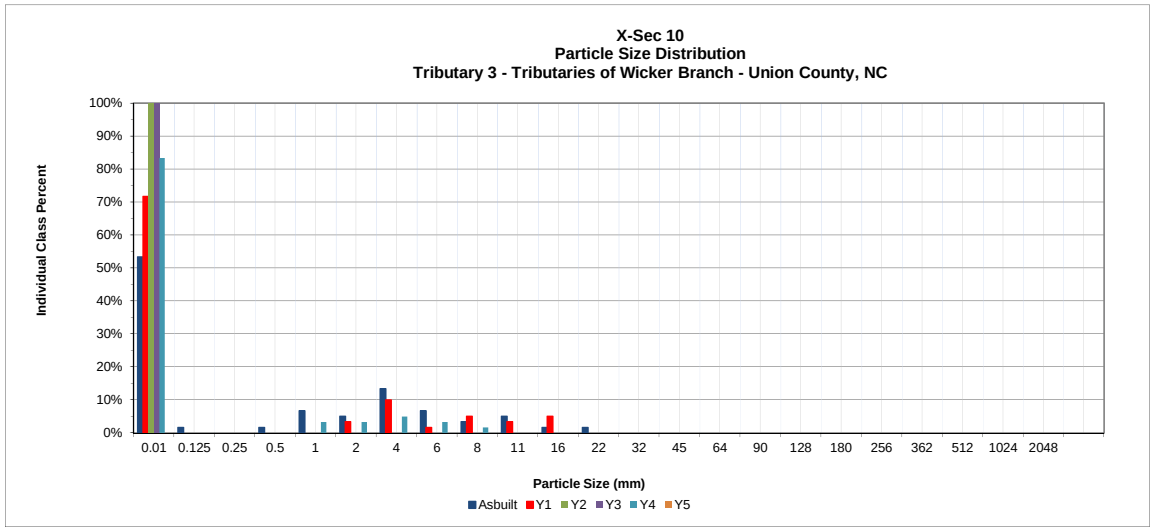
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 10
Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	50	83%	83%
S	Very Fine	.062 - .125	0	0%	83%
A	Fine	.125 - .25	0	0%	83%
N	Medium	.25 - .50	0	0%	83%
D	Coarse	.50 - 1.0	2	3%	87%
S	Very Coarse	1.0 - 2.0	2	3%	90%
	Very Fine	2.0 - 4.0	3	5%	95%
G	Fine	4.0 - 5.7	2	3%	98%
R	Fine	5.7 - 8.0	1	2%	100%
A	Medium	8.0 - 11.3	0	0%	100%
V	Medium	11.3 - 16.0	0	0%	100%
E	Coarse	16.0 - 22.6	0	0%	100%
L	Coarse	22.6 - 32.0	0	0%	100%
S	Very Coarse	32.0 - 45.0	0	0%	100%
	Very Coarse	45.0 - 64.0	0	0%	100%
C	Small	64 - 90	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	0.03
D84	0.04
D95	0.06



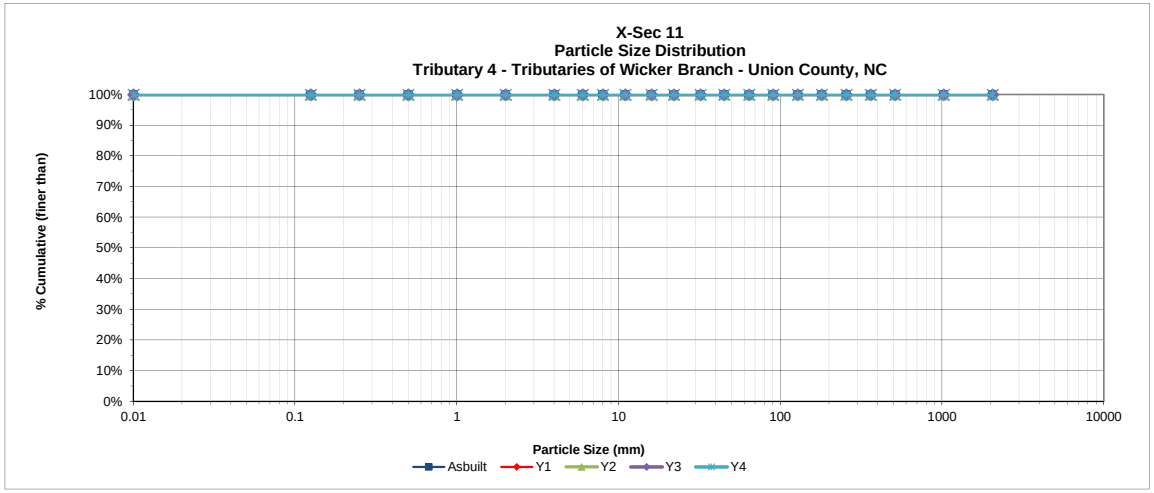


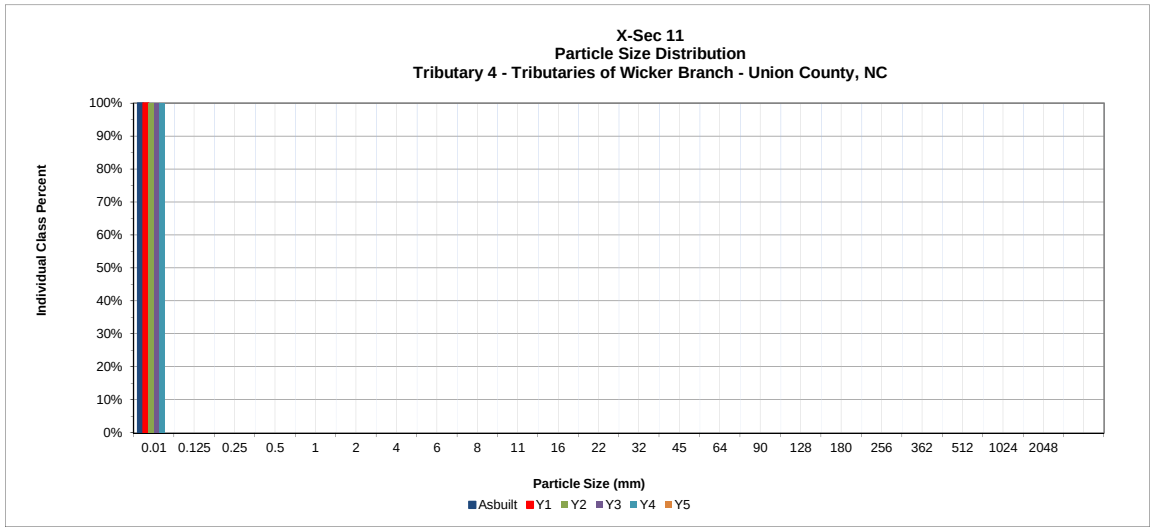
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 11
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	60	100%	100%
S	Very Fine	.062 - .125	0	0%	100%
A	Fine	.125 - .25	0	0%	100%
N	Medium	.25 - .50	0	0%	100%
D	Coarse	.50 - 1.0	0	0%	100%
S	Very Coarse	1.0 - 2.0	0	0%	100%
	Very Fine	2.0 - 4.0	0	0%	100%
G	Fine	4.0 - 5.7	0	0%	100%
R	Fine	5.7 - 8.0	0	0%	100%
A	Medium	8.0 - 11.3	0	0%	100%
V	Medium	11.3 - 16.0	0	0%	100%
E	Coarse	16.0 - 22.6	0	0%	100%
L	Coarse	22.6 - 32.0	0	0%	100%
S	Very Coarse	32.0 - 45.0	0	0%	100%
	Very Coarse	45.0 - 64.0	0	0%	100%
C	Small	64 - 90	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	0.03
D84	0.05
D95	0.06



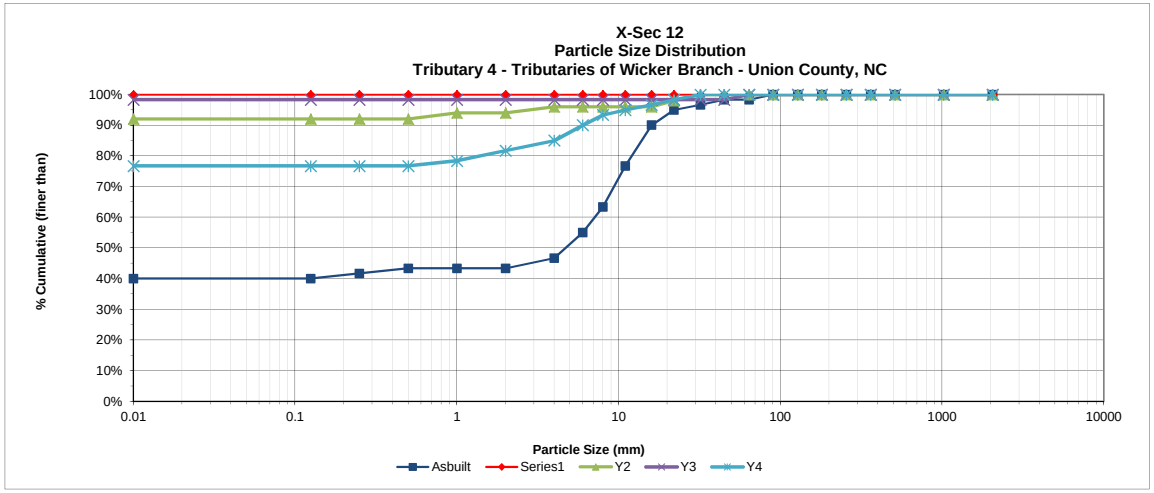


Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 12
Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	46	77%	77%
S	Very Fine	.062 - .125	0	0%	77%
A	Fine	.125 - .25	0	0%	77%
N	Medium	.25 - .50	0	0%	77%
D	Coarse	.50 - 1.0	1	2%	78%
S	Very Coarse	1.0 - 2.0	2	3%	82%
	Very Fine	2.0 - 4.0	2	3%	85%
G	Fine	4.0 - 5.7	3	5%	90%
R	Fine	5.7 - 8.0	2	3%	93%
A	Medium	8.0 - 11.3	1	2%	95%
V	Medium	11.3 - 16.0	1	2%	97%
E	Coarse	16.0 - 22.6	1	2%	98%
L	Coarse	22.6 - 32.0	1	2%	100%
S	Very Coarse	32.0 - 45.0	0	0%	100%
	Very Coarse	45.0 - 64.0	0	0%	100%
C	Small	64 - 90	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	0.03
D84	0.04
D95	3.4



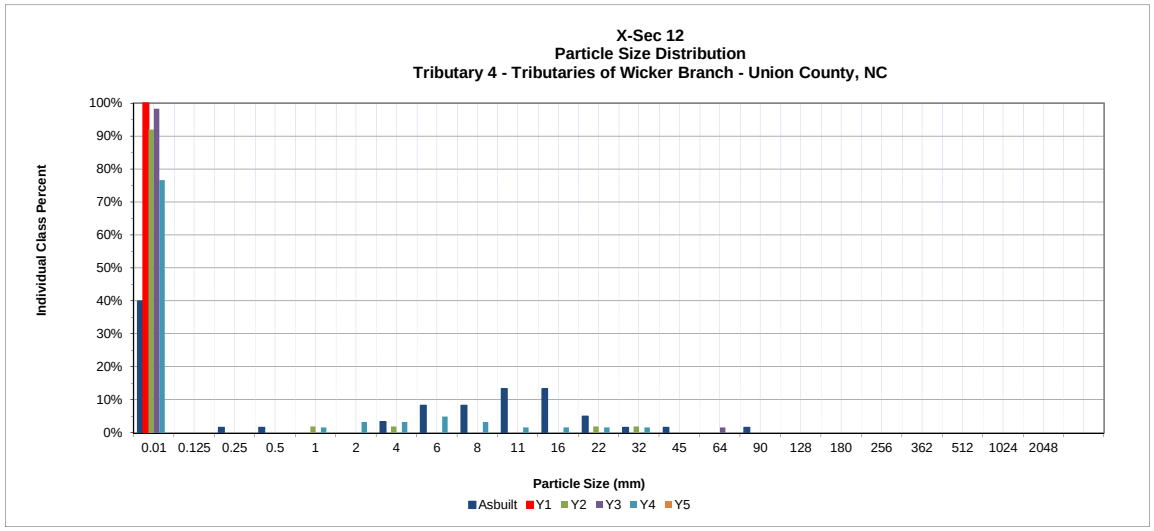


Table 8. Baseline Stream Data Summary
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Parameter	Existing Trib 1A to Wickers Branch			Reference Reach- Spencer Creek			Reference Reach UT4 Rockwell Pastures			Proposed Trib 1 to Wickers Branch			As-built Baseline (Tributary 1A)			
Stream Type	G4/B4c			C4			C4			E4						
Drainage Area (sq mi)	0.14			0.5			0.11			0.1						
Dimension	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	n
BF Width (ft)	3.27	3.90	**3.58**			**12.30**			**7.30**			**4.00**	3.93	4.93	**4.43**	4
BF Cross Sectional Area (ft^2)	1.52	1.99	**1.74**			**10.80**			**4.20**			**1.50**	1.62	2.80	**1.94**	4
BF Mean Depth (ft)	0.43	0.61	**0.50**			**0.88**			**0.60**			**0.38**	0.30	0.61	**0.41**	4
BF Max Depth (ft)	0.54	1.10	**0.76**			**1.80**			**1.10**			**0.50**	0.42	0.69	**0.53**	4
Width/Depth Ratio	5.36	8.48	**7.37**			**13.98**			**12.60**			**10.52**	7.49	14.94	**11.56**	4
Entrenchment Ratio	1.54	1.88	**1.70**			**>2.20**			**2.70**			**>2.20**	7.16	10.18	**8.63**	4
Wetted Perimeter (ft)	3.94	4.31	**4.17**			**14.13**			**5.77**			**4.76**	4.31	5.09	**4.73**	4
Hydraulic radius (ft)	0.39	0.47	**0.43**			**0.76**			**0.76**			**0.32**	0.29	0.55	**0.38**	4
Bank Height Ratio	2.21	2.41	**2.32**			**1.10**			**1.00**			**1.00**	1.00	1.00	**1.00**	4
Pool Area/Riffle Area			**N/A**			**1.17**			**1.00**			**5.70**			**1.98**	
Max riffle depth/mean riffle depth	1.08	1.22	**1.52**			**2.05**			**1.90**			**1.32**			**1.29**	
Max pool depth/mean riffle depth	1.22	2.3	**1.76**			**2.38**			**2.5**			**6.50**			**2.76**	
Pattern																
Channel Beltwidth (ft)	7	10	**9**	24	52	**38**	3.20	5.70	**4.40**	15	30	**23**	18	25	**22**	
Radius of Curvature (ft)	6	8	**7**	5	22	**13**	5	13	**9**	5	30	**18**	6	20	**12**	
Meander Wavelength	27	497	**181**	54	196	**125**	10.00	17.00	**13.60**	30	110	**70**	34	106	**50**	
Meander Width ratio	1.98	2.79	**2.39**	1.95	4.23	**3.09**	0.40	0.80	**0.60**	1.80	4.50	**3.15**			**5.0**	
Meander Length ratio	7.64	138.78	**50.53**	4.39	15.93	**10.16**	1.40	2.30	**1.90**	7.50	27.50	**17.50**			**11.20**	
Radius of Curvature/Riffle Width (ft)	1.68	2.23	**1.96**	0.44	4.23	**1.05**	0.70	1.70	**1.20**	1.00	4.20	**2.60**	1.35	4.06	**2.71**	
Pool Length/Riffle Width	3.91	7.65	**5.53**	0.76	1.94	**1.45**			**N/A**	1.05	3.75	**2.40**			**2.50**	
Pool to Pool Spacing/ Riffle Width	5.50	26.26	**13.08**	1.06	3.78	**1.97**	2.40	3.30	**2.90**	3.50	14.75	**9.13**	2.93	13.77	6.00	
Riffle Length/Riffle Width	1.90	20.75	**8.13**	0.30	1.84	**1.07**			**N/A**	2.45	11.00	**6.73**	1.85	10.61	3.54	
Profile	.															
Pool length (ft)	14.0	27.4	**19.8**	9.3	23.9	**17.8**			**N/A**	4.2	15.0	**9.8**	4.9	17.8	**11.3**	49
Pool spacing (ft)	19.7	94.0	**46.8**	13.0	46.5	**24.2**	17.6	24.1	**20.8**	14.0	59.0	**26.5**	13.0	61.0	**26.6**	48
Riffle length (ft)	6.8	74.3	**29.1**	3.7	22.6	**13.1**			**N/A**	9.8	44.0	**26.9**	8.2	47.0	**15.7**	50
Riffle slope (ft/ft)	0.014	0.027	**0.02**	0.020	0.036	**0.026**	0.006	0.049	**0.028**	0.018	0.029	**0.02**	0.01	0.48	**0.03**	50
Pool slope (ft/ft)	0.006	0.017	**0.012**	0.000	0.005	**0.003**	0.008	0.014	**0.010**	0.018	0.029	**0.024**	0.010	0.001	**0.005**	48
Run slope (ft/ft)	0.009	0.025	**0.018**	0.028	0.059	**0.041**			**N/A**			**N/A***			**N/A***	
Glide slope (ft/ft)	0.006	0.016	**0.01**	0.000	0.012	**0.003**			**N/A**			**N/A***			**N/A***	
Riffle Slope/Avg. Water Surface Slope	1.09	2.11	**1.56**	1.52	2.73	**1.97**	0.40	3.20	**1.80**	1.29	2.09	**1.69**			**2.36**	
Run slope/Avg. Water Surface Slope	0.73	1.95	**1.41**	2.12	4.47	**3.11**			**N/A**			**N/A***			**N/A***	
Pool Slope/Avg. Water Surface Slope	0.47	1.33	**0.94**	0.00	0.38	**0.23**	0.50	0.90	**0.60**	1.29	2.09	**1.69**			**0.39**	
Glide Slope/Avg.Water Surface Slope	0.50	1.25	**0.78**	0.00	0.91	**0.23**			**N/A**			**N/A***			**N/A***	
Substrate																
d50 (mm)	2.5	23.32	**10.09**			**8.6**			**12.70**				13.8	35.5	**25.6**	4
d84 (mm)	10.38	44.3	**25.7**			**77.00**			**38.00**		123		37	88	**65.3**	4
Additional Reach Parameters																
Valley Length (ft)			**1285**			**235**			**N/A**			**1284**			**1285**	
Channel Length (ft)			**1293**			**266**			**N/A**			**1395**			**1390**	
Valley Slope (ft/ft)	0.0113	0.0138	**0.0132**			**0.0139**			**0.0173**			**0.0132**			**0.0129**	
Water Surface Slope (ft/ft)	0.0080	0.0177	**0.0128**			**0.0132**			**0.0156**			**0.0139**			**0.0127**	
Sinuosity			**1**			**1.1**			**1.05**			**1.1**			**1.1**	

* Runs and Glides are too short to obtain meaningful measurements

Table 8. Baseline Stream Data Summary
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Parameter	Existing Trib 3 to Wickers Branch			Existing Trib 4 to Wickers Branch			Reference Reach- Spencer Creek			Reference Reach UT4 Rockwell Pastures			Proposed Trib 3 & 4 to Wickers Branch*			As-built Baseline (Tributary 3)				As-built Baseline (Tributary 4)			
Stream Type	**B6c**			**E6****			**C4**			**C4**			**C4**										
Drainage Area (sq mi)	**0.05**			**0.05**			**0.5**			**0.11**			**0.05**										
Dimension	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	n	Min	Max	**Avg**	n
BF Width (ft)	2.55	2.66	**2.61**	2.90	3.66	**3.28**			**12.30**			**7.30**			**3.60**	3.58	6.74	**4.70**	3	3.53	4.29	3.91	2
BF Cross Sectional Area (ft^2)	0.40	0.63	**0.52**	0.83	1.13	**0.98**			**10.80**			**4.20**			**1.08**	1.16	6.98	**3.2**	3	1.21	1.23	**1.22**	2
BF Mean Depth (ft)	0.15	0.25	**0.20**	0.23	0.39	**0.31**			**0.88**			**0.60**			**0.30**	0.32	1.04	**0.59**	3	0.29	0.34	**0.32**	2
BF Max Depth (ft)	0.38	0.45	**0.42**	0.38	0.65	**0.52**			**1.80**			**1.10**			**0.60**	0.49	1.53	**0.89**	3	0.43	0.69	**0.56**	2
Width/Depth Ratio	10.20	17.73	**13.97**	7.44	15.91	**11.68**			**13.98**			**12.60**			**12.00**	6.48	11.19	**9.15**	3	10.38	14.79	**12.59**	2
Entrenchment Ratio	1.36	1.88	**1.62**	2.46	4.84	**3.65**			**>2.20**			**2.70**			**>2.20**	5.12	8.60	**7.20**	3	4.26	5.50	**4.88**	2
Wetted Perimeter (ft)	2.83	2.84	**2.84**	3.26	3.77	**3.52**			**14.13**			**5.77**			**4.20**	3.59	6.80	**5.20**	2	3.81	4.42	**4.12**	2
Hydraulic radius (ft)	0.14	0.22	**0.18**	0.22	0.35	**0.29**			**0.76**			**0.76**			**0.26**	0.24	0.72	0.48	2	0.28	0.32	**0.3**	2
Bank Height Ratio	2.24	3.32	**2.78**	1.00	1.60	**1.30**			**1.10**			**1.00**			**1.00**			**1.00**				**1.00**	
Pool Area/Riffle Area			**N/A**			**N/A**			**1.17**			**1.00**			**8.00**			**0.52**				**N/A**	
Max riffle depth/mean riffle depth	1.9	2.25	**2.08**			**1.68**			**2.05**			**1.90**			**2.00**			**1.51**				**1.78**	
Max pool depth/mean riffle depth	2.15	3.4	**2.78**	1.13	1.97	**1.55**			**2.38**			**2.5**			**8.30**			**2.64**				**N/A**	
Pattern																							
Channel Beltwidth (ft)	5	9	**7**			**N/A**	24	52	**38**	3.20	5.70	**4.40**			**N/A***			**N/A*****				**N/A*****	
Radius of Curvature (ft)	2	8	**5**			**N/A**	5	22	**13**	5	13	**9**			**N/A***			**N/A*****				**N/A*****	
Meander Wavelength	109	312	**189**			**N/A**	54	196	**125**	10.00	17.00	**13.60**			**N/A***			**N/A*****				**N/A*****	
Meander Width ratio	2.00	3.31	**2.65**			**N/A**	1.95	4.23	**3.09**	0.40	0.80	**0.60**			**N/A***			**N/A*****				**N/A*****	
Meander Length ratio	41.68	119.38	**72.24**			**N/A**	4.39	15.93	**10.16**	1.40	2.30	**1.90**			**N/A***			**N/A*****				**N/A*****	
Radius of Curvature/Riffle Width (ft)	0.69	3.07	**1.88**			**N/A**	0.44	4.23	**1.05**	0.70	1.70	**1.20**			**N/A***			**N/A*****				**N/A*****	
Pool Length/Riffle Width	6.79	14.39	**9.13**	3.60	10.09	**6.22**	0.76	1.94	**1.45**			**N/A**	1.11	1.67	**N/A***			**2.19**				**2.38**	
Pool to Pool Spacing/ Riffle Width	14.80	34.66	**24.86**	5.46	15.70	**9.91**	1.06	3.78	**1.97**	2.40	3.30	**2.90**	5.56	16.11	**10.83**			**11**				**37**	
Riffle Length/Riffle Width	2.72	8.58	**5.40**	5.46	11.16	**8.45**	0.30	1.84	**1.07**			**N/A**	4.44	14.44	**9.44**			**8.64**				**35.29**	
Profile	.			.																			
Pool length (ft)	17.7	37.6	**23.8**	11.8	33.1	**20.4**	9.3	23.9	**17.8**			**N/A**	4.0	6.0	**5.0**	7.7	17.7	**10.3**	11	7.6	11.2	**9.3**	4
Pool spacing (ft)	38.6	90.5	**64.9**	17.9	51.5	**32.5**	13.0	46.5	**24.2**	17.6	24.1	**20.8**	20.0	58.0	**45.3**	34.7	88	**52**	10	140	150	**145**	4
Riffle length (ft)	7.1	22.4	**14.1**	17.9	36.62	**27.7**	3.7	22.6	**13.1**			**N/A**	16.0	52.0	**34.0**	22.2	74.9	**40.6**	10	133	145	**138**	3
Riffle slope (ft/ft)	0.011	0.027	**0.019**	0.008	0.014	**0.0095**	0.020	0.036	**0.026**	0.006	0.049	**0.028**	0.018	0.029	**0.02**	0.0048	0.0179	**0.0115**	10	0.007	0.014	**0.009**	3
Pool slope (ft/ft)	0.012	0.013	**0.011**	0.008	0.009	**0.0085**	0.000	0.005	**0.003**	0.008	0.014	**0.010**	0.018	0.029	**0.024**	0.0001	0.0048	**0.0025**	10	0.0001	0.0012	**0.0007**	4
Run slope (ft/ft)	0.013	0.034	**0.023**	0.008	0.030	**0.0125**	0.028	0.059	**0.041**			**N/A**			**N/A**			**N/A******				**N/A******	
Glide slope (ft/ft)	0.008	0.020	**0.012**	0.0050	0.0460	**0.015**	0.000	0.012	**0.003**			**N/A**			**N/A**			**N/A******				**N/A******	
Riffle Slope/Avg. Water Surface Slope	0.79	1.93	**1.36**	0.89	1.56	**1.06**	1.52	2.73	**1.97**	0.40	3.20	**1.80**	1.29	2.09	**1.69**			**0.97**				**0.95**	
Run slope/Avg. Water Surface Slope	0.93	2.43	**1.64**	0.87	3.33	**1.39**	2.12	4.47	**3.11**			**N/A**			**N/A**			**N/A******				**N/A******	
Pool Slope/Avg. Water Surface Slope	0.86	0.93	**0.79**	0.89	0.97	**0.94**	0.00	0.38	**0.23**	0.50	0.90	**0.60**	1.29	2.09	**1.69**			**0.21**				**0.07**	
Glide Slope/Avg.Water Surface Slope	0.57	1.43	**0.86**	0.56	5.11	**1.67**	0.00	0.91	**0.23**			**N/A**			**N/A**			**N/A******				**N/A******	
Substrate																							
d50 (mm)			**0.04**			**0.04**			**8.6**			**12.70**				0.06	16	**7.1**	3	0.03	4.7	**2.4**	2
d84 (mm)			**0.06**			**6.16**			**77.00**			**38.00**		**108**		5	29	**17**	3	0.05	14	**7**	2
Additional Reach Parameters																							
Valley Length (ft)			**1184**			**629**			**235**			**N/A**			**1284**			**1184**				**629**	
Channel Length (ft)			**1184**			**631**			**266**			**N/A**			**1395**			**1184**				**631**	
Valley Slope (ft/ft)	0.0116	0.0164	**0.0135**	0.0087	0.0122	**0.0095**			**0.0139**			**0.0173**			**0.0132**			**0.0119**				**0.0097**	
Water Surface Slope (ft/ft)	0.0100	0.0176	**0.0140**	0.0090	0.0090	**0.0090**			**0.0132**			**0.0156**			**0.0139**			**0.0119**				**0.0095**	
Sinuosity			**1**			**1**			**1.1**			**1.05**			**1.1**			**1.0**				**1.0**	

* Tributary 3 and 4 - The Pattern of the channel was not altered. Tributary 4 only minimal work consisting of altering dimension was performed.

** Tributary modified/channelized in past so application of classification of natural channels may not be applicable

***Note on Tributaries 3 and 4 Pattern Data. These two tributaries are relatively straight channels. Beltwidth, radius of curvature, and other measurements are not applicable.

**** Runs and glides are too short to obtain meaningfull measurements

Table 9a. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)

Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
	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)	3.97	3.93	3.07	3.26	4.77			5.13	6.09	5.85	4.81	8.83			4.51	4.57	5.08	4.25	11			5.14	5.31	6.2	9.9	9.6			4.76	4.27	3.8	3.9	4.5		
Floodprone Width (ft)	50	50	50	50	50			50	50	50	50	50			50	50	50	50	50			50	50	50	50	50			50	50	50	50	50		
Bankfull Mean Depth (ft)	0.38	0.41	0.42	0.28	0.31			0.78	0.7	0.69	0.82	0.45			0.68	0.61	0.8	0.6	0.28			0.72	0.68	0.83	0.41	0.38			0.32	0.3	0.3	0.3	0.34		
Bankfull Max Depth (ft)	0.53	0.51	0.5	0.37	0.45			1.19	1.21	1.38	1.21	1.2			1	0.69	1.22	0.9	0.89			1.33	1.26	1.5	1.28	1.42			0.79	0.42	0.45	0.42	0.47		
Bankfull Cross Sectional Area (ft^2)	1.51	1.62	1.28	0.92	1.51			3.98	4.27	4.03	3.96	3.98			3.08	2.8	4.06	2.36	3.08			3.72	3.59	5.17	4.1	3.72			1.54	1.7	1.3	1.1	1.54		
Bankfull Width/Depth Ratio	10.45	9.59	7.31	11.64	15.39			6.58	8.7	8.5	4.81	19.6			6.63	7.49	6.4	7.59	39.29			7.14	7.81	7.4	24.1	25.2			14.87	14.23	11.5	13.6	13.24		
Bankfull Entrenchment Ratio	10.06	10.18	16.29	15.34	8.03			7.79	6.57	8.5	10.4	5.6			11.1	8.72	9.8	11.8	4.5			9.7	7.49	8.1	5	5.2			10.5	8.44	13.2	12.6	11.11		
Low Top of Bank Depth (ft)	NA	NA	NA	NA	0.43			NA	NA	NA	NA	1.07							0.89							1.31							0.43		
Bankfull Bank Height Ratio	1	1	1	1	0.96			1	1	1	1	0.89			1	1	0.9	0.9	1			1	1	1	1	0.92			1	1	1	1	0.9		
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)	35.5	32.9	31.2	14.5	21.8			7.7	6.9	0.8	13.6	6.8			25.7	32	73	64	65			0.03	0.04	0.05	0.06	0.06			27.3	42.4	45	11.3	30.6		
	Cross Section 6 (Riffle)							**Cross Section 7 (Pool)**							**Cross Section**							**Cross Section**							**Cross Section**						
	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)	4.39	4.93	4.37	3.98	10.02			6.59	6.21	9.94	10.5	7.1																							
Floodprone Width (ft)	50	50	50	50	50			40	40	40	40	40																							
Bankfull Mean Depth (ft)	0.39	0.33	0.4	0.34	0.17			0.49	0.59	0.4	0.4	0.45																							
Bankfull Max Depth (ft)	0.58	0.5	0.5	0.43	0.5			0.85	0.92	0.97	0.87	0.9																							
Bankfull Cross Sectional Area (ft^2)	1.72	1.64	1.73	1.35	1.72			3.21	3.69	3.98	3.92	3.21																							
Bankfull Width/Depth Ratio	11.26	14.94	10.97	11.7	58.4			13.45	10.53	24.8	28.5	15.78																							
Bankfull Entrenchment Ratio	11.4	7.16	11.4	11.4	4.99			6.1	6.37	4.02	3.8	5.6																							
Low Top of Bank Depth (ft)	NA	NA	NA	NA	0.44			NA	NA	NA	NA	0.74																							
Bankfull Bank Height Ratio	1	1	1	1	0.88			1	1	1	1	0.82																							
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)	13.8	12.9	41	5.2	10			11.2	6.3	0.8	3	3.6																							

Note: Bankfull elevation for MY 1 - 3 based on fixed baseline bankfull elevation. Bankfull elevation for MY 4 and 5 based on Bankfull Cross-sectional area per USACE guidance.

Table 9a. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)

Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

	Cross Section 8 (Pool)							Cross Section 9 (Riffle)							Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	4	4.3	4.2	4.9	3.8			3.58	3.48	3.3	3.2	4.17			6.74	6.19	6.61	6.39	12.03		
Floodprone Width (ft)	32	32	40	40	40			31	31	32	33	33			35	35	33	32	35		
Bankfull Mean Depth (ft)	0.41	0.38	0.33	0.25	0.44			0.32	0.24	0.31	0.32	0.27			1.04	0.79	0.84	0.8	0.57		
Bankfull Max Depth (ft)	0.65	0.71	0.6	0.6	0.77			0.49	0.38	0.49	0.54	0.55			1.53	1.29	1.22	1.2	1.46		
Bankfull Cross Sectional Area (ft^2)	1.66	1.65	1.38	1.25	1.66			1.16	0.85	1.01	1.03	1.16			6.98	4.87	5.53	5.09	6.98		
Bankfull Width/Depth Ratio	9.78	11.32	12.8	19.9	8.59			11.19	14.5	10.6	10	15.44			6.48	7.84	7.87	7.99	21.1		
Bankfull Entrenchment Ratio	7.9	9.31	9.48	8	10.57			8.6	6.89	9.77	10.35	7.89			5.12	5.1	4.96	5.02	2.96		
Low Top of Bank Depth (ft)					0.89							0.51							1.29		
Bankfull Bank Height Ratio	1	1	1	1	1.15			1	1	1	1	0.93			1	1	1	1	0.89		
Based on current/developing bankfull feature																					
Bankfull Width (ft)																					
Floodprone Width (ft)																					
Bankfull Mean Depth (ft)																					
Bankfull Max Depth (ft)																					
Bankfull Cross Sectional Area (ft^2)																					
Bankfull Width/Depth Ratio																					
Bankfull Entrenchment Ratio																					
Bankfull Bank Height Ratio																					
Cross Sectional Area between end pins (ft^2)																					
d50 (mm)	5.42	0.04	0.03	4	4			16	0.04	0.04	0.03	0.04			0.06	0.04	0.03	0.03	0.03		
	Cross Section 11 (Riffle)							**Cross Section 12 (Riffle)**							**Cross Section**						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	3.53	2.98	3.22	3.54	3.58			4.29	4.17	4.18	3.15	3.81									
Floodprone Width (ft)	19.5	19.5	18	14	14			18.3	18.3	24	11	19									
Bankfull Mean Depth (ft)	0.34	0.41	0.35	0.36	0.33			0.29	0.25	0.28	0.3	0.32									
Bankfull Max Depth (ft)	0.69	0.69	0.62	0.53	0.53			0.43	0.44	0.5	0.48	0.53									
Bankfull Cross Sectional Area (ft^2)	1.21	1.22	1.12	1.27	1.21			1.23	1.05	1.19	0.94	1.23									
Bankfull Width/Depth Ratio	10.38	7.27	9.2	9.83	10.85			14.79	16.68	14.93	10.5	11.91									
Bankfull Entrenchment Ratio	5.5	6.39	5.42	3.94	3.97			4.26	5.4	5.83	3.5	5.1									
Low Top of Bank Depth (ft)					0.49							0.6									
Bankfull Bank Height Ratio	1	1	1	1	0.93			1	1	1	1.1	1.1									
Based on current/developing bankfull feature																					
Bankfull Width (ft)																					
Floodprone Width (ft)																					
Bankfull Mean Depth (ft)																					
Bankfull Max Depth (ft)																					
Bankfull Cross Sectional Area (ft^2)																					
Bankfull Width/Depth Ratio																					
Bankfull Entrenchment Ratio																					
Bankfull Bank Height Ratio																					
Cross Sectional Area between end pins (ft^2)																					
d50 (mm)	0.03	0.03	0.03	0.03	0.03			4.7	0.03	0.03	0.03	0.03									

Note: Bankfull elevation for MY 1 - 3 based on fixed baseline bankfull elevation. Bankfull elevation for MY 4 and 5 based on Bankfull Cross-sectional area per USACE guidance.

Table 9b. Stream Reach Data Summary
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Parameter	MY 0 Trib 1A			MY 1 Trib 1A			MY 2 Trib 1A			MY 3 Trib 1A			MY 4 Trib 1A			MY 5 Trib 1A		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	3.97	4.76	4.41	3.93	4.93	4.43	3.07	5.08	4.08	3.26	4.25	3.84	4.50	11.00	7.57			
Floodprone Width (ft)	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50			
Bankfull Mean Depth (ft)	0.32	0.68	0.44	0.30	0.61	0.41	0.30	0.80	0.48	0.28	0.6	0.38	0.17	0.34	0.28			
[1]Bankfull Max Depth (ft)	0.53	1.00	0.73	0.42	0.69	0.53	0.45	1.22	0.67	0.37	0.9	0.53	0.45	0.89	0.58			
Bankfull Cross Sectional Area (ft^2)	1.51	3.08	1.96	1.62	2.80	1.94	1.28	4.06	2.09	0.92	2.36	1.43	1.51	3.08	1.96			
Width/Depth Ratio	6.63	14.87	10.80	7.49	14.94	11.56	6.40	11.50	9.05	7.59	13.6	11.13	13.24	58.40	31.58			
Entrenchment Ratio	10.1	11.4	10.8	7.16	10.18	8.63	9.80	16.29	12.67	11.4	15.34	12.79	4.50	11.11	7.16			
Low Top of Bank Depth (ft)													0.43	0.89	0.55			
[1]Bank Height Ratio			1			1			1			1	0.88	1	0.94			
Profile																		
Riffle Length (ft)	8.2	47	15.7	6.3	46	14.4	10	47	16	6.7	48	16.5	8	48	16.5			
Riffle Slope (ft/ft)	0.0125	0.475	0.0253	0.007	0.047	0.024	0.006	0.047	0.022	0.011	0.048	0.025	0.012	0.047	0.025			
Pool Length (ft)	4.9	17.8	11.3	7.8	17.9	13.1	7.9	18	12.9	5.2	17.3	10.4	7.6	17.5	10.3			
Pool Max depth (ft)	1.27	1.78	1.53	1.15	1.92	1.49	1.14	1.8	1.47	1.2	1.6	1.4	1.2	1.58	1.42			
Pool Spacing (ft)	13	61	26.6	13.8	60	26.9	12.7	60	27.6	14	60	27.1	13	60	27.5			
Pattern																		
Channel Beltwidth (ft)	18	25	22	18	25	22	18	25	22	18	25	22	18	25	22			
Radius of Curvature (ft)	6	20	12	6	20	12	6	20	12	6	20	12	6	20	12			
Rc/Bankfull width (ft/ft)	1.36	4.54	2.72	1.35	4.51	2.71	1.47	4.90	2.94	1.56	5.21	3.13	0.79	2.64	1.58			
Meander Wavelength (ft)	34	106	50	34	106	50	34	106	50	34	106	50	34	106	50			
Meander Width Ratio			5.0			5.0			5.4			5.7			2.9			
Transport parameters																		
Reach Shear Stress (competency) lb/f^2																		
Max part size (mm) mobilized at bankfull																		
Stream Power (transport capacity) W/m^2																		
Additional Reach Parameters																		
Rosgen Classification	C4			C4			C4			C4			C4					
Bankfull Velocity (fps)																		
Bankfull Discharge (cfs)																		
Valley length (ft)	1285			1285			1285			1285			1285					
Channel Thalweg length (ft)	1390			1390			1390			1390			1390					
Sinuosity (ft)	1.1			1.1			1.1			1.1			1.1					
Water Surface Slope (Channel) (ft/ft)	0.0127			0.0127			0.0127			0.0127			0.0127					
BF slope (ft/ft)	0.0129			0.0129			0.0129			0.0129			0.0129					
[3]Bankfull Floodplain Area (acres)																		
[4]Proportion over wide (%)																		
Channel Stability or Habitat Metric																		
Biological or Other																		

Table 9b. Stream Reach Data Summary
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Parameter	MY 0 Trib 3			MY 1 Trib 3			MY 2 Trib 3			MY 3 Trib 3			MY 4 Trib 3			MY 5 Trib 3		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	3.58	6.74	4.77	3.48	6.19	4.66	3.30	6.61	4.70	3.2	6.39	4.83	3.80	12.03	6.67			
Floodprone Width (ft)	31.00	35.00	32.67	31	35	32.70	32	40	35	32	40	35.00	33	40	36			
Bankfull Mean Depth (ft)	0.32	1.04	0.59	0.24	0.79	0.47	0.31	0.84	0.49	0.25	0.8	0.46	0.27	0.57	0.43			
[1]Bankfull Max Depth (ft)	0.49	1.53	0.89	0.38	1.29	0.79	0.49	1.22	0.77	0.54	1.2	0.78	0.55	1.46	0.93			
Bankfull Cross Sectional Area (ft^2)	1.16	6.98	3.27	0.85	4.87	2.45	1.01	5.53	2.64	1.03	5.09	2.46	1.16	6.98	3.27			
Width/Depth Ratio	6.48	11.19	9.15	7.84	14.5	11.22	7.87	12.80	10.42	7.99	19.9	12.63	8.59	21.10	15.04			
Entrenchment Ratio	5.12	8.60	7.21	5.1	9.31	7.10	4.96	9.77	8.07	5.02	10.35	7.79	2.96	10.57	7.14			
Low Top of Bank Depth (ft)													0.51	1.29	0.90			
[1]Bank Height Ratio			1			1			1			1	0.89	1.15	0.99			
Profile																		
Riffle Length (ft)	22.2	74.9	40.6	22.2	74.9	40.6	24	73	43	25	76	43	23	73	43			
Riffle Slope (ft/ft)	0.0048	0.0179	0.0115	0.0048	0.019	0.013	0.0048	0.0179	0.0115	0.003	0.019	0.012	0.0048	0.0179	0.013			
Pool Length (ft)	7.7	17.7	10.3	7.6	17.8	10.4	6	12	9.4	6	9	7.6	6	12	10			
Pool Max depth (ft)	1.01	1.97	1.56	1	1.95	1.52	0.9	1.7	1.3	0.9	1.6	1.2	0.9	1.7	1.2			
Pool Spacing (ft)	34.7	88	52	34.8	88.1	52	31	84	52	31	83	50	32	83	52			
Pattern																		
Channel Beltwidth (ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Radius of Curvature (ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Rc/Bankfull width (ft/ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Meander Wavelength (ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Meander Width Ratio	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Transport parameters																		
Reach Shear Stress (competency) lb/f^2																		
Max part size (mm) mobilized at bankfull																		
Stream Power (transport capacity) W/m^2																		
Additional Reach Parameters																		
Rosgen Classification	C4			C4			C4			C4			C4					
Bankfull Velocity (fps)																		
Bankfull Discharge (cfs)																		
Valley length (ft)	1184			1184			1184			1184			1184					
Channel Thalweg length (ft)	1184			1184			1184			1184			1184					
Sinuosity (ft)	1.0			1.0			1.0			1.0			1.0					
Water Surface Slope (Channel) (ft/ft)	0.0119			0.0119			0.0119			0.0119			0.0119					
BF slope (ft/ft)	0.0119			0.0119			0.0119			0.0119			0.0119					
[3]Bankfull Floodplain Area (acres)																		
[4]Proportion over wide (%)																		
Channel Stability or Habitat Metric																		
Biological or Other																		

*Note on Tributary 3 Pattern Data. This tributary is a relatively straight channel. Beltwidth, radius of curvature, and other pattern measurements does not provide meaningfull information

Table 9b. Stream Reach Data Summary
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

Parameter	MY 0 Trib 4			MY 1 Trib 4			MY 2 Trib 4			MY 3 Trib 4			MY 4 Trib 4			MY 5 Trib 4		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	3.53	4.29	3.91	2.98	4.17	3.57	3.57	4.17	2.98	3.15	3.54	3.34	3.58	3.81	3.70			
Floodprone Width (ft)	18.30	19.50	18.90	18.3	19.5	18.9	18.9	19.5	18.3	11	14	12.50	14.00	19.00	16.50			
Bankfull Mean Depth (ft)	0.29	0.34	0.32	0.25	0.41	0.33	0.33	0.41	0.25	0.3	0.36	0.33	0.32	0.33	0.33			
[1]Bankfull Max Depth (ft)	0.43	0.69	0.56	0.44	0.69	0.56	0.56	0.69	0.44	0.48	0.53	0.51	0.53	0.53	0.53			
Bankfull Cross Sectional Area (ft^2)	1.21	1.23	1.22	1.05	1.22	1.13	1.13	1.22	1.05	0.94	1.27	1.11	1.21	1.23	1.22			
Width/Depth Ratio	10.38	14.79	12.59	7.27	16.68	11.97	11.97	16.68	7.27	9.83	10.5	10.17	10.85	11.91	11.38			
Entrenchment Ratio	4.26	5.50	4.88	5.4	6.39	5.89	5.89	6.39	5.40	3.5	3.94	3.72	3.97	5.10	4.54			
Low Top of Bank Depth (ft)													0.49	0.60	0.55			
[1]Bank Height Ratio			1			1			1				0.93	1.10	1.02			
Profile																		
Riffle Length (ft)	133	145	138	130	145	136	140	160	148	134	146	139	134	160	148			
Riffle Slope (ft/ft)	0.007	0.014	0.009	0.006	0.014	0.009	0.006	0.014	0.009	0.007	0.014	0.01	0.006	0.014	0.009			
Pool Length (ft)	7.6	11.2	9.3	7.4	11.1	9.2	7.1	13	10.6	5	9	7	7.4	13	10.6			
Pool Max depth (ft)	1.39	2.35	1.78	1.37	2.35	1.77	1.18	1.79	1.46	1	1.53	1.22	1.39	1.79	1.46			
Pool Spacing (ft)	140	150	145	140	150	145	140	150	145	140	150	145	140	150	145			
Pattern																		
Channel Beltwidth (ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Radius of Curvature (ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Rc/Bankfull width (ft/ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Meander Wavelength (ft)	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Meander Width Ratio	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*			
Transport parameters																		
Reach Shear Stress (competency) lb/f^2																		
Max part size (mm) mobilized at bankfull																		
Stream Power (transport capacity) W/m^2																		
Additional Reach Parameters																		
Rosgen Classification	N/A			N/A			N/A			N/A			N/A					
Bankfull Velocity (fps)																		
Bankfull Discharge (cfs)																		
Valley length (ft)	631			631			631			631			631					
Channel Thalweg length (ft)	631			631			631			631			631					
Sinuosity (ft)	1.0			1.0			1.0			1.0			1.0					
Water Surface Slope (Channel) (ft/ft)	0.00972			0.00972			0.00972			0.00972			0.00972					
BF slope (ft/ft)	0.0095			0.0095			0.0095			0.0095			0.0095					
[3]Bankfull Floodplain Area (acres)																		
[4]Proportion over wide (%)																		
Channel Stability or Habitat Metric																		
Biological or Other																		

*Note on Tributary 4 Pattern Data. This tributary is a relatively straight channel. Beltwidth, radius of curvature, and other pattern measurements does not provide meaningfull information

APPENDIX E: HYDROLOGIC DATA

Table 10 – Verification of Bankfull Events

Table 10. Documentation of Geomorphologically Significant Flow Events Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022					
Date of Observation	**Date of occurrence**	**Method**	**Greater Than Qgs=Q2*0.66 Stage**	**Greater than Qbkf Stage?**	**Notes**
12/3/2014	11/23/2014	Photo on-site wrack line		Yes	See photo below
4/17/2017	Apr-17	Crest Gauge		Yes	See photos below. Most likely occurred on 1/2/2017 or 1/3/2017 when site received a total of 1.5 inches of rain
2/6/2018	1/29/2018	Photo, crest gauge, and transducer data		Yes	See photos and transducer graphs
9/16/2016	9/16/2018	Transducer data		Yes	See transducer graphs

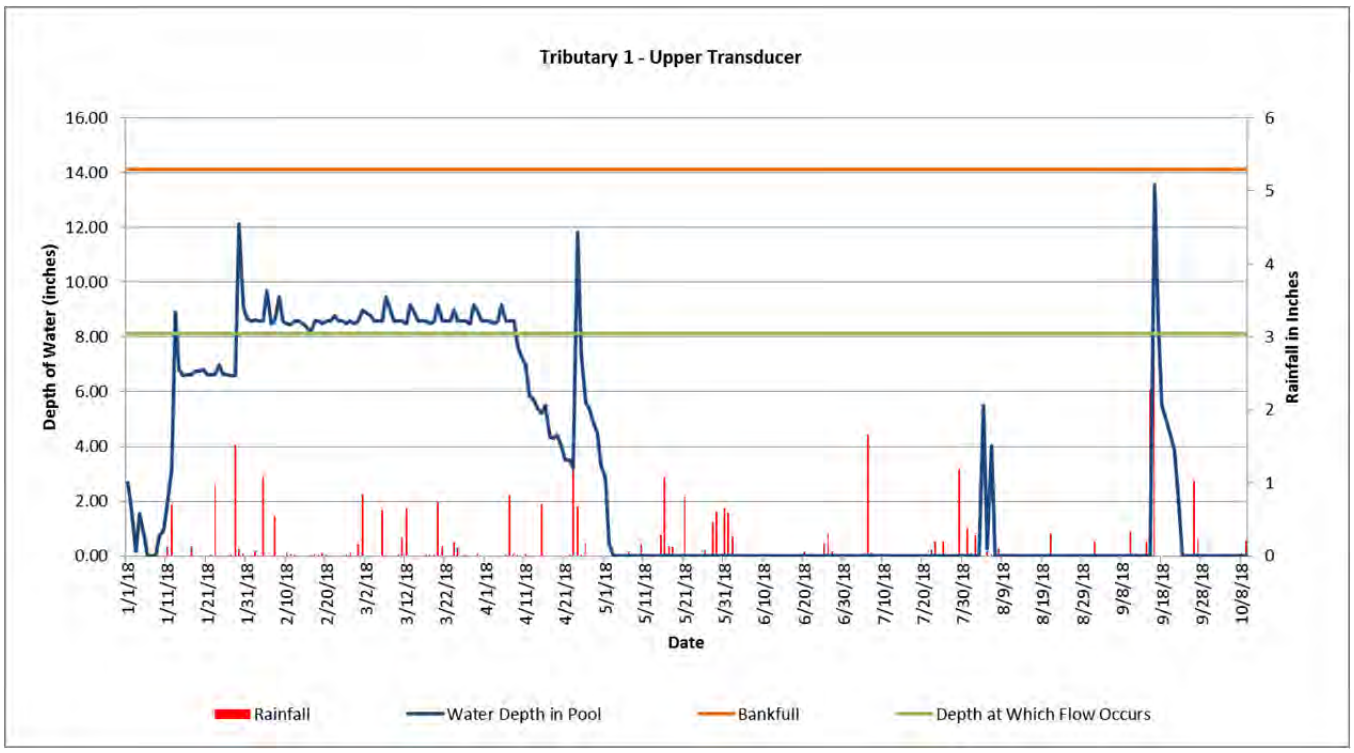
Photo of wrack lines from 11/23/2014 bankfull event

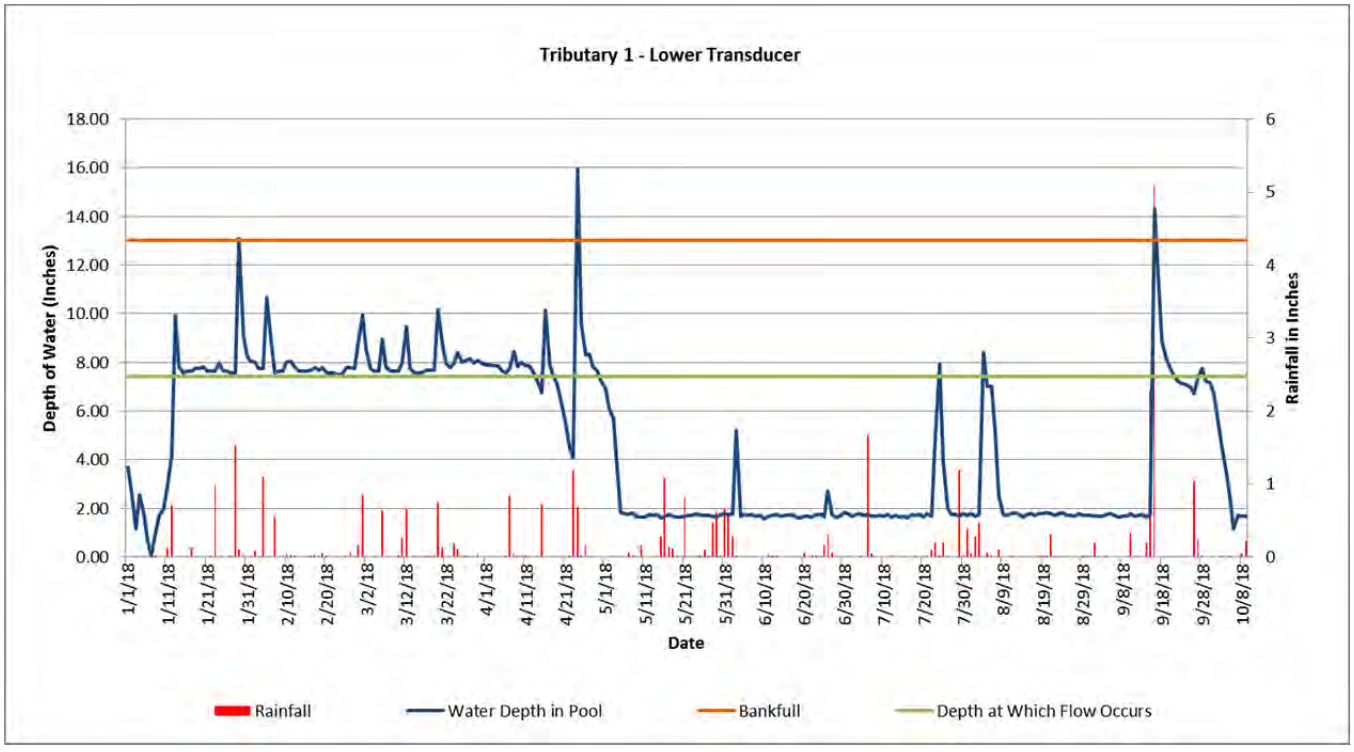
Tributary 1 Crest Gauge 4/17/2017

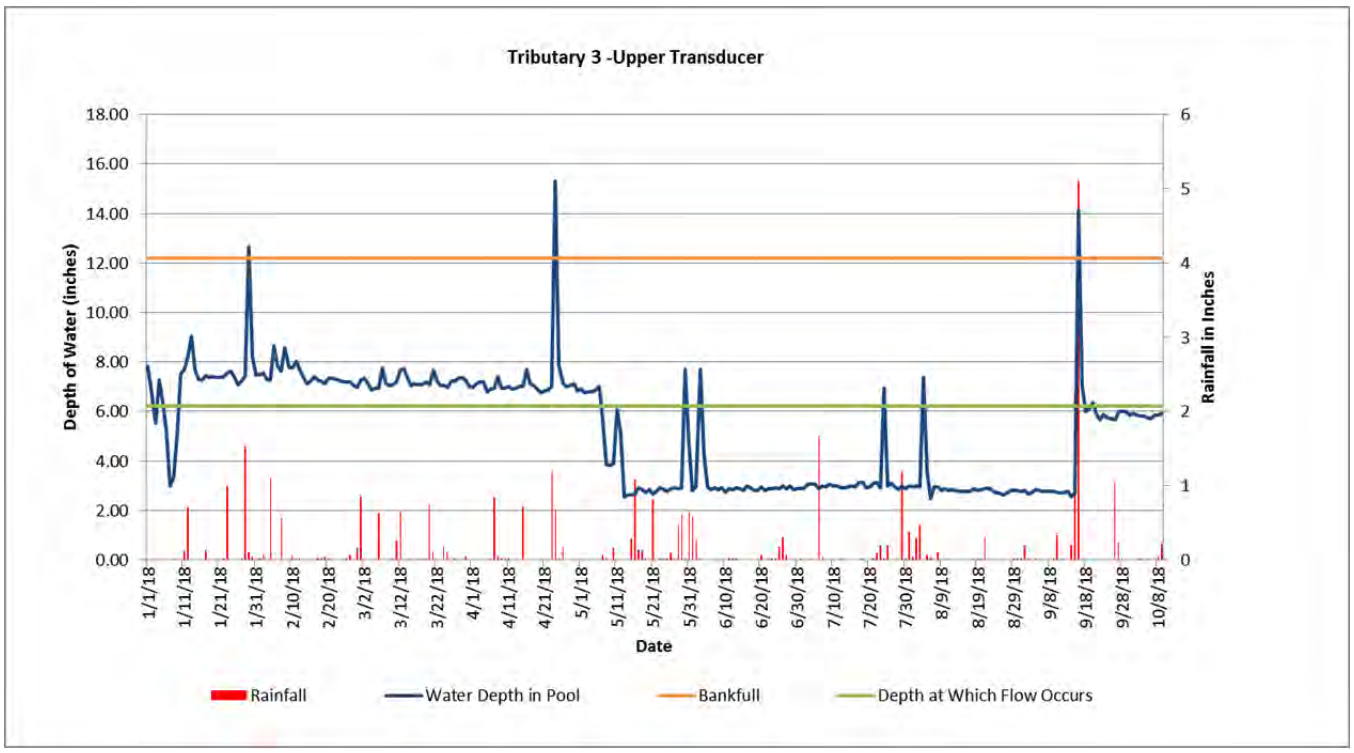
Tributary 3 Crest Gauge 4/17/2017

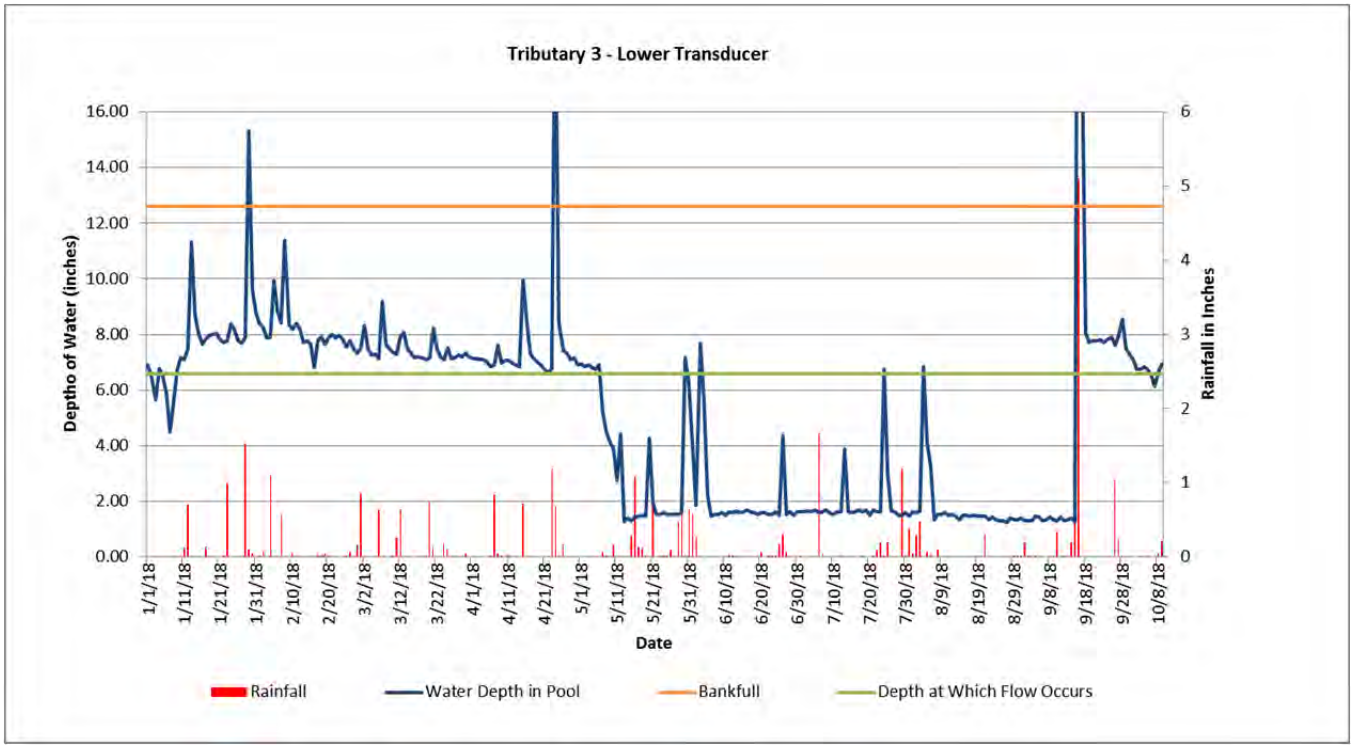
Tributary 1 wrack lines 2/6/2018

Tributary 3 wrack lines 2/6/2018


Tributary 1 - Upper Transducer
Depth of Water (inches)
Rainfall in Inches
Date
Rainfall
Water Depth in Pool
Bankfull
Depth at Which Flow Occurs


Tributary 1 - Lower Transducer
Depth of Water (Inches)
Rainfall in Inches
Date
Rainfall
Water Depth in Pool
Bankfull
Depth at Which Flow Occurs


Tributary 3 -Upper Transducer
Depth of Water (inches)
Rainfall in Inches
Date
Rainfall
Water Depth in Pool
Bankfull
Depth at Which Flow Occurs


Tributary 3 - Lower Transducer
Depth of Water (inches)
Rainfall in Inches
Date
Rainfall
Water Depth in Pool
Bankfull
Depth at Which Flow Occurs