YEAR 3 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 2017
Submitted: February 2018

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February 2018

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February 22, 2018

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

RE: Year 3 (2017) Monitoring Report the Tributaries of Wicker Branch Project (DMS Project # 95022)

Dear Mr. Tsomides,

Please find enclosed four copies of the Year 3 Monitoring Report for the Tributaries of Wicker Branch Project. Also included is a disc containing the Digital Data submission files. This report has been finalized following your review comments dated February 20, 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 2017; is this for both stream and vegetation? If so please indicate, if not please provide the distinct dates.

Monitoring data collected in October was for both vegetation and stream stability. This is now noted in Table 2. A similar notation was made for monitoring years 1 and 2.

Tributary 2 should be mentioned with reason for not being credited noted since it is in the tables and maps.

A statement regarding Tributary 2 has been added to the text in the Project Summary (4th paragraph). This statement was taken from the As-built report.

Table 3 should indicate NCDEQ rather than NCDENR where it appears.

Table 3 has been updated to reflect NCDEQ.

Table 10 should show all cumulative bank full events, not just the past year.

Table 10 has been updated to reflect all previously documented known bankfull events.

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.

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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 434 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. Plot 6 and 10 are both at 243 stems per acre. 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. An extensive removal effort occurred during construction in 2014 but stems remain. A second treatment occurred in the spring of 2016 but it was not very effective and continued treatment is required. These areas will be addressed again more vigorously during spring and summer of 2018.

The stream channels appear to be stable with no areas of bank erosion observed.

The adjacent fields were planted in corn in 2017. Additional signage installed in the spring of 2016 was augmented in 2017. Only minor encroachment at the crossings of Tributary 2 and 3 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**.

A site visit by the Interagency Review Team (IRT) was performed on April 17, 2017. During the site visit several items were noted and are detailed in a Memorandum dated May 4, 2017. These were:

- Possible areas of low stem density
- Bankfull event data collection and verification
- Presence of invasives
- Easement violations
- Lack of channel on Tributary 3 between the two wetland areas

Areas of low stem density – It was noted by the IRT that overall stem density appeared to be showing success. However, agency personnel indicated that there appeared to be grassy expanses in some areas along the stream where planted stems are not evident. It was recommended that supplemental planting be conducted this fall/winter so that larger areas with low woody stem density more closely represent the plot location densities. To evaluate these areas ten linear transects were performed to document non-plot areas. The location of the transects are shown on **Figure 3**. All planted stems in the 25 X 4 meter transects were located, identified, and counted. The following table presents the results of the evaluation.

Species	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
Betula nigra	13	0	0	0	0	1	0	0	0	0
Cercis canadensis	5	4	0	6	7	8	4	9	4	2
Cornus amomum	4	7	1	5	2	2	5	5	0	3
Diospyros virginiana	1	3	2	2	3	2	1	4	6	0
Elderberry	6	4	1	2	0	1	4	3	3	2
Fraxinus pennsylvanica	0	0	0	0	0	0	1	0	0	0
Platanus occidentalis	0	4	1	0	0	1	1	0	0	0
Populus sp.	6	4	1	2	0	1	4	3	3	2
Quercus alba	0	10	2	6	5	4	1	5	1	6

Species	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
Quercus falcata	0	0	1	1	2	0	0	0	1	0
Quercus rubra	0	0	0	0	0	0	0	0	0	2
Robinia pseudoacacia	4	1	2	5	3	3	0	0	2	0
Total	**39**	**37**	**11**	**29**	**22**	**23**	**21**	**29**	**20**	**17**
Plot Size (acres)	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**
Density - #/Acre	**1578**	**1497**	**445**	**1174**	**890**	**931**	**850**	**1174**	**809**	**688**

The transect data indicates that while it may appear that planted stem density in several areas may be low, that in general areas outside of the monitoring plots are meeting the planted stem criteria of 320 stems per acre.

Bankfull event and flow data collection and verification – To help address IRT concerns two additional continuous flow gauges were installed on the site. One on Tributary 1A, 150-200 feet above the confluence with Tributary 2, and a second half way up Tributary 3. There are now four continuous flow gauges and two crest gauges. The crest gauges were moved from their initial locations about a foot back from the top of the bank to top of the bank so that they would pick up a bankfull event “better”.

Graphs showing flow at the downstream reaches of Tributaries 1 and 3 are presented in Appendix E. Tributary 1 had 22 days of continuous flow from 4/24/2017 to 5/15/2017 and Tributary 3 had at least 52 days of continuous flow from 4/18/2017 to 6/10/2017. No bankfull events were recorded by the transducers from 4/18/2017 to the end of the year. The transducers installed at the upper reaches of the Tributaries 1 and 3 have not produced reliable data and AECOM is continuing to evaluate their setup.

Invasives treatment – AECOM has contracted with Habitat Assessment & Restoration Professionals to perform multiple invasive treatments in 2018 and 2019.

Easement violations – AECOM has periodically met with the farmer in 2017 to discuss the equipment crossings and will continue to monitor, post/repost boundary markings as necessary to ensure compliance.

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

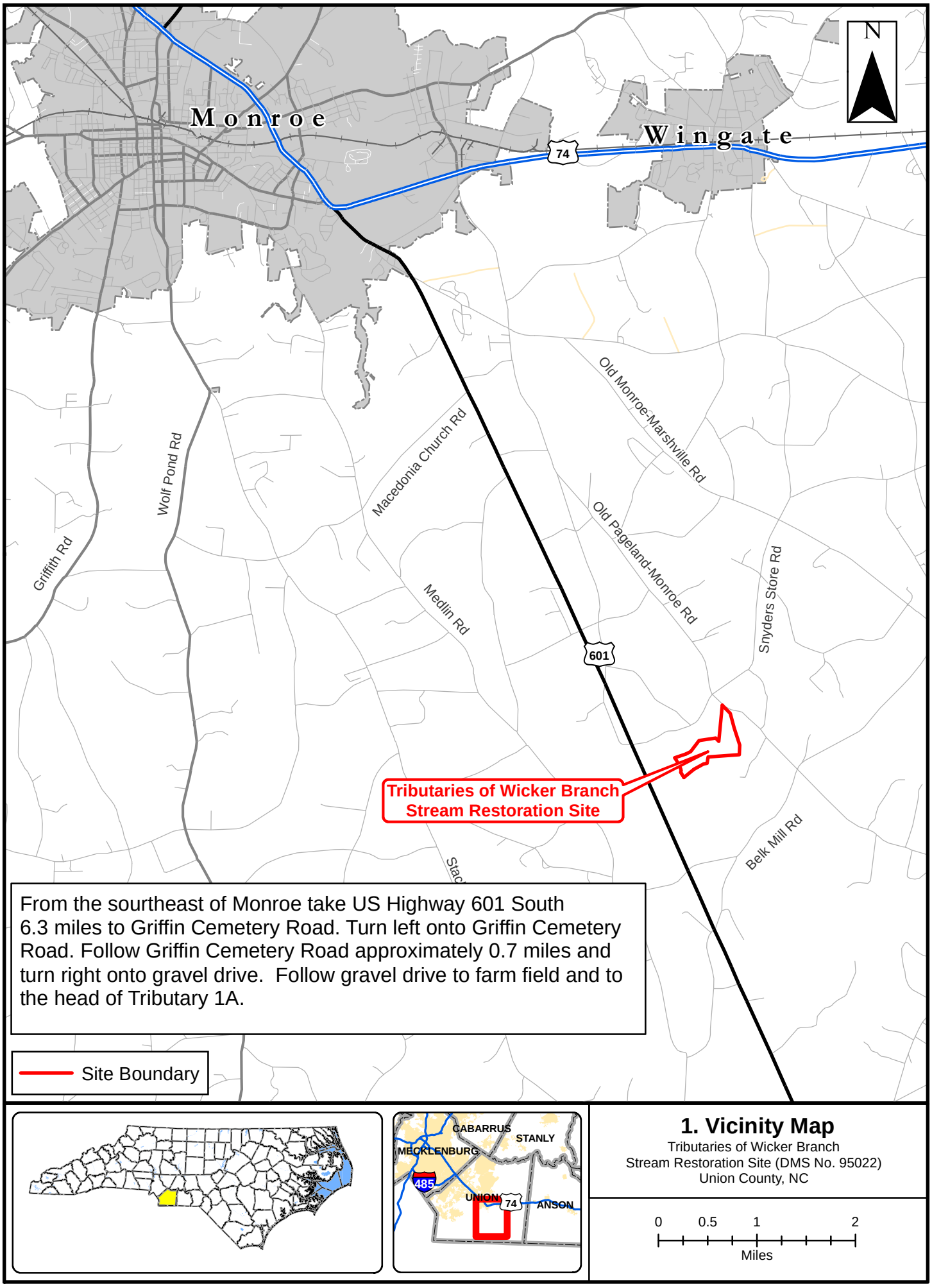
Figure 2: Stream Assets Map

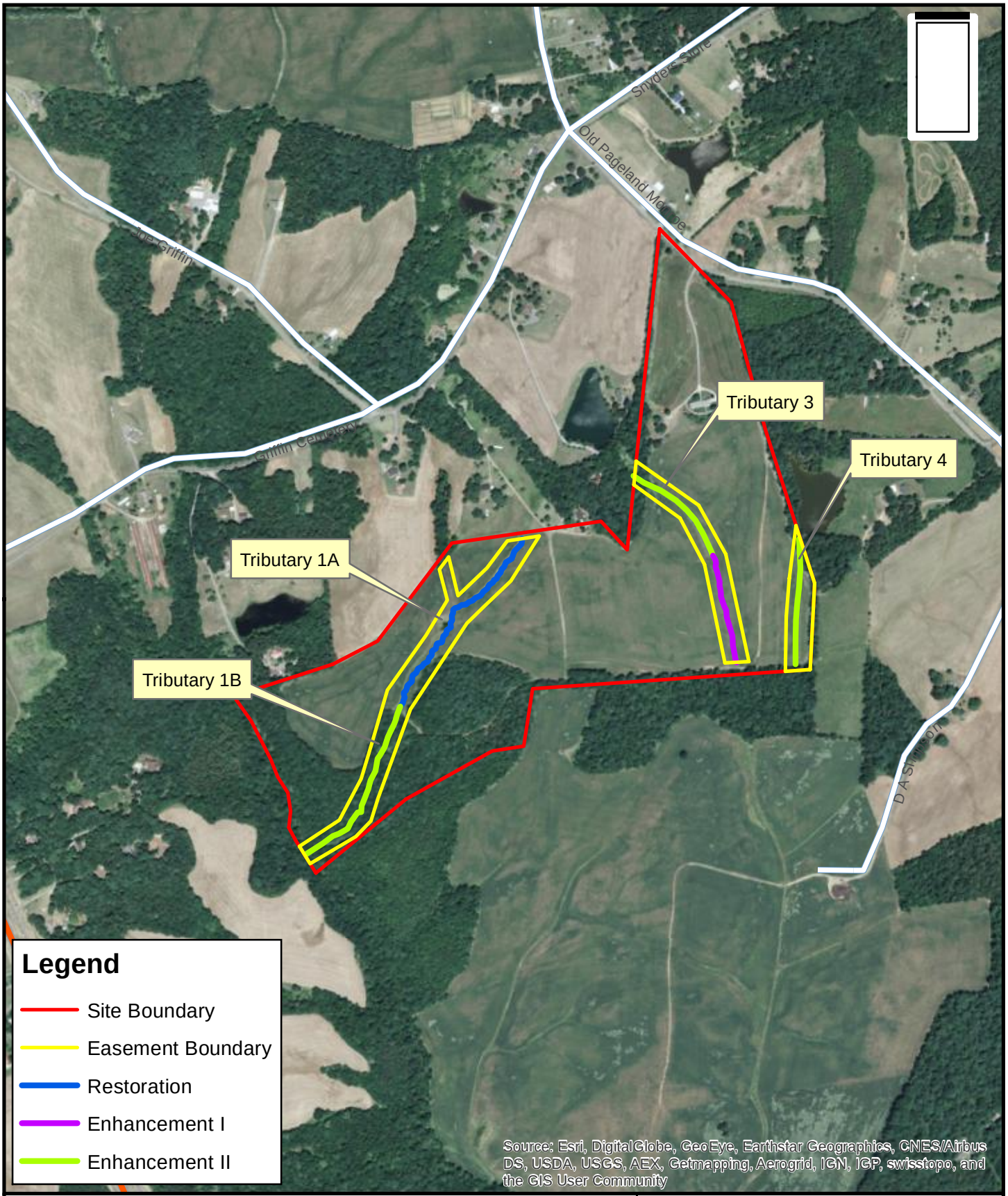
Table 1: Project Components and Mitigation Credits

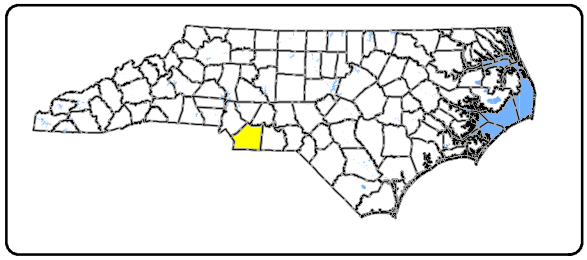
Table 2: Project Activity and Reporting History

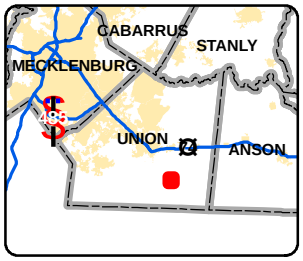
Table 3: Project Contacts

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
Year 4 Monitoring		
Year 5 Monitoring		

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

Tributary 1B

Figure 3a

Figure 3b

Tributary 2

Wicker Branch

Wicker Branch

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geogr

N

Legend

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

Year 3 Conditions

- Photo Locations
- Invasives
- Enchroachment
- Vegetation Problem Area

Vegetation Plots

- Criteria Met
- Criteria Not Met

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

XS-7

VP - 1

VT 1

0+00

1+00

2+00

3+00

4+00

5+00

Photo Monitoring Point 1

Transducer 2

Photo Monitoring Point 6

VP - 3

VT 3

VP - 2

VT 2

6+00

7+00

8+00

9+00

10+00

11+00

12+00

13+00

14+00

Crest Gauge

Transducer 1

VT 4

VP - 4

Tributary 2

XS-3

XS-4

Tributary 1A

Photo Monitoring Point 2

NC Center for Geographic Information & Analysis

N

Year 3 Conditions

- Stationing
- Photo Locations
- Crest Gauge
- Transducer
- Temporary Vegetation Plot
- Invasives
- Enchroachment
- Vegetation Problem Areas

Vegetation Plots

- Criteria Met
- Criteria Not Met

Legend

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

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

Existing Condition Plan View

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

FIGURE 3b

XS-11
XS-12
XS-10
XS-9
XS-8
Tributary 4
Tributary 3
VP - 10
VP - 11
VP - 8
VP - 9
VP - 7
VP - 6
VP - 5
VT 9
VT 10
VT 8
VT 7
VT 6
VT 5
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
Photo Monitoring Point 5
Photo Monitoring Point 4
Photo Monitoring Point 3
Crest Gauge
Transducer 3
Transducer 4
N
Legend
Existing Wetlands
Culvert
Level Spreader
Stream
Easement Boundary
Unimproved Road
Cross Sections
Equipment Crossing
Log Sill
0
50
100
Scale in Feet
Year 3 Conditions
Stationing
Photo Locations
Crest Gauge
Transducer
Temporary Vegetation Plot
Invasives
Enchroachment
Vegetation Problem Areas
Vegetation Plots
Criteria Met
Criteria Not Met
NC Center for Geographic Information & Analysis
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.	1000 SF	Yellow Hatch	1	1.00	6.5%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Green Hatch	3	0.08	0.5%

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

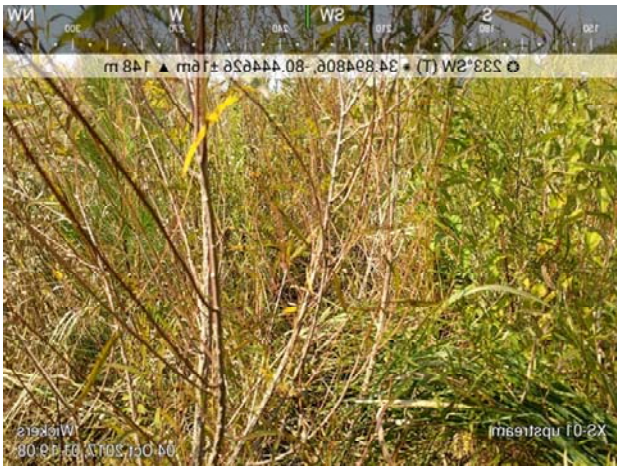
Vegetation Monitoring Plot 7 – 10/9/2017

Vegetation Monitoring Plot 10 – 10/9/2017

Vegetation Monitoring Plot 8 – 10/9/2017

Vegetation Monitoring Plot 11 – 10/9/2017

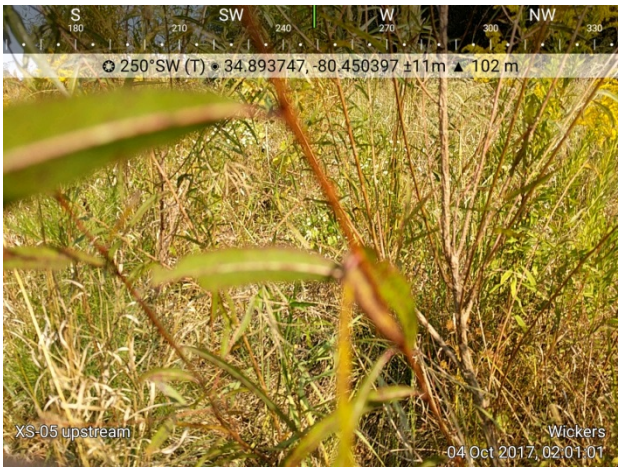
Vegetation Monitoring Plot 9 – 10/9/2017



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

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

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



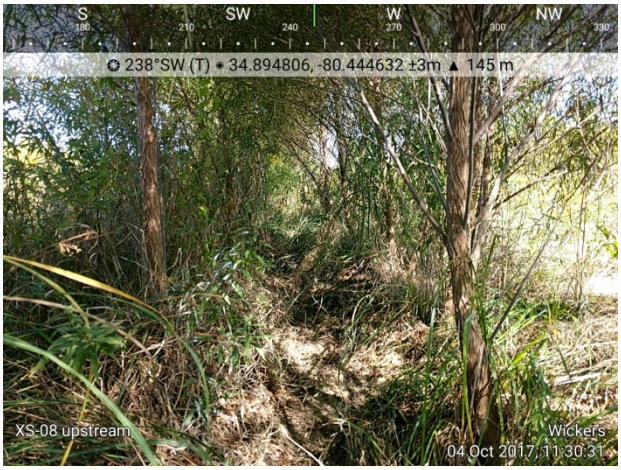
Cross Section 5 (looking upstream) – 10/4/17

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

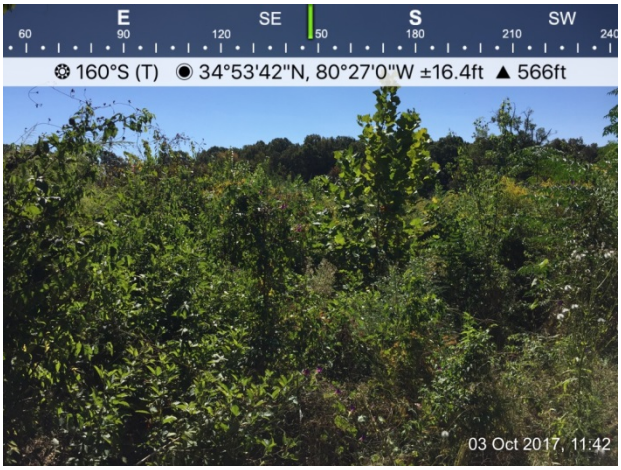


Photo Monitoring Point 2 – 10/3/2017

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 (MY3 2017)																								
			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																								
Celtis occidentalis	common hackberry	Tree			1																					
Cercis canadensis	eastern redbud	Tree	1	1	1	2	2	2	3	3	3	4	4	4	2	2	2				3	3	3	1	1	1
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	1	1	1													3	3	3
Liquidambar styraciflua	sweetgum	Tree																								
Liriodendron tulipifera	tuliptree	Tree	1	1	1	2	2	2				2	2	2	4	4	4				1	1	1			
Pinus taeda	loblolly pine	Tree																								
Platanus occidentalis	American sycamore	Tree																								
Populus deltoides	eastern cottonwood	Tree																								1
Quercus	oak	Tree																								
Quercus alba	white oak	Tree	3	3	3	2	2	2	2	2	2	1	1	1	5	5	5	4	4	4	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																								
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																					
Unknown		Shrub or Tree																								
		Stem count	20	20	23	12	12	12	9	9	9	9	10	10	14	14	14	6	6	6	15	15	15	9	9	10
		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	10	7	7	7	4	4	4	4	5	5	5	5	5	3	3	3	5	5	5	4	4	5
		Stems per ACRE	809.4	809.4	930.8	485.6	485.6	485.6	364.2	364.2	364.2	364.2	404.7	404.7	566.6	566.6	566.6	242.8	242.8	242.8	607	607	607	364.2	364.2	404.7

			Current Plot Data (MY3 2017)									Annual Means												
			95022-01-0009			95022-01-0010			95022-01-0011			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
Acer negundo	boxelder	Tree						2			3			5			3						
Celtis occidentalis	common hackberry	Tree												1									
Cercis canadensis	eastern redbud	Tree	4	4	4	2	2	2	1	1	1	23	23	23	22	22	25	21	21	21	26	26	26
Cornus amomum	silky dogwood	Shrub							1	1	1	10	10	10	11	11	12	18	18	18	21	21	21
Diospyros virginiana	common persimmon	Tree										6	6	6	7	7	10	6	6	6	7	7	7
Liquidambar styraciflua	sweetgum	Tree															13						
Liriodendron tulipifera	tuliptree	Tree	2	2	2				1	1	1	13	13	13	16	16	18	16	16	16	38	38	38
Pinus taeda	loblolly pine	Tree															2						
Platanus occidentalis	American sycamore	Tree															1						
Populus deltoides	eastern cottonwood	Tree												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	35	35	36	26	26	26	41	41	41
Quercus falcata	southern red oak	Tree										7	7	7	9	9	11	10	10	10	20	20	20
Rhus copallinum	flameleaf sumac	shrub															1						
Rhus glabra	smooth sumac	shrub															1						
Robinia pseudoacacia	black locust	Tree	1	1	1	1	1	1				9	9	9	8	8	14	7	7	7	9	9	9
Salix nigra	black willow	Tree											1	1		1	4		1	1		1	1
Sambucus canadensis	Common Elderberry	Shrub				2	2	2	2	2	2	16	16	16	18	18	21	15	15	15	21	21	21
Ulmus alata	winged elm	Tree															2						
Ulmus rubra	slippery elm	Tree												2									
Unknown		Shrub or Tree							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Stem count	10	10	10	6	6	8	9	9	12	119	120	129	127	128	175	121	122	122	186	187	187
		size (ares)	1			1			1			11			11			11			11		
		size (ACRES)	0.02			0.02			0.02			0.27			0.27			0.27			0.27		
		Species count	4	4	4	4	4	5	6	6	7	9	10	14	9	10	17	10	11	11	10	11	11
		Stems per ACRE	404.7	404.7	404.7	242.8	242.8	323.7	364.2	364.2	485.6	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	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0.17	578.273	LBPIN
9.21	577.451	GR
18.52	577.659	TOB
18.72	577.37	TOE
20.08	577.299	TW
21.05	577.362	TOE
21.92	577.796	TOB
26.95	577.698	GR
31.87	577.405	GR
37.28	577.811	GR
39.73	578.092	RBPIN

Summary Data

Bankfull Elevation	577.67
Bankfull Width (ft)	3.29
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.28
Bankfull Max Depth (ft)	0.37
Bankfull Cross Sectional Area (ft^2)	0.93
Bankfull Width/Depth Ratio	11.75
Bankfull Entrenchment Ratio	15.2
Bankfull Bank Height Ratio	0.9

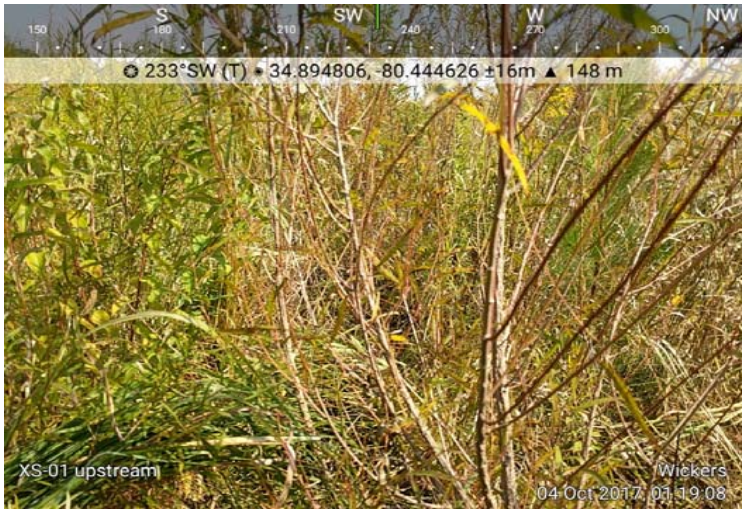
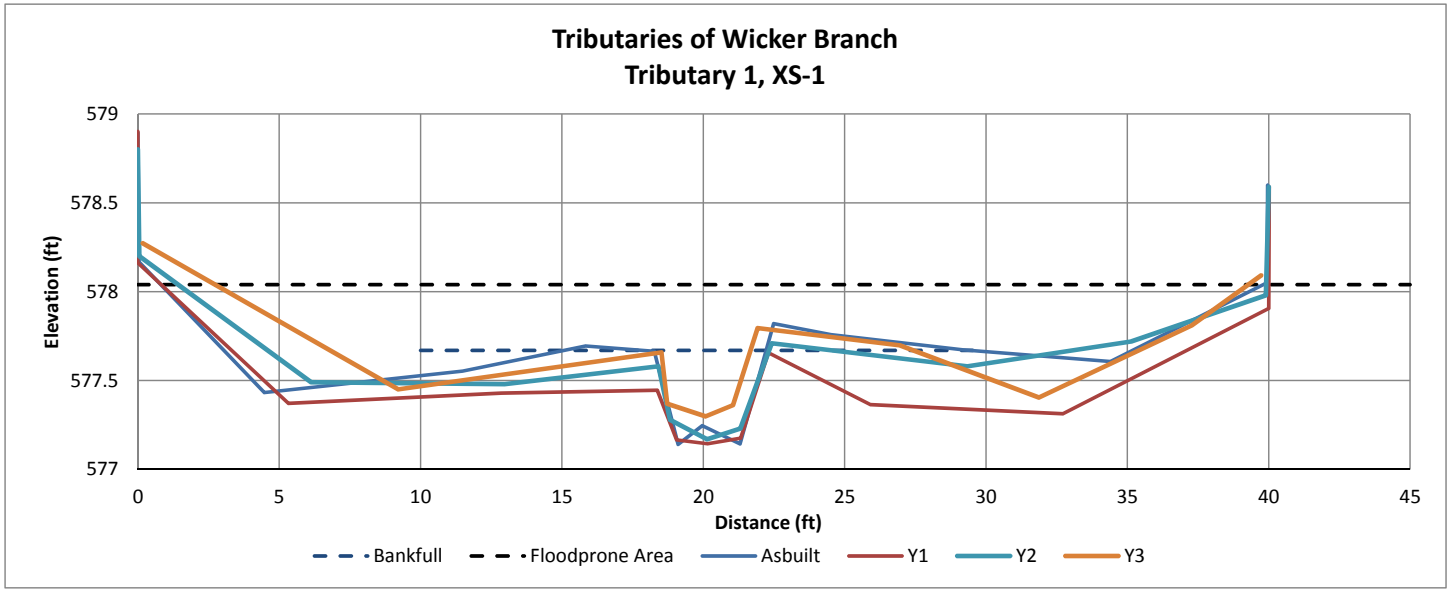


Photo: Cross-section 1 looking upstream



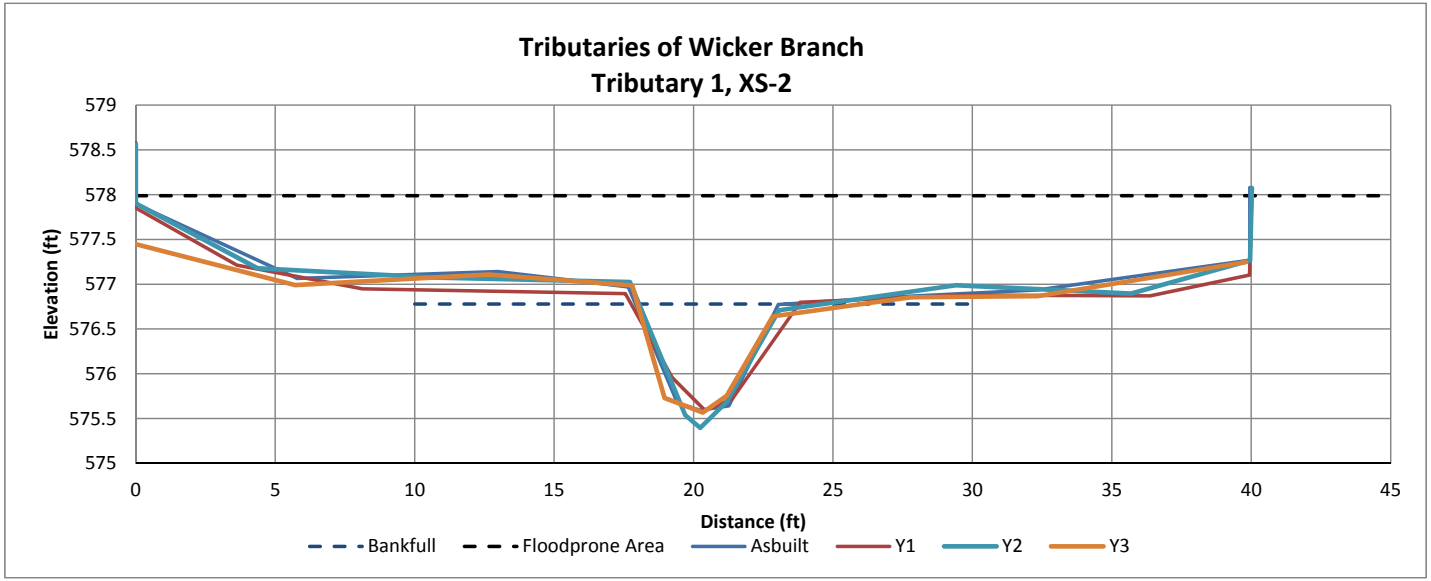
Cross-section Plot Exhibit

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	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0	577.447	LBPIN
5.72	576.99	GR
12.65	577.108	GR
17.8	576.986	TOB
18.96	575.731	TOE
20.33	575.568	TW
21.19	575.756	TOE
22.84	576.641	TOB
27.78	576.854	GR
32.33	576.867	GR
39.8	577.248	RBPIN

Summary Data	
Bankfull Elevation	576.78
Bankfull Width (ft)	4.81
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.82
Bankfull Max Depth (ft)	1.21
Bankfull Cross Sectional Area (ft^2)	3.96
Bankfull Width/Depth Ratio	4.81
Bankfull Entrenchment Ratio	10.4
Bankfull Bank Height Ratio	1

Photo: Cross-section 2 looking upstream



Cross-section Plot Exhibit

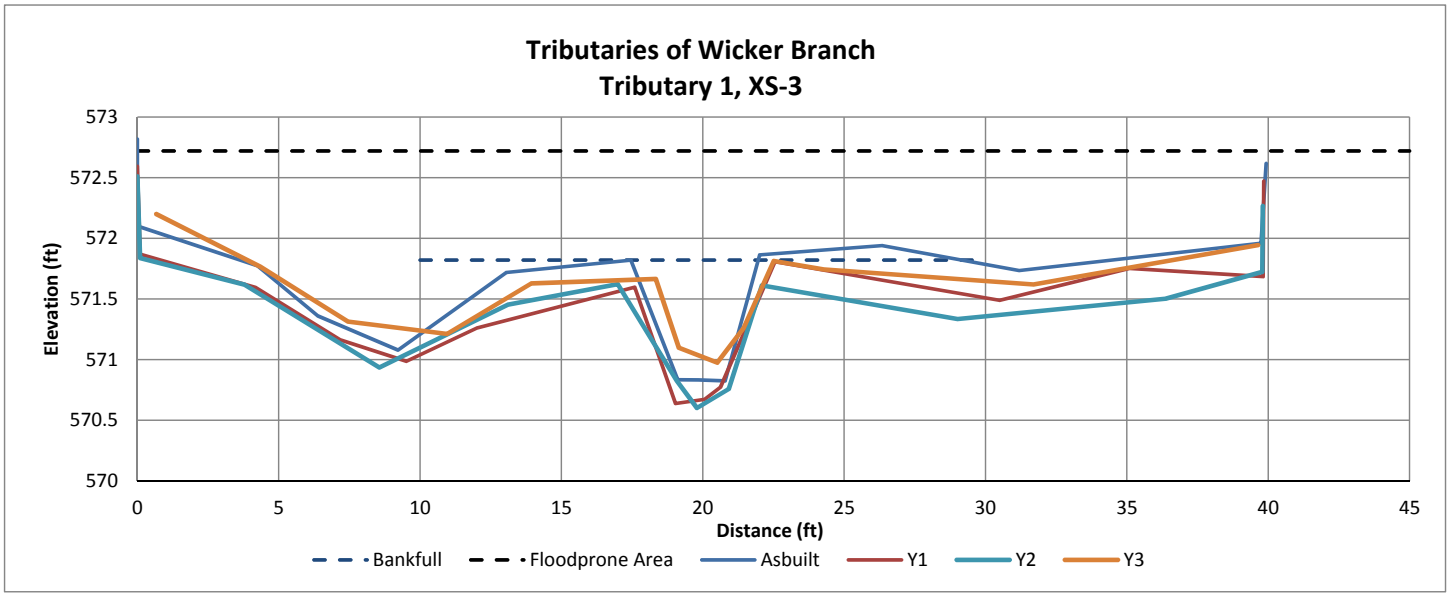
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-3, Sta. 9+34
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0.67	572.201	LBPIN
4.35	571.767	GR
7.45	571.314	GR
10.95	571.212	GR
13.93	571.628	GR
18.34	571.665	TOB
19.15	571.098	TOE
20.51	570.975	TW
21.44	571.258	TOE
22.51	571.814	TOB
24.28	571.744	GR
31.7	571.62	GR
39.64	571.944	RBPIN

Summary Data

Bankfull Elevation	571.82
Bankfull Width (ft)	4.25
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.6
Bankfull Max Depth (ft)	0.9
Bankfull Cross Sectional Area (ft^2)	2.36
Bankfull Width/Depth Ratio	7.59
Bankfull Entrenchment Ratio	11.8
Bankfull Bank Height Ratio	0.9

Photo: Cross-section 3 looking upstream



Cross-section Plot Exhibit

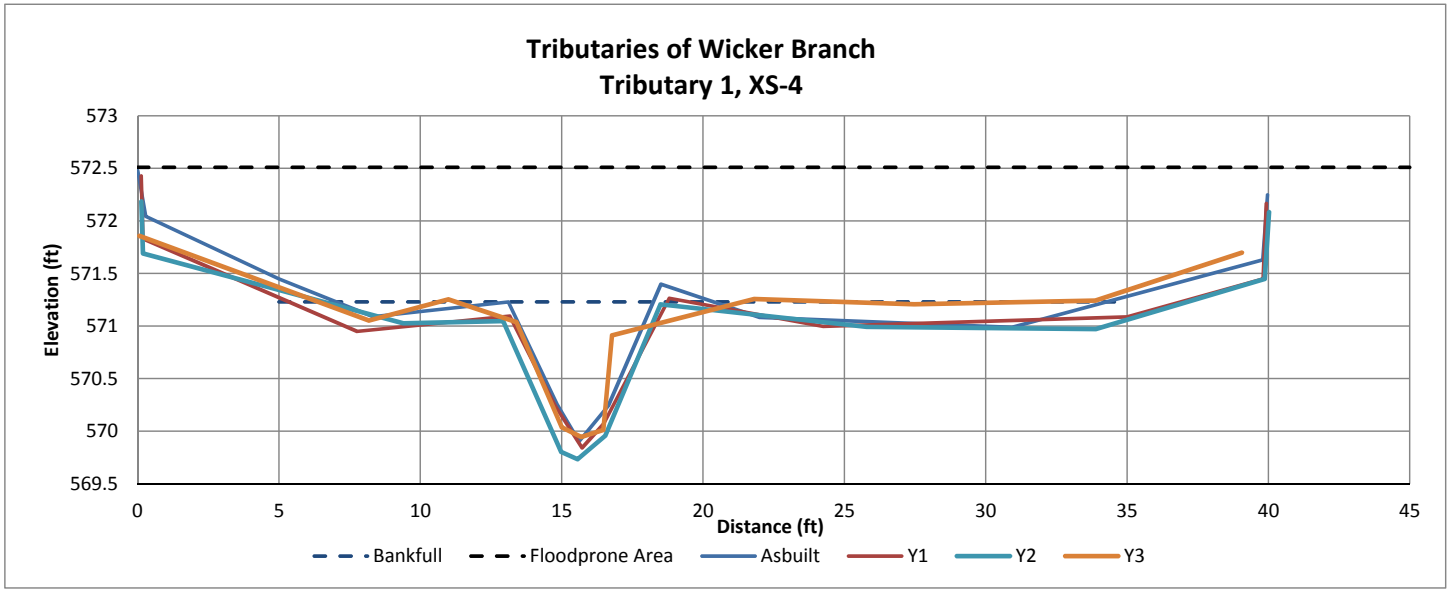
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-4, Sta. 9+72
Feature	Pool
Drainage Area (sq mi)	0.15
Date	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0.06	571.858	LBPIN
8.18	571.053	GR
10.99	571.253	GR
13.4	571.037	TOB
15	570.037	TOE
15.69	569.945	TW
16.47	570.012	TOE
16.78	570.912	TOB
21.8	571.257	GR
27.47	571.206	GR
33.87	571.241	GR
39.06	571.698	RBPIN

Summary Data

Bankfull Elevation	571.23
Bankfull Width (ft)	9.9
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.41
Bankfull Max Depth (ft)	1.28
Bankfull Cross Sectional Area (ft^2)	4.1
Bankfull Width/Depth Ratio	24.1
Bankfull Entrenchment Ratio	5
Bankfull Bank Height Ratio	1

Photo: Cross-section 4 looking upstream



Cross-section Plot Exhibit

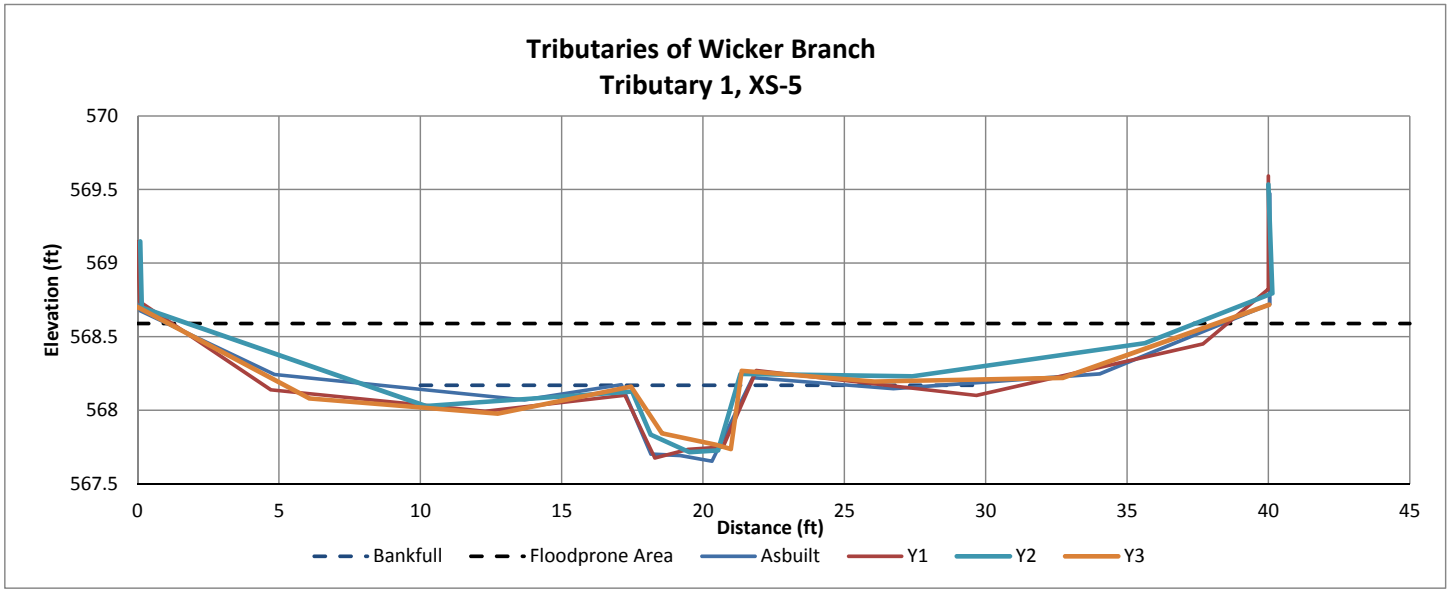
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-5, Sta. 12+10
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0	568.701	LBPIN
6.08	568.081	GR
12.73	567.977	GR
17.45	568.161	TOB
18.55	567.844	TOE
20.45	567.767	TW
20.98	567.737	TOE
21.37	568.269	TOB
26.06	568.196	GR
32.71	568.22	GR
40.03	568.718	RBPIN

Summary Data

Bankfull Elevation	568.17
Bankfull Width (ft)	3.9
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.3
Bankfull Max Depth (ft)	0.42
Bankfull Cross Sectional Area (ft^2)	1.1
Bankfull Width/Depth Ratio	13.6
Bankfull Entrenchment Ratio	12.6
Bankfull Bank Height Ratio	1

Photo: Cross-section 5 looking upstream



Cross-section Plot Exhibit

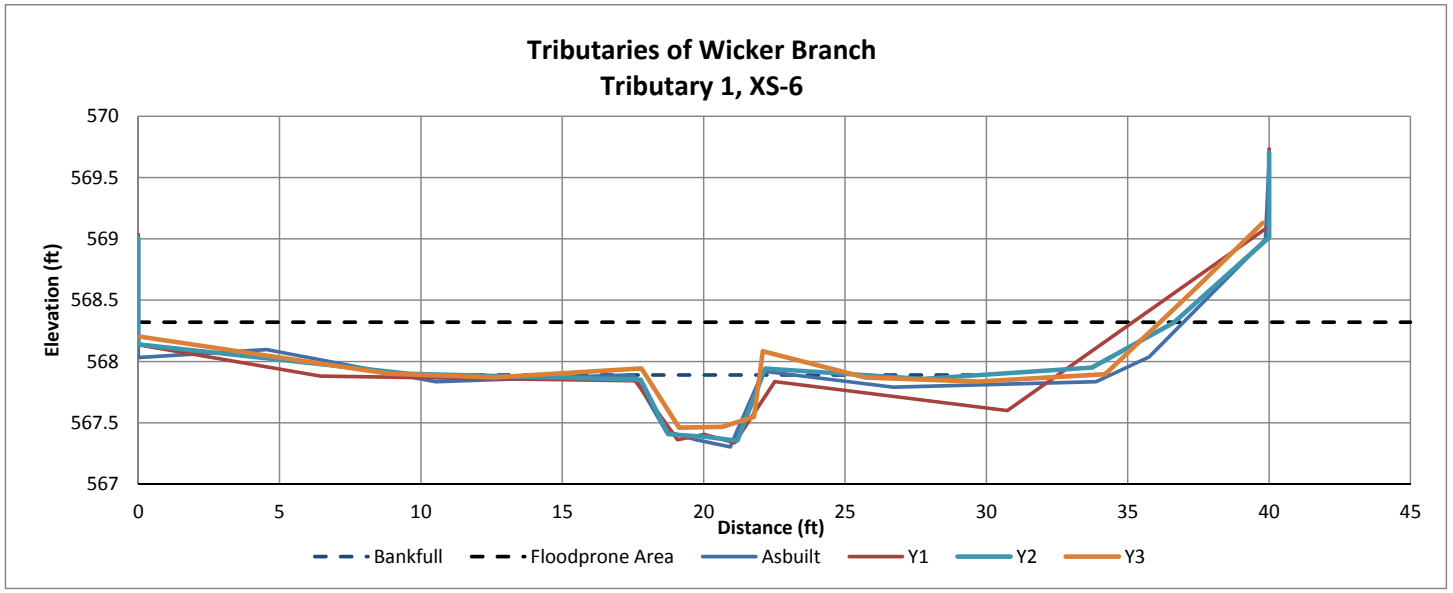
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-6, Sta. 12+37
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0.07	568.203	LBPIN
8.88	567.9	GR
12.59	567.87	GR
17.8	567.944	TOB
19.13	567.461	TOE
20.65	567.468	TW
21.78	567.55	TOE
22.09	568.085	TOB
25.74	567.869	GR
29.72	567.836	GR
34.2	567.897	GR
37.34	568.583	GR
39.77	569.131	RBPIN

Summary Data

Bankfull Elevation	567.89
Bankfull Width (ft)	3.98
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.34
Bankfull Max Depth (ft)	0.43
Bankfull Cross Sectional Area (ft^2)	1.35
Bankfull Width/Depth Ratio	11.7
Bankfull Entrenchment Ratio	11.4
Bankfull Bank Height Ratio	1

Photo: Cross-section 6 looking uptream



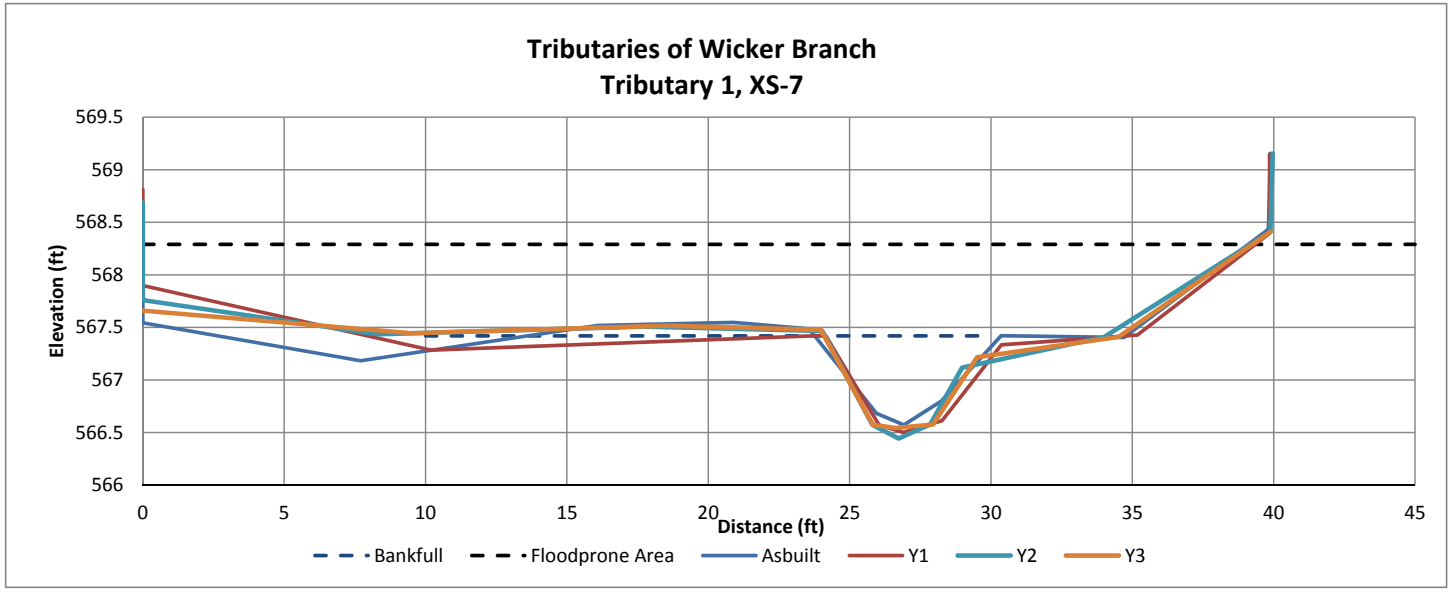
Cross-section Plot Exhibit

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	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0	567.66	LBPIN
9.5	567.45	GR
18.55	567.52	GR
23.98	567.48	TOB
25.82	566.58	TOE
26.63	566.55	TW
27.95	566.58	TOE
29.51	567.22	TOB
34.51	567.41	GR
39.88	568.41	RBPIN

Summary Data	
Bankfull Elevation	567.42
Bankfull Width (ft)	10.5
Floodprone Width (ft)	40
Bankfull Mean Depth (ft)	0.4
Bankfull Max Depth (ft)	0.87
Bankfull Cross Sectional Area (ft^2)	3.92
Bankfull Width/Depth Ratio	28.5
Bankfull Entrenchment Ratio	3.8
Bankfull Bank Height Ratio	1

Photo: Cross-section 7 looking upstream



Cross-section Plot Exhibit

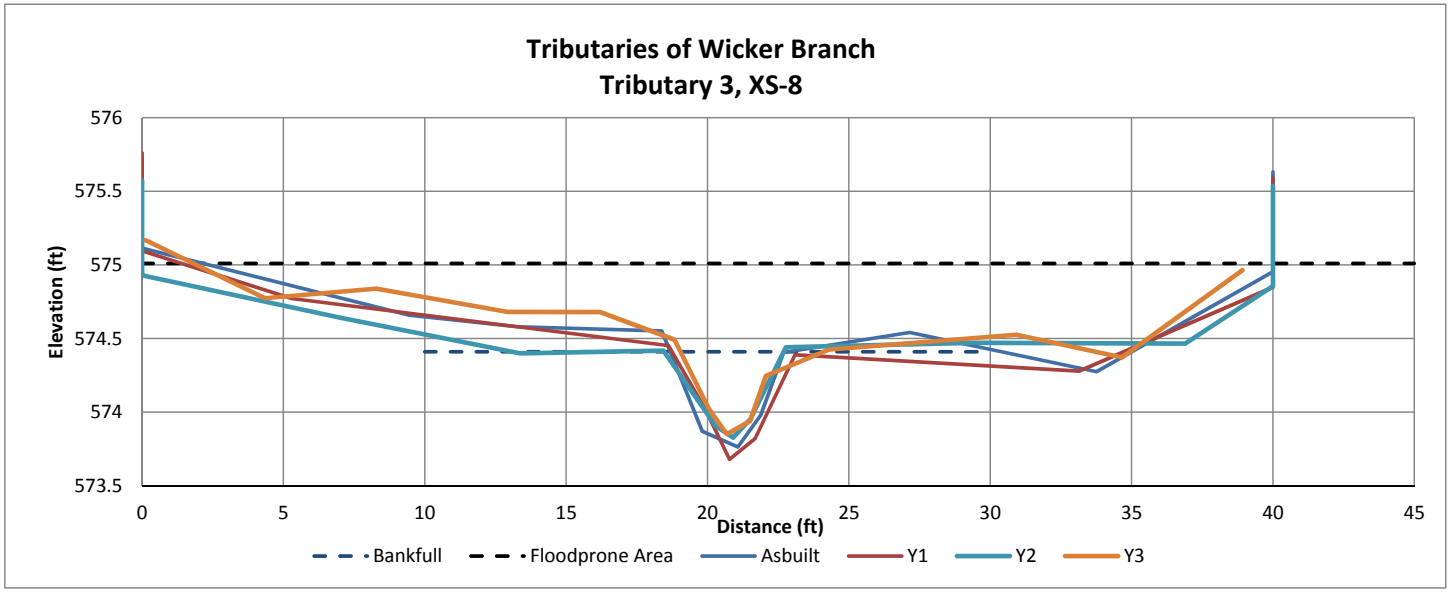
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-8, Sta. 1+83
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/3/2017
Field Crew	Chris Inscore

Station	Elevation	
0.12	575.169	LBPIN
4.35	574.774	GR
8.28	574.839	GR
12.94	574.681	GR
16.21	574.679	GR
18.83	574.493	LTOB
20.04	574.025	LTOE
20.68	573.85	TW
21.5	573.939	RTOE
22.07	574.247	RTOB
24.29	574.425	GR
30.92	574.526	GR
34.66	574.372	GR
38.92	574.964	RBPIN

Summary Data

Bankfull Elevation	574.41
Bankfull Width (ft)	4.99
Floodprone Width (ft)	40
Bankfull Mean Depth (ft)	0.25
Bankfull Max Depth (ft)	0.6
Bankfull Cross Sectional Area (ft^2)	1.25
Bankfull Width/Depth Ratio	19.9
Bankfull Entrenchment Ratio	8
Bankfull Bank Height Ratio	1

Photo: Cross-section 8 looking downstream



Cross-section Plot Exhibit

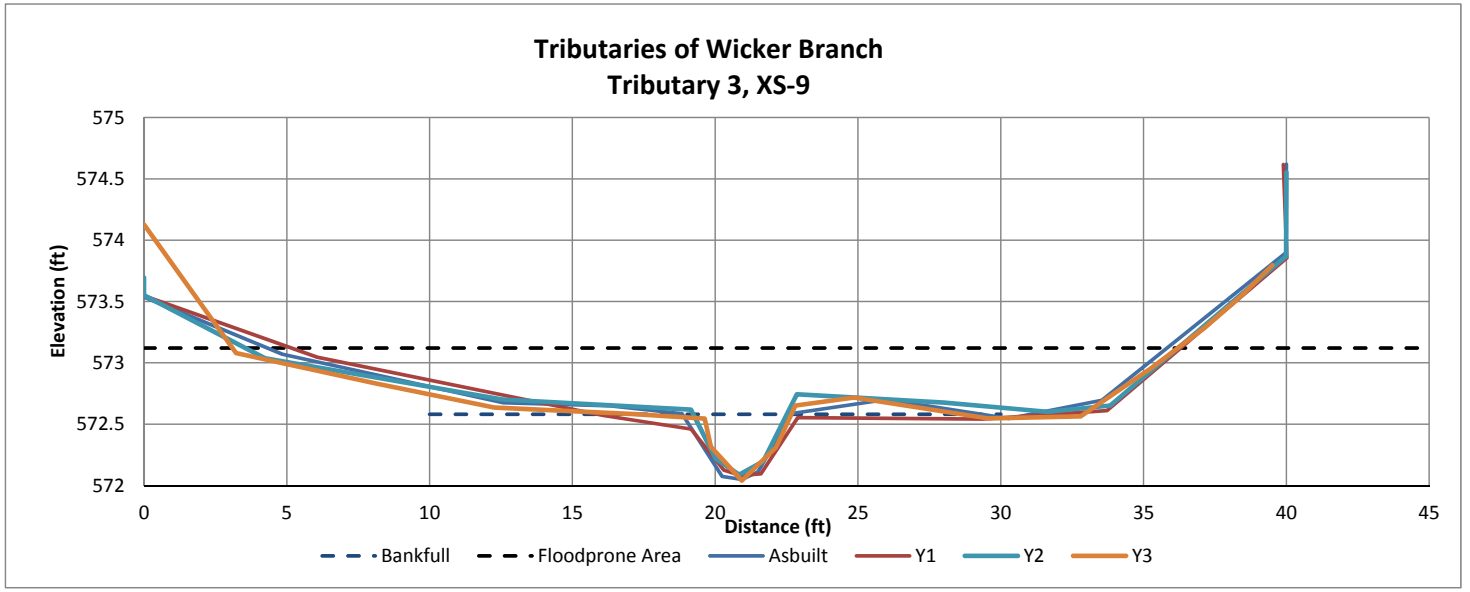
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-9, Sta 3+19
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/4/2017
Field Crew	Chris Inscore

Station	Elevation	
0	574.128	LBPIN
3.22	573.08	GR
8.09	572.833	GR
12.28	572.635	GR
17.17	572.582	GR
19.63	572.545	LTOB
19.85	572.315	LTOE
20.93	572.04	TW
22.13	572.312	RTOE
22.81	572.652	RTOB
24.86	572.718	GR
29.58	572.547	GR
32.79	572.563	GR
35.27	572.958	GR
37.14	573.288	GR
38.39	573.539	GR
39.51	573.796	RBPIN

Summary Data

Bankfull Elevation	572.58
Bankfull Width (ft)	3.2
Floodprone Width (ft)	33
Bankfull Mean Depth (ft)	0.32
Bankfull Max Depth (ft)	0.54
Bankfull Cross Sectional Area (ft^2)	1.03
Bankfull Width/Depth Ratio	10
Bankfull Entrenchment Ratio	10.35
Bankfull Bank Height Ratio	1

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	
0.29	573.872	LBPIN
2.64	573.077	GR
6.89	571.884	GR
9.18	571.284	GR
12.6	570.815	GR
13.96	570.805	GR
16.02	570.747	TOB
16.49	569.952	LTOE
18.35	569.593	TW
20.28	569.74	RTOE
22.13	570.694	RTOB
26.16	570.689	GR
28.21	570.557	GR
32.18	570.951	GR
36.04	571.368	GR
39.1	571.956	GR
40.03	572.217	RBPIN

Summary Data

Bankfull Elevation	570.76
Bankfull Width (ft)	6.39
Floodprone Width (ft)	32
Bankfull Mean Depth (ft)	0.8
Bankfull Max Depth (ft)	1.2
Bankfull Cross Sectional Area (ft^2)	5.09
Bankfull Width/Depth Ratio	7.99
Bankfull Entrenchment Ratio	5.02
Bankfull Bank Height Ratio	1

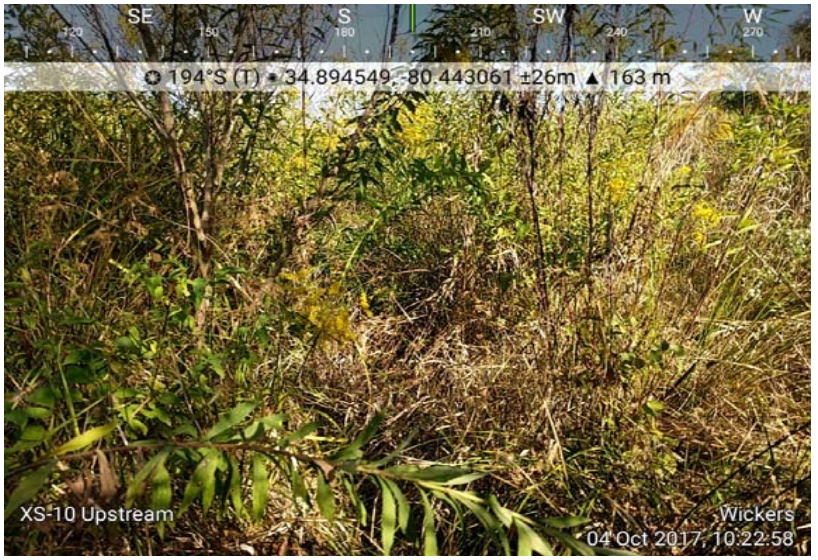
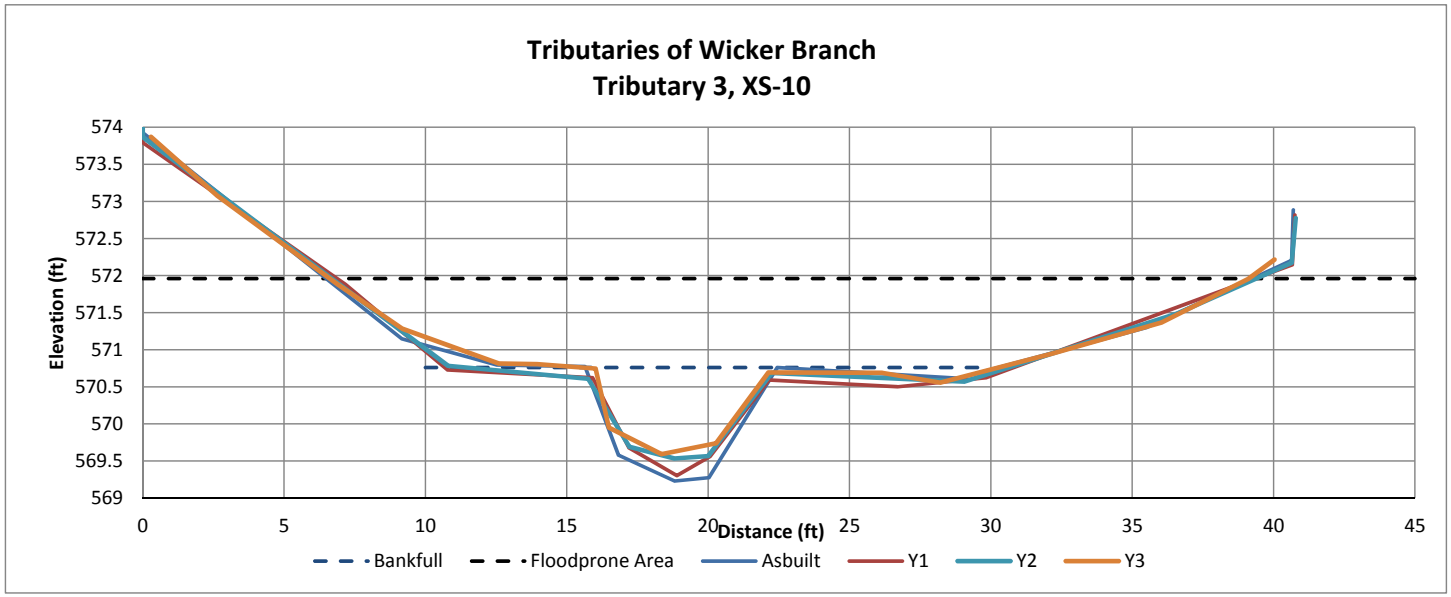


Photo: Cross-section 10 looking downstream



Cross-section Plot Exhibit

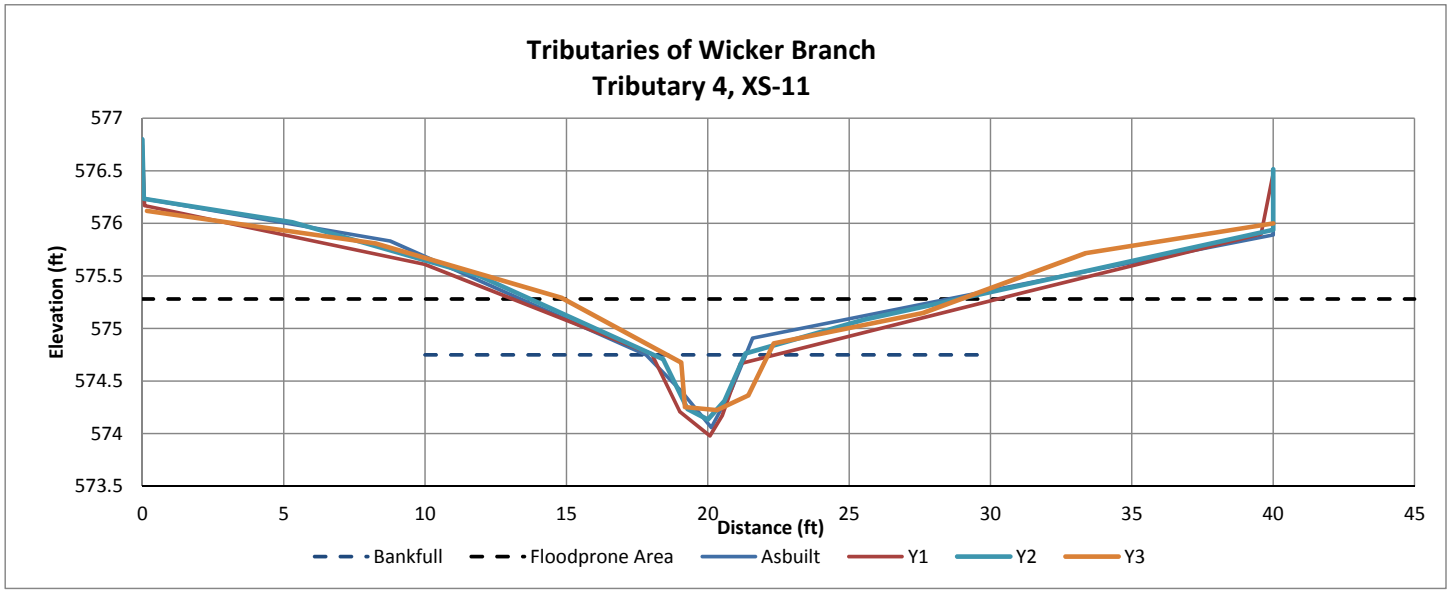
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-11, Sta. 3+61
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/4/2017
Field Crew	Chris Inscore

Station	Elevation	
0.16	576.12	LBPIN
8.24	575.811	GR
14.82	575.293	GR
19.06	574.676	LTOB
19.19	574.254	LTOE
20.32	574.224	TW
21.43	574.365	RTOE
22.33	574.859	RTOB
27.61	575.149	GR
33.37	575.717	GR
40	576	RBPIN

Summary Data

Bankfull Elevation	574.75
Bankfull Width (ft)	3.54
Floodprone Width (ft)	14
Bankfull Mean Depth (ft)	0.36
Bankfull Max Depth (ft)	0.53
Bankfull Cross Sectional Area (ft^2)	1.27
Bankfull Width/Depth Ratio	9.83
Bankfull Entrenchment Ratio	3.94
Bankfull Bank Height Ratio	1

Photo: Cross-section 11 looking upstream



Cross-section Plot Exhibit

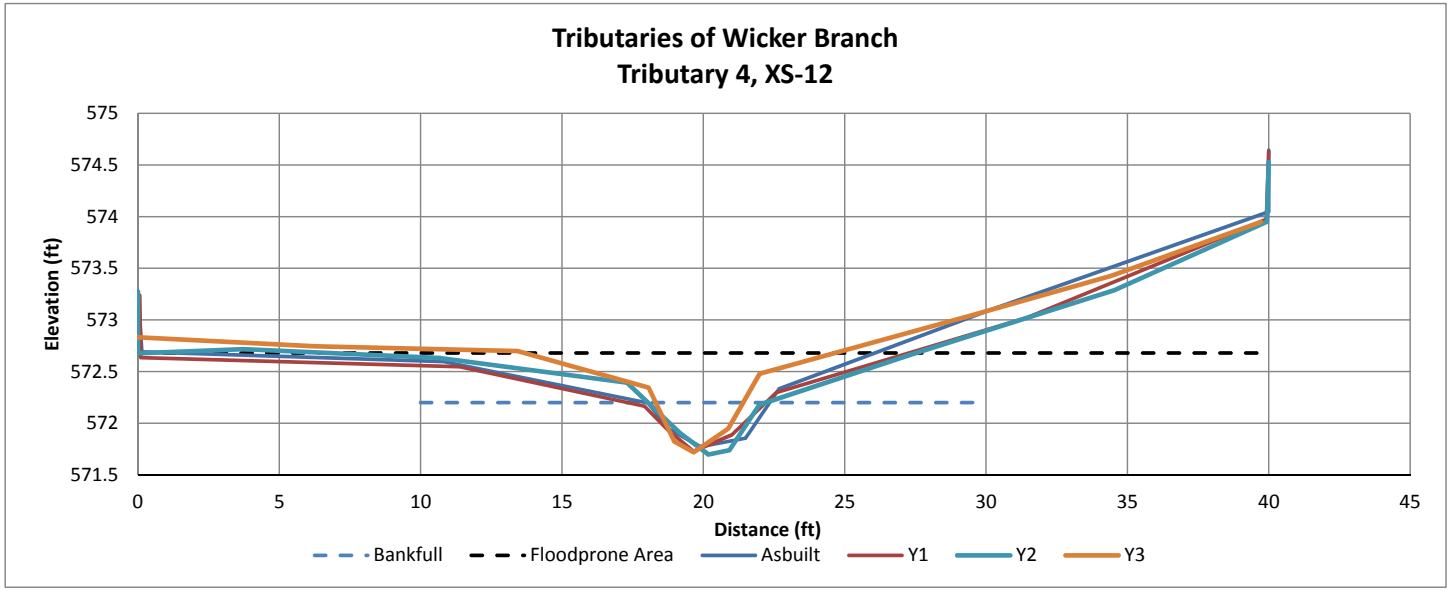
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-12, Sta. 6+42
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/4/2017
Field Crew	Chris Inscore

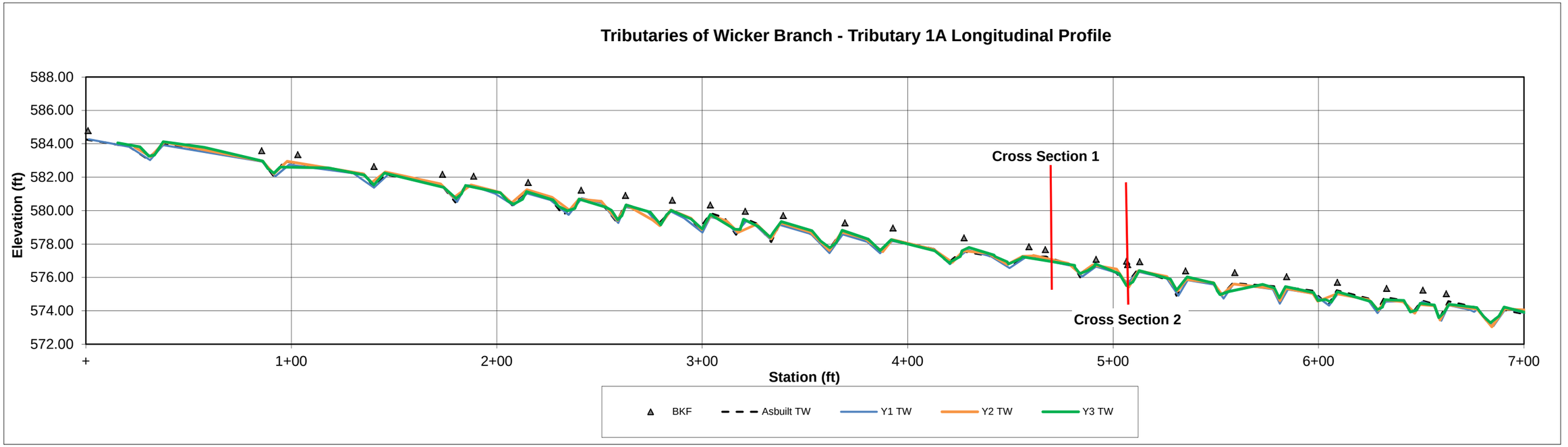
Station	Elevation	
0	572.831	RBPIN
6.24	572.745	GR
13.44	572.698	GR
18.06	572.345	RTOB
18.97	571.825	RTOE
19.66	571.72	TW
20.88	571.948	LTOE
21.99	572.48	LTOB
29.35	573.035	GR
34.43	573.428	GR
39.72	573.949	LBPIN

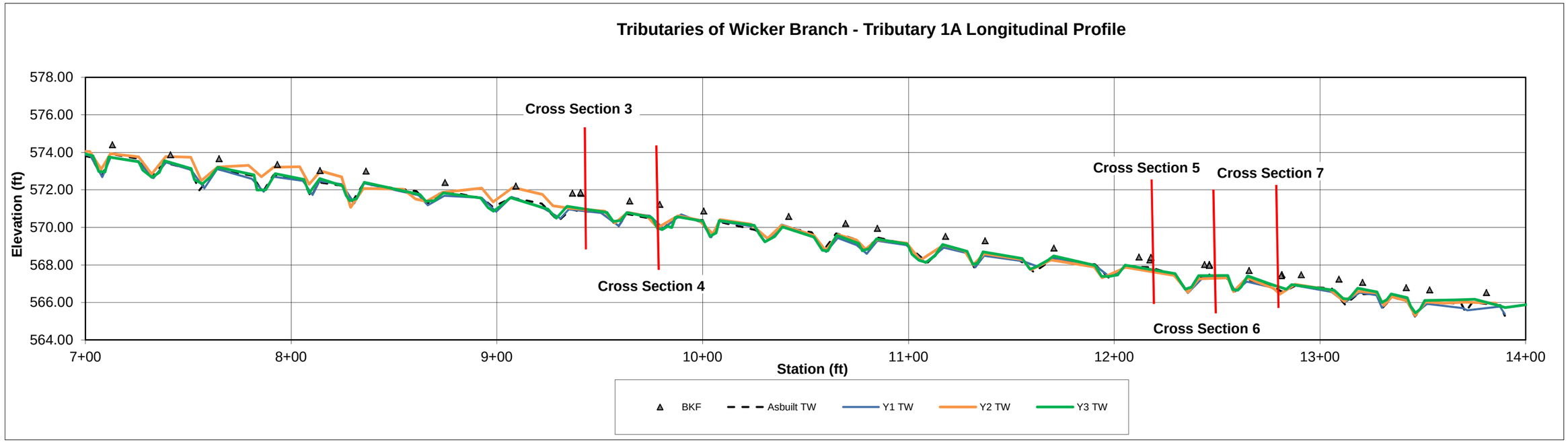
Summary Data

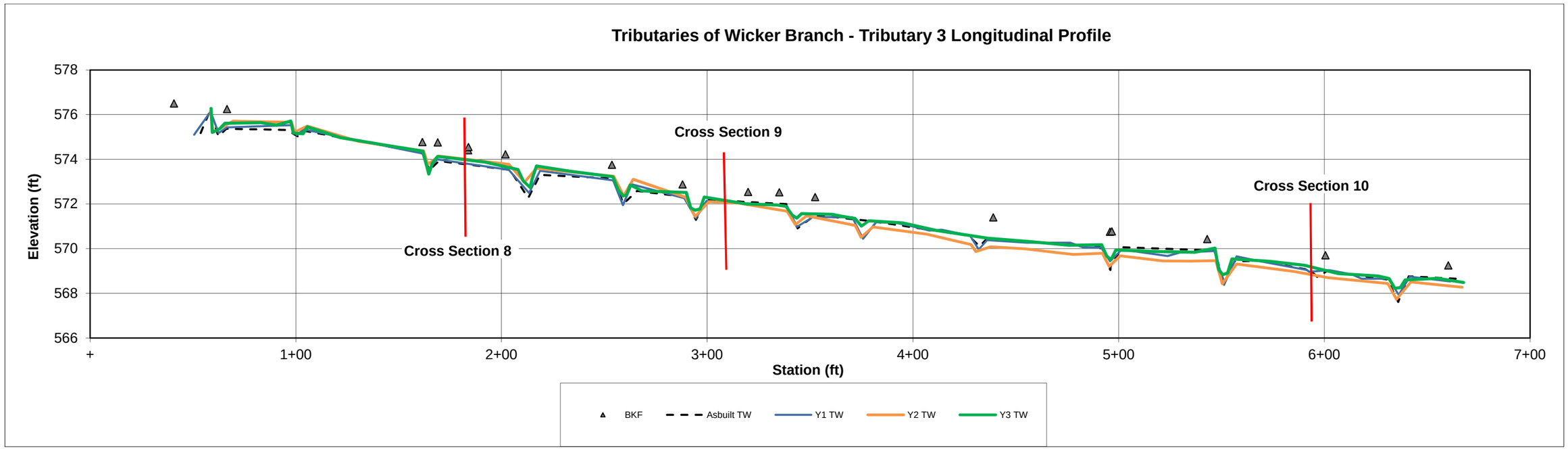
Bankfull Elevation	572.2
Bankfull Width (ft)	3.15
Floodprone Width (ft)	11
Bankfull Mean Depth (ft)	0.3
Bankfull Max Depth (ft)	0.48
Bankfull Cross Sectional Area (ft^2)	0.94
Bankfull Width/Depth Ratio	10.5
Bankfull Entrenchment Ratio	3.5
Bankfull Bank Height Ratio	1.1

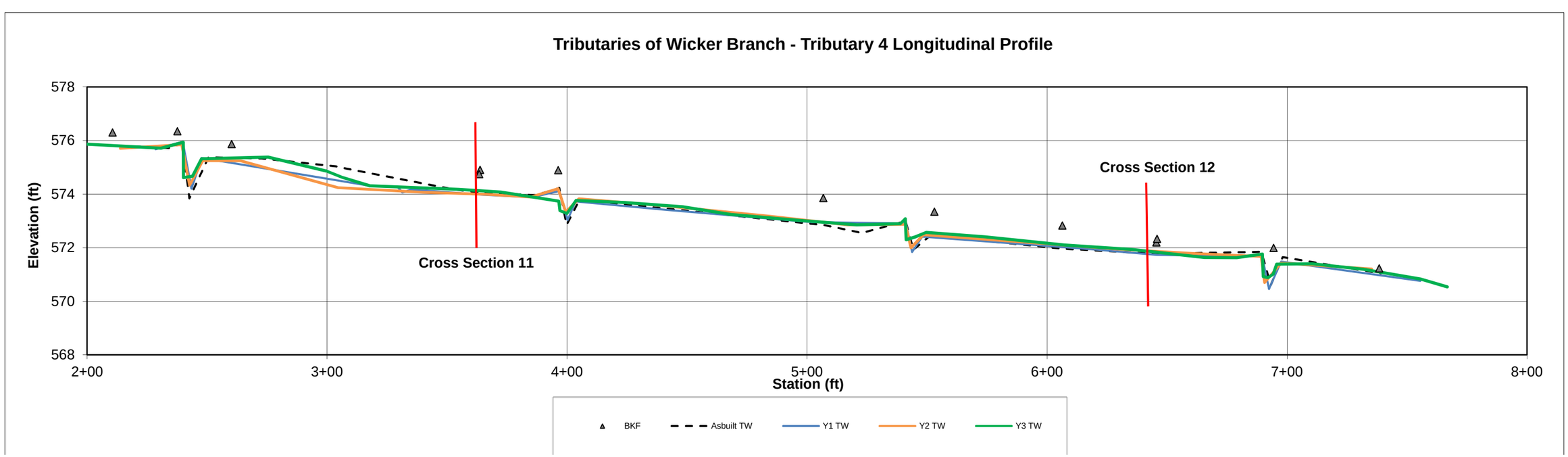
Photo: Cross-section 12 looking upstream




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


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


Tributaries of Wicker Branch - Tributary 3 Longitudinal Profile
Elevation (ft)
578
576
574
572
570
568
566
+
1+00
2+00
3+00
4+00
5+00
6+00
7+00
Station (ft)
Cross Section 8
Cross Section 9
Cross Section 10
BKF
Asbuilt TW
Y1 TW
Y2 TW
Y3 TW

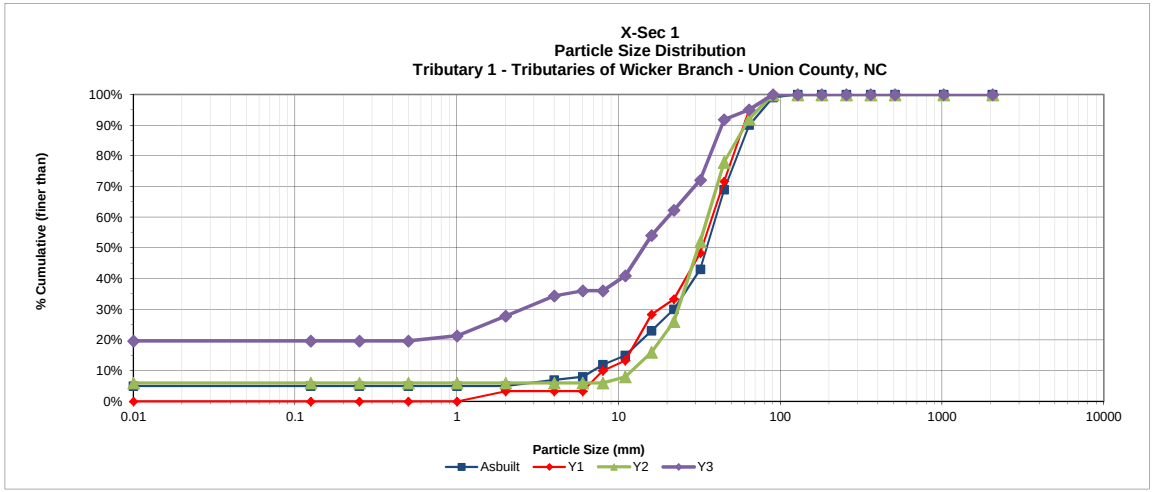

Tributaries of Wicker Branch - Tributary 4 Longitudinal Profile
Elevation (ft)
578
576
574
572
570
568
2+00
3+00
4+00
5+00
6+00
7+00
8+00
Station (ft)
Cross Section 11
Cross Section 12
BKF
Asbuilt TW
Y1 TW
Y2 TW
Y3 TW

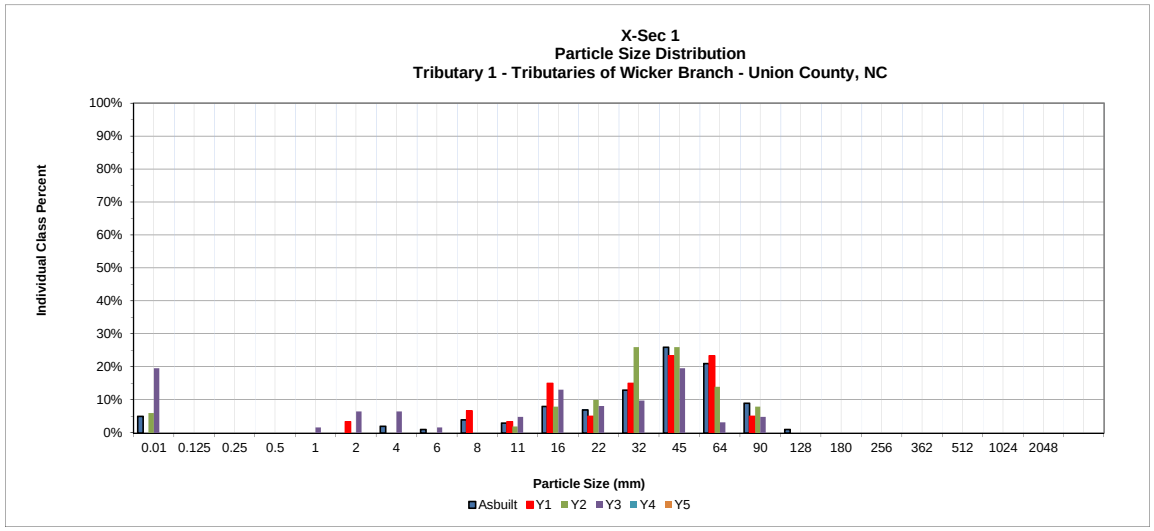
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	12	20%	20%
S	Very Fine	.062 - .125	0	0%	20%
A	Fine	.125 - .25	0	0%	20%
N	Medium	.25 - .50	0	0%	20%
D	Coarse	.50 - 1.0	1	2%	21%
S	Very Coarse	1.0 - 2.0	4	7%	28%
	Very Fine	2.0 - 4.0	4	7%	34%
G	Fine	4.0 - 5.7	1	2%	36%
R	Fine	5.7 - 8.0	0	0%	36%
A	Medium	8.0 - 11.3	3	5%	41%
V	Medium	11.3 - 16.0	8	13%	54%
E	Coarse	16.0 - 22.6	5	8%	62%
L	Coarse	22.6 - 32.0	6	10%	72%
S	Very Coarse	32.0 - 45.0	12	20%	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			61	100%	

Summary Data	
D50	15
D84	40
D95	64



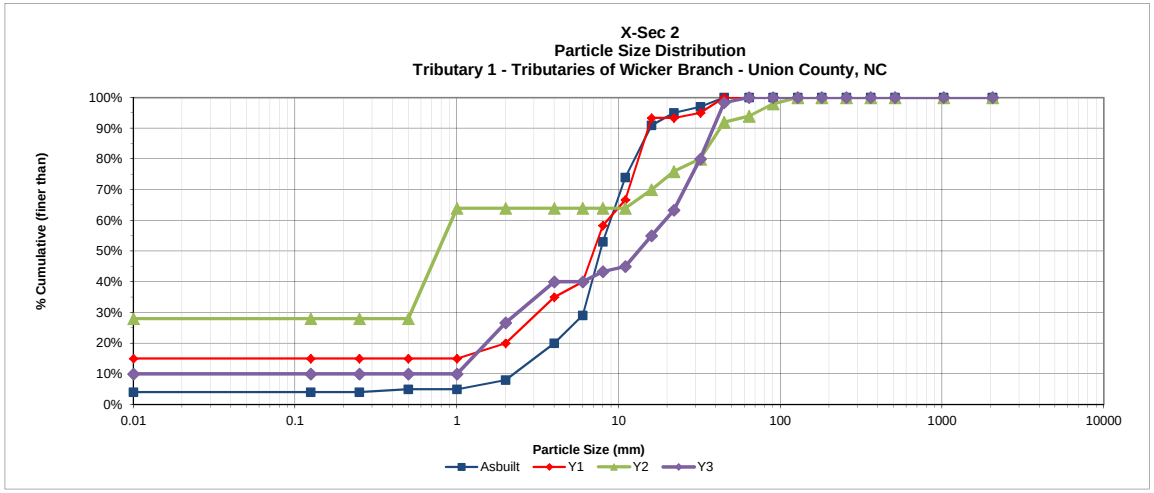


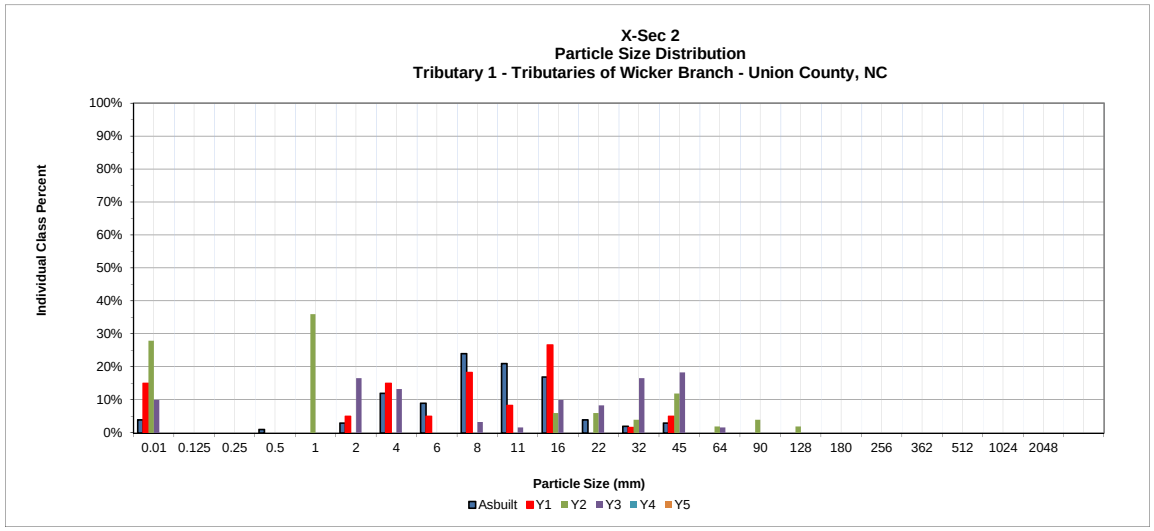
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	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	0	0%	10%
S	Very Coarse	1.0 - 2.0	10	17%	27%
	Very Fine	2.0 - 4.0	8	13%	40%
G	Fine	4.0 - 5.7	0	0%	40%
R	Fine	5.7 - 8.0	2	3%	43%
A	Medium	8.0 - 11.3	1	2%	45%
V	Medium	11.3 - 16.0	6	10%	55%
E	Coarse	16.0 - 22.6	5	8%	63%
L	Coarse	22.6 - 32.0	10	17%	80%
S	Very Coarse	32.0 - 45.0	11	18%	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	13.6
D84	35
D95	43



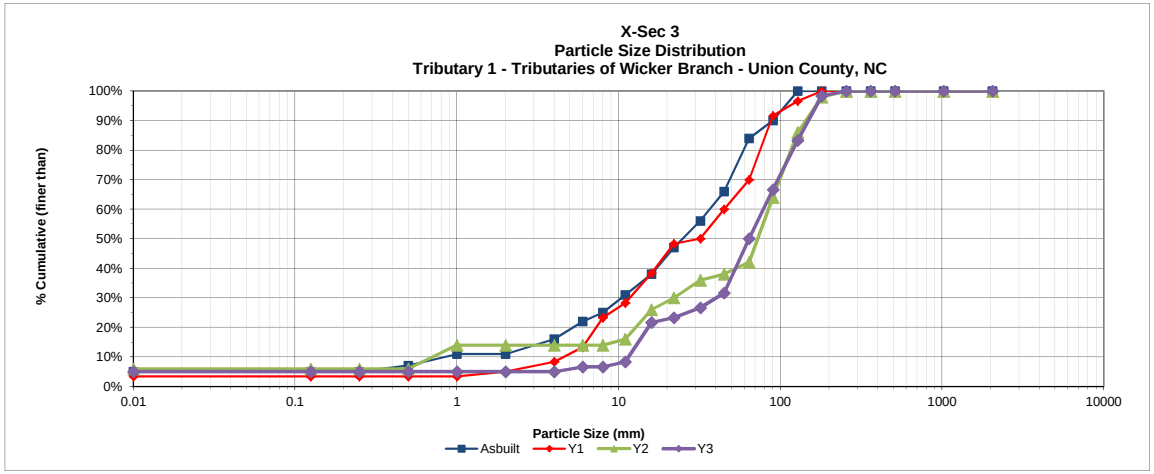


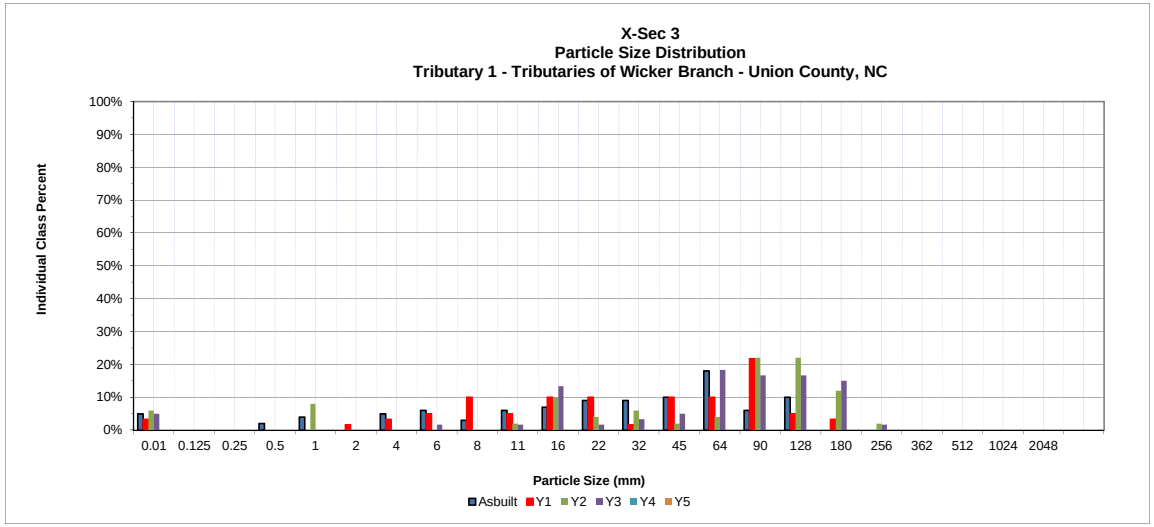
Cross - Section Pebble Count

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	0	0%	5%
	Very Fine	2.0 - 4.0	0	0%	5%
G	Fine	4.0 - 5.7	1	2%	7%
R	Fine	5.7 - 8.0	0	0%	7%
A	Medium	8.0 - 11.3	1	2%	8%
V	Medium	11.3 - 16.0	8	13%	22%
E	Coarse	16.0 - 22.6	1	2%	23%
L	Coarse	22.6 - 32.0	2	3%	27%
S	Very Coarse	32.0 - 45.0	3	5%	32%
	Very Coarse	45.0 - 64.0	11	18%	50%
C	Small	64 - 90	10	17%	67%
O	Small	90 - 128	10	17%	83%
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			60	100%	

Summary Data	
D50	64
D84	130
D95	168



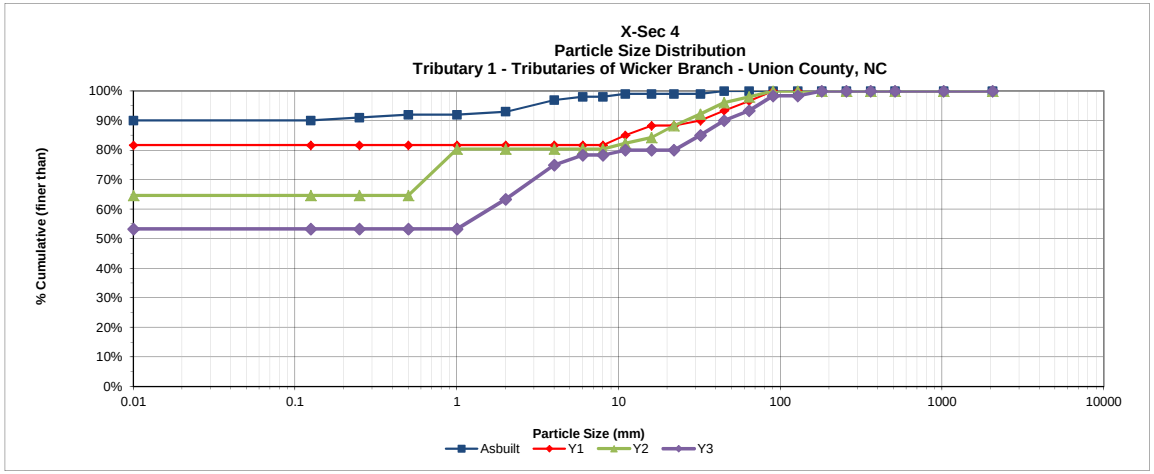


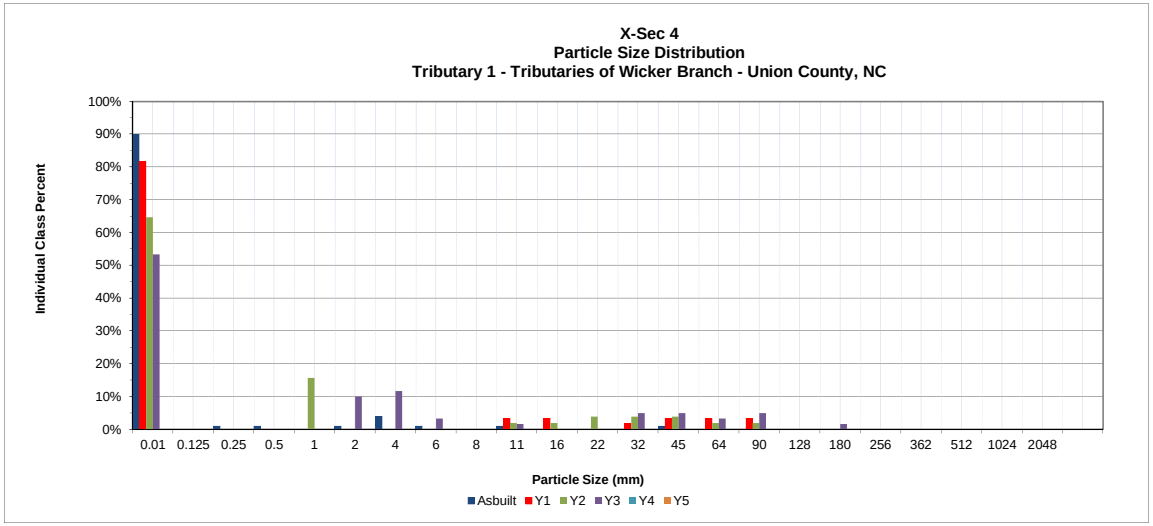
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	32	53%	53%
S	Very Fine	.062 - .125	0	0%	53%
A	Fine	.125 - .25	0	0%	53%
N	Medium	.25 - .50	0	0%	53%
D	Coarse	.50 - 1.0	0	0%	53%
S	Very Coarse	1.0 - 2.0	6	10%	63%
	Very Fine	2.0 - 4.0	7	12%	75%
G	Fine	4.0 - 5.7	2	3%	78%
R	Fine	5.7 - 8.0	0	0%	78%
A	Medium	8.0 - 11.3	1	2%	80%
V	Medium	11.3 - 16.0	0	0%	80%
E	Coarse	16.0 - 22.6	0	0%	80%
L	Coarse	22.6 - 32.0	3	5%	85%
S	Very Coarse	32.0 - 45.0	3	5%	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	30
D95	73



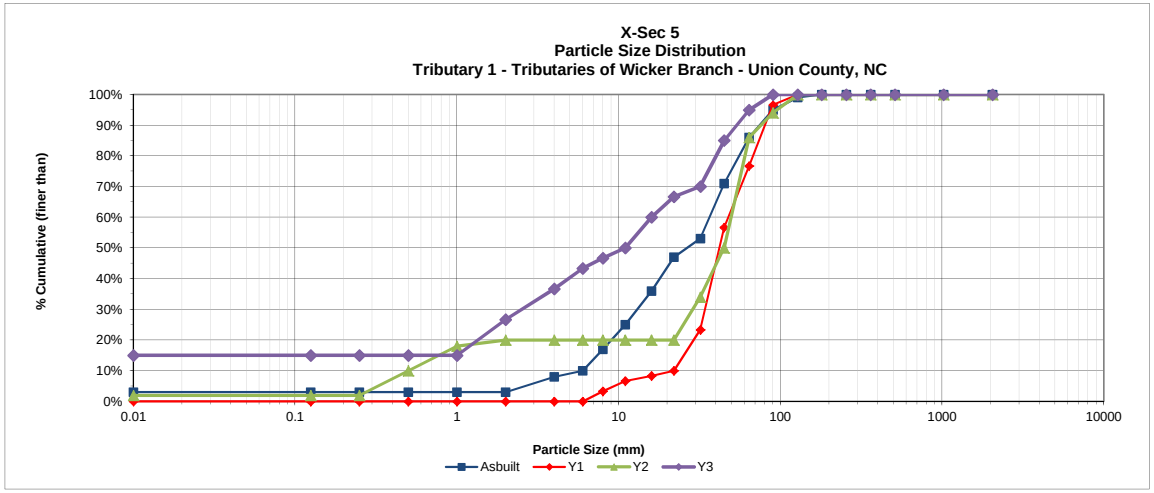


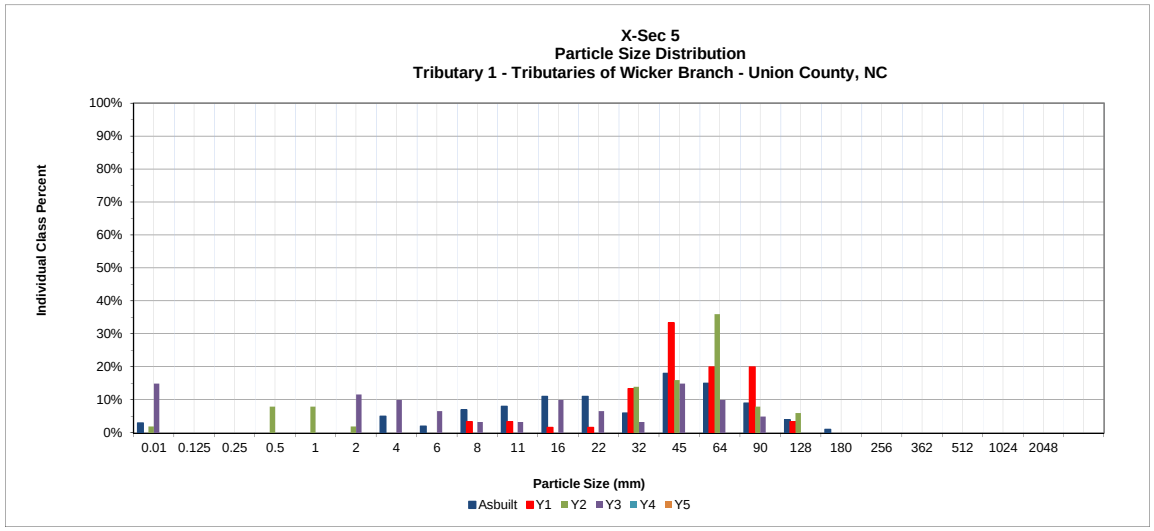
Cross - Section Pebble Count

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	11
D84	44
D95	64



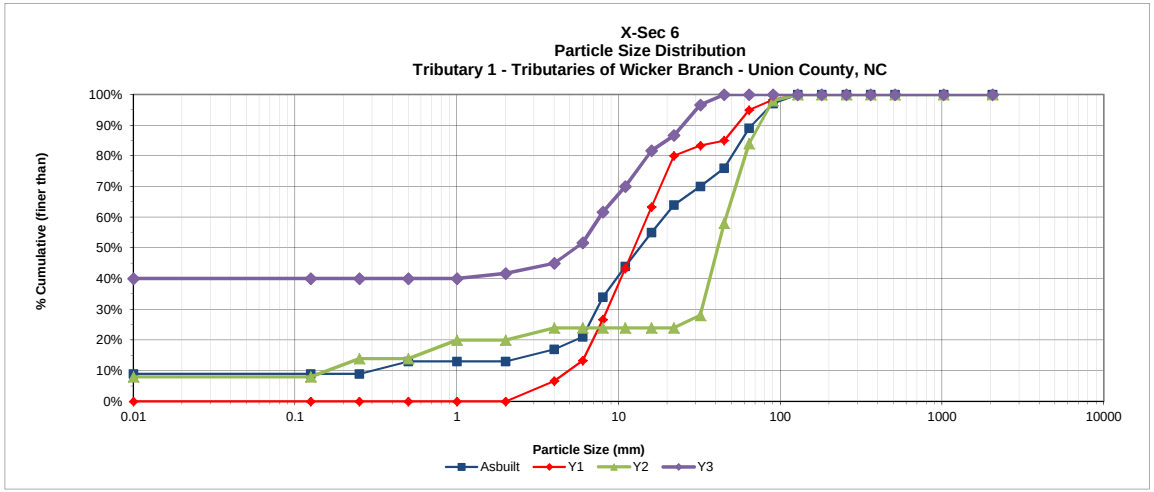


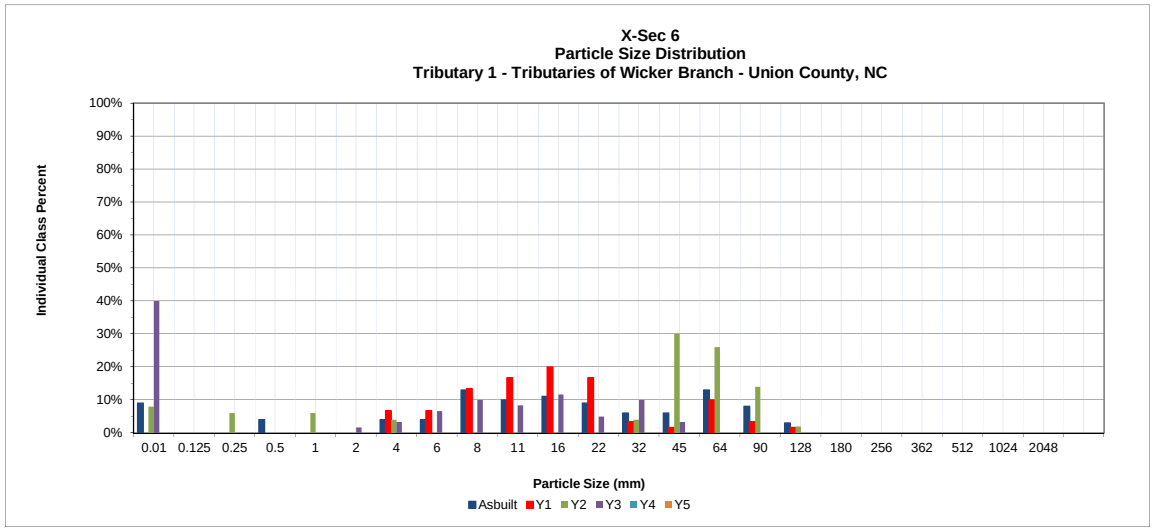
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	24	40%	40%
S	Very Fine	.062 - .125	0	0%	40%
A	Fine	.125 - .25	0	0%	40%
N	Medium	.25 - .50	0	0%	40%
D	Coarse	.50 - 1.0	0	0%	40%
S	Very Coarse	1.0 - 2.0	1	2%	42%
	Very Fine	2.0 - 4.0	2	3%	45%
G	Fine	4.0 - 5.7	4	7%	52%
R	Fine	5.7 - 8.0	6	10%	62%
A	Medium	8.0 - 11.3	5	8%	70%
V	Medium	11.3 - 16.0	7	12%	82%
E	Coarse	16.0 - 22.6	3	5%	87%
L	Coarse	22.6 - 32.0	6	10%	97%
S	Very Coarse	32.0 - 45.0	2	3%	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	5
D84	19
D95	30



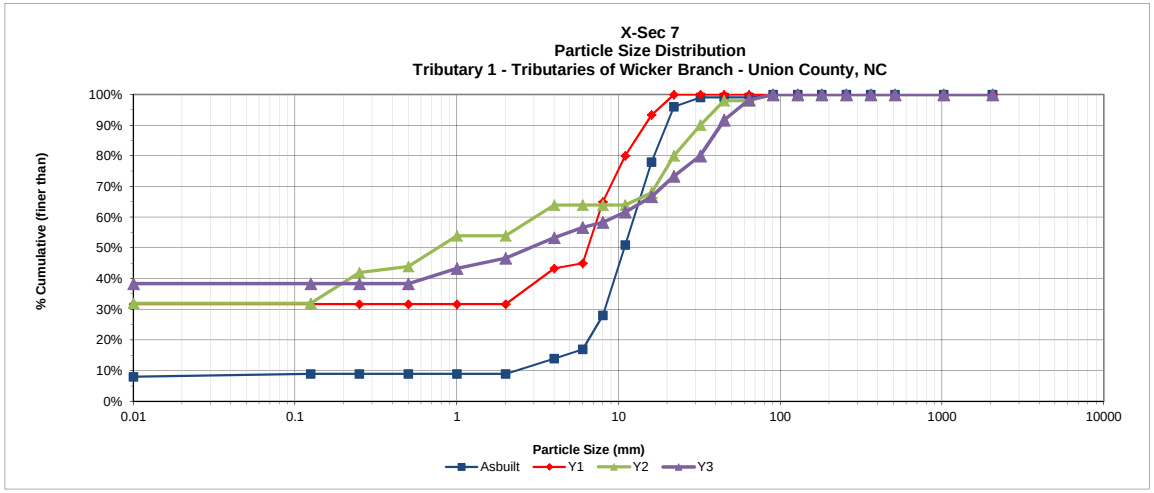


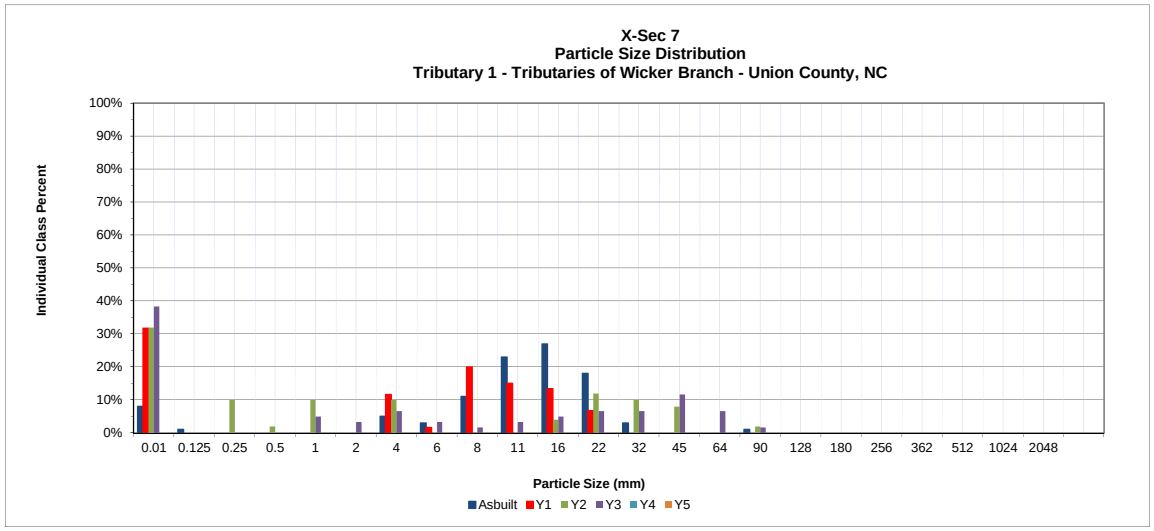
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	23	38%	38%
S	Very Fine	.062 - .125	0	0%	38%
A	Fine	.125 - .25	0	0%	38%
N	Medium	.25 - .50	0	0%	38%
D	Coarse	.50 - 1.0	3	5%	43%
S	Very Coarse	1.0 - 2.0	2	3%	47%
	Very Fine	2.0 - 4.0	4	7%	53%
G	Fine	4.0 - 5.7	2	3%	57%
R	Fine	5.7 - 8.0	1	2%	58%
A	Medium	8.0 - 11.3	2	3%	62%
V	Medium	11.3 - 16.0	3	5%	67%
E	Coarse	16.0 - 22.6	4	7%	73%
L	Coarse	22.6 - 32.0	4	7%	80%
S	Very Coarse	32.0 - 45.0	7	12%	92%
	Very Coarse	45.0 - 64.0	4	7%	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	3
D84	36
D95	54



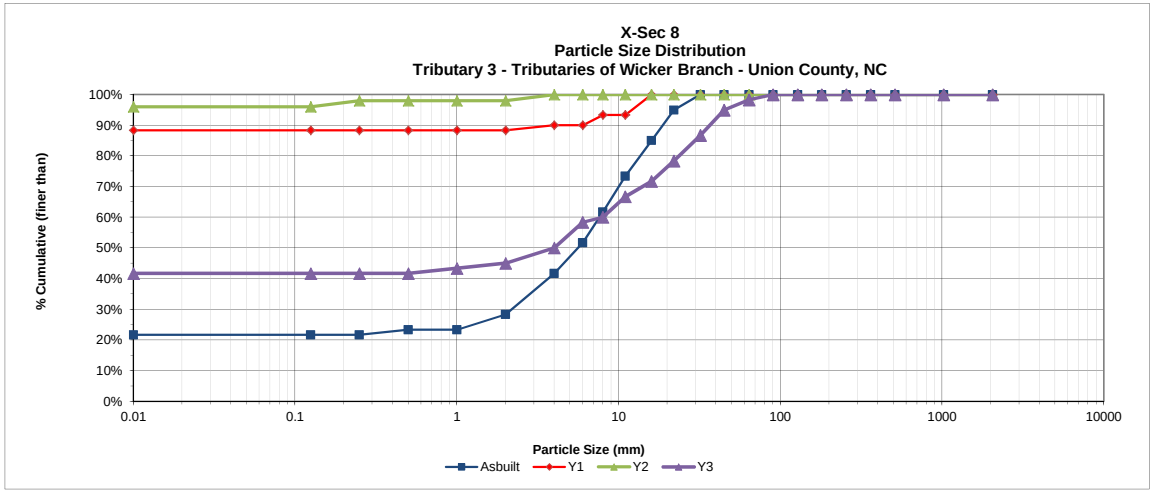


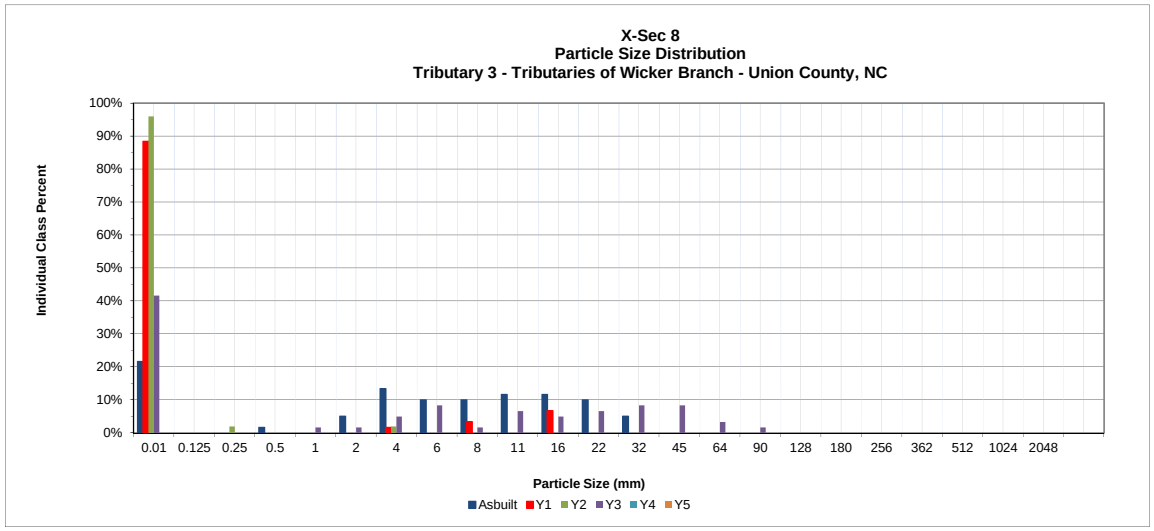
Cross - Section Pebble Count

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	4	7%	67%
V	Medium	11.3 - 16.0	3	5%	72%
E	Coarse	16.0 - 22.6	4	7%	78%
L	Coarse	22.6 - 32.0	5	8%	87%
S	Very Coarse	32.0 - 45.0	5	8%	95%
	Very Coarse	45.0 - 64.0	2	3%	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	4
D84	29
D95	45



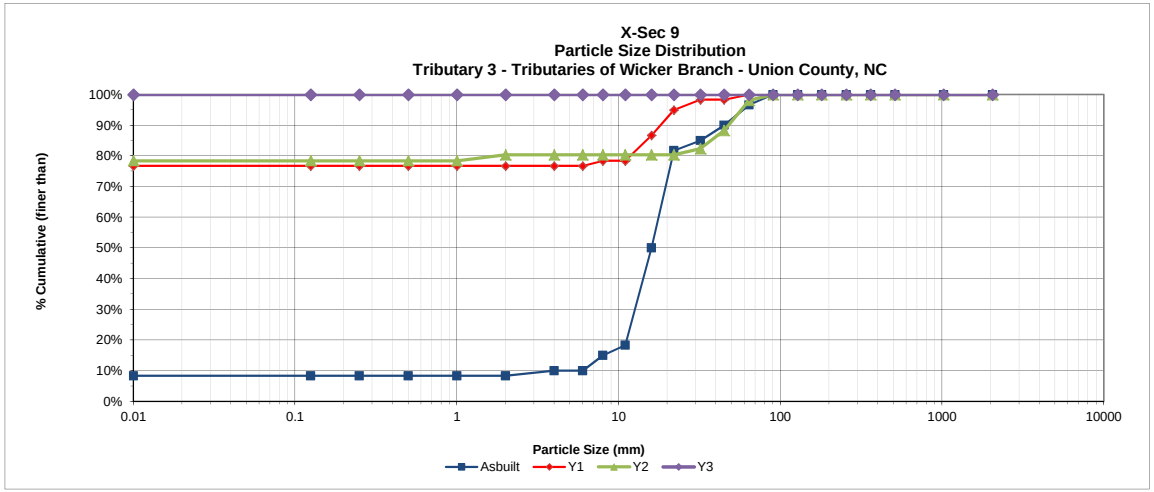


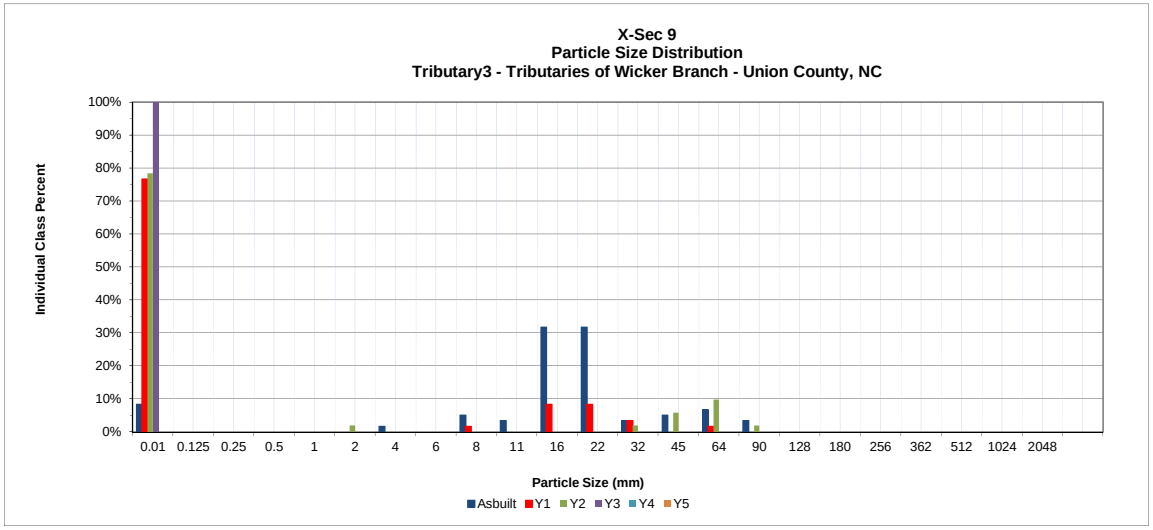
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	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



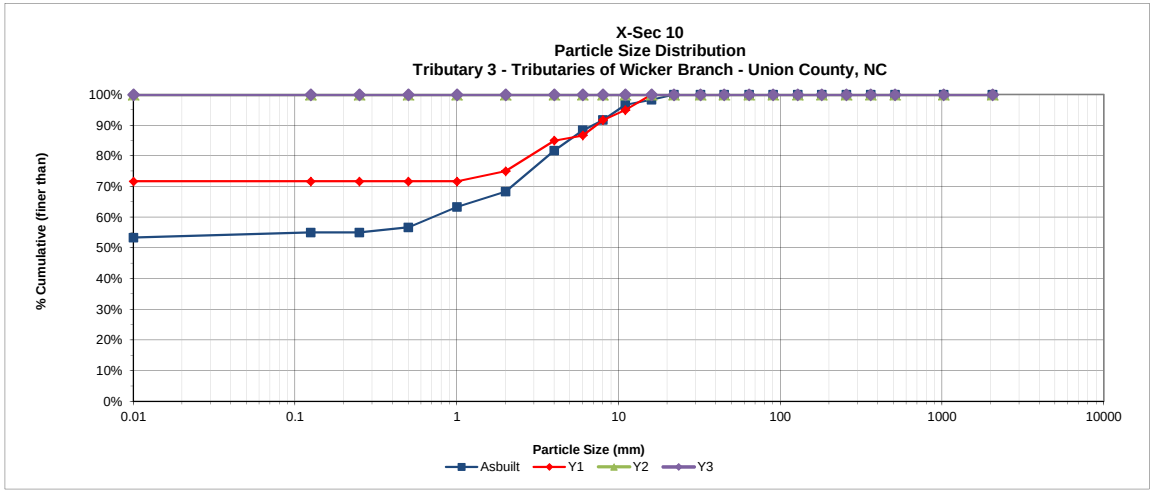


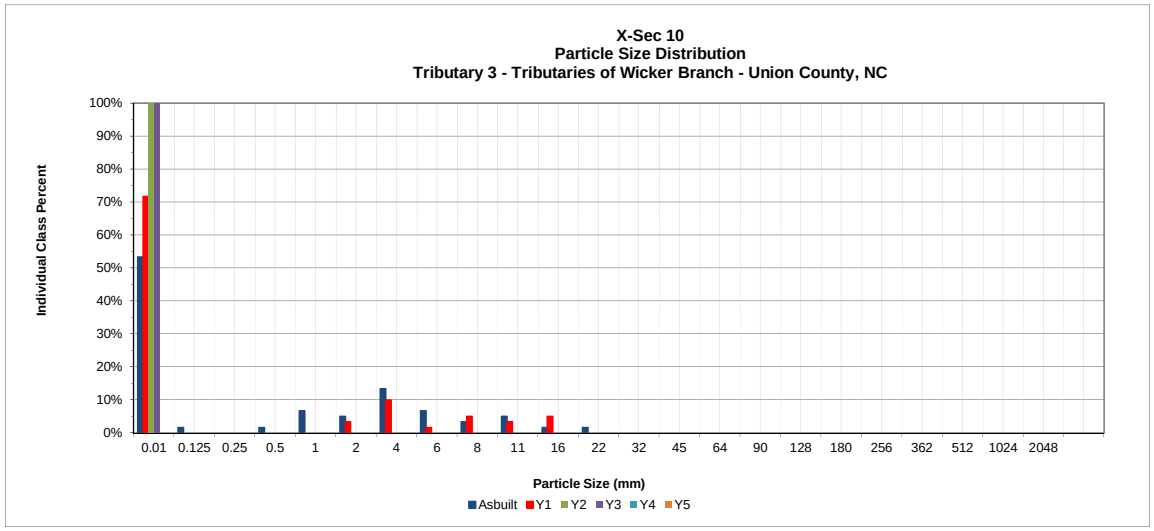
Cross - Section Pebble Count

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

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



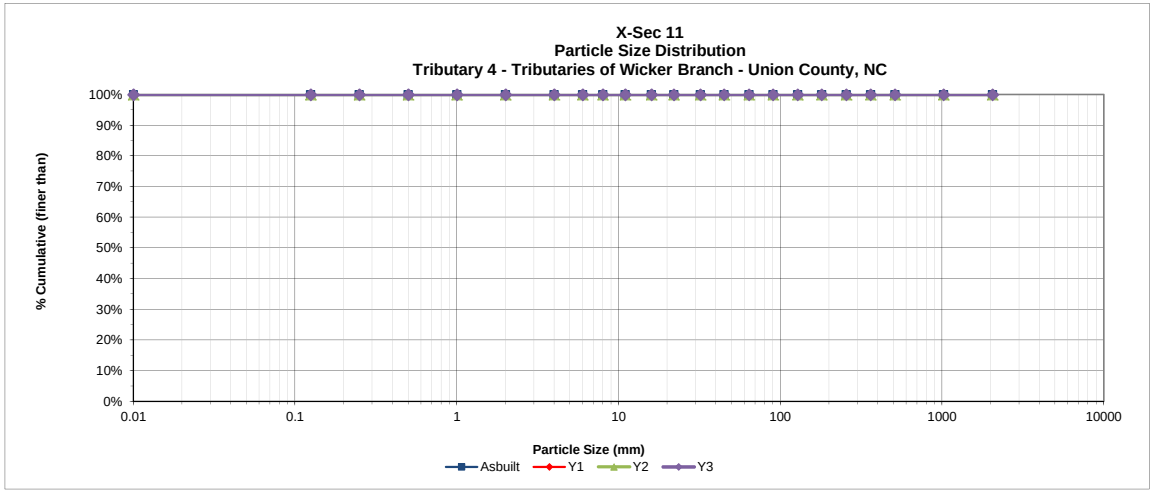


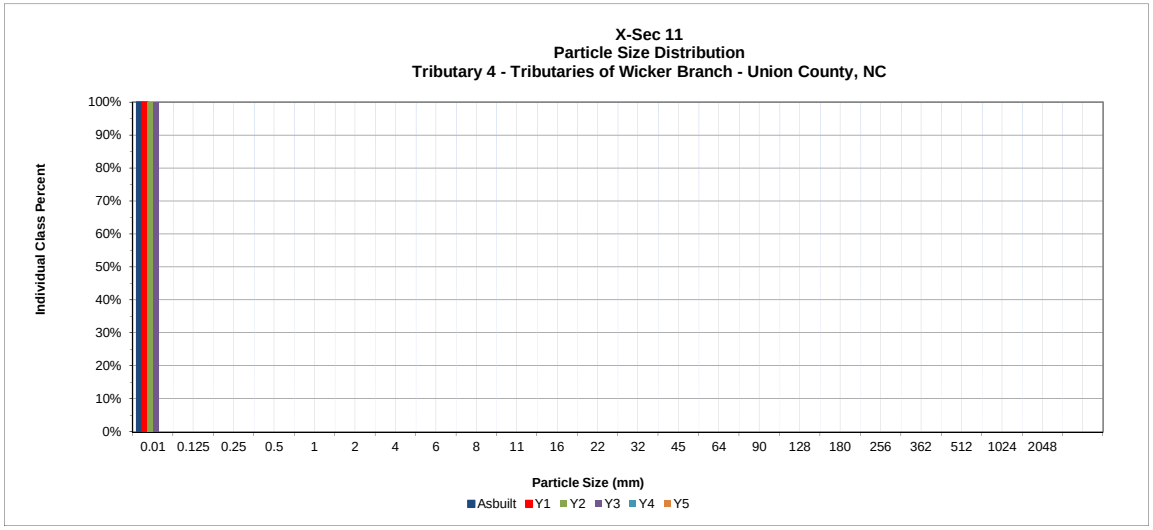
Cross - Section Pebble Count

Project Name : Tributaries of Wickers Branch
Cross Section: 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



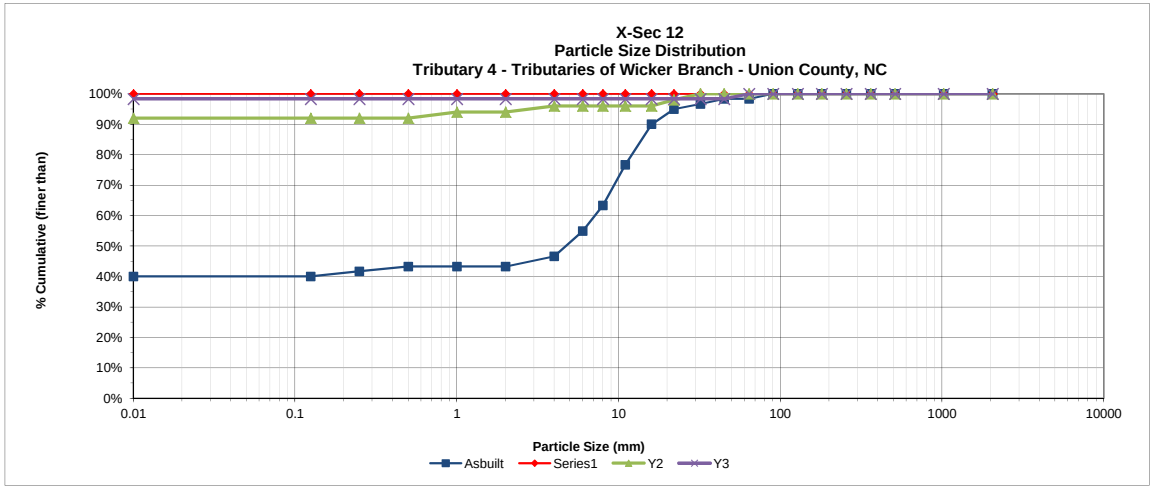


Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	59	98%	98%
S	Very Fine	.062 - .125	0	0%	98%
A	Fine	.125 - .25	0	0%	98%
N	Medium	.25 - .50	0	0%	98%
D	Coarse	.50 - 1.0	0	0%	98%
S	Very Coarse	1.0 - 2.0	0	0%	98%
	Very Fine	2.0 - 4.0	0	0%	98%
G	Fine	4.0 - 5.7	0	0%	98%
R	Fine	5.7 - 8.0	0	0%	98%
A	Medium	8.0 - 11.3	0	0%	98%
V	Medium	11.3 - 16.0	0	0%	98%
E	Coarse	16.0 - 22.6	0	0%	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	0.03
D84	0.05
D95	0.06



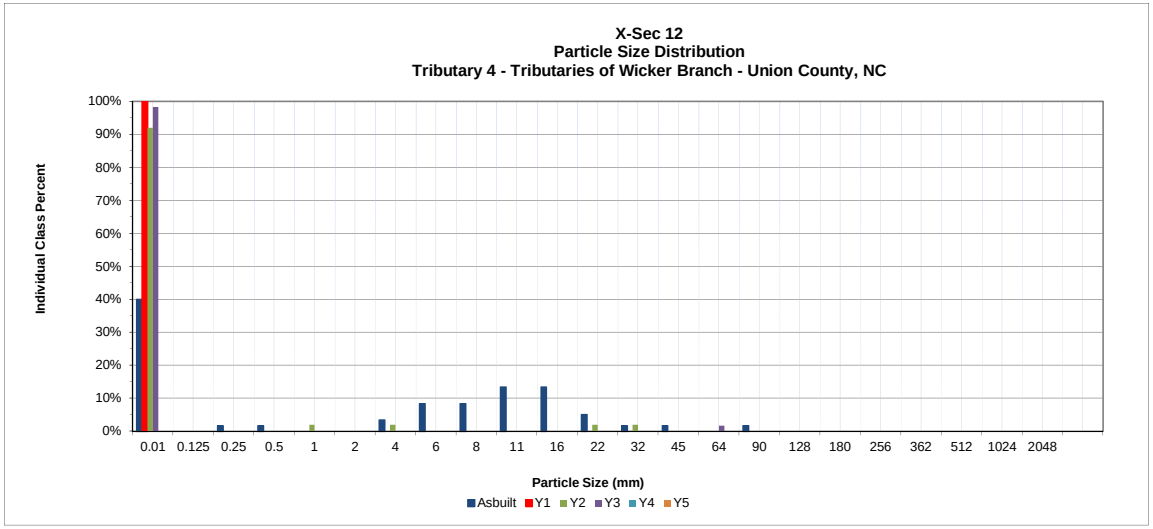


Table 8. Baseline Stream Data Summary
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

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)						
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+	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				5.13	6.09	5.85	4.81				4.51	4.57	5.08	4.25				5.14	5.31	6.2	9.9				4.76	4.27	3.8	3.9			
Floodprone Width (ft)	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				0.78	0.7	0.69	0.82				0.68	0.61	0.8	0.6				0.72	0.68	0.83	0.41				0.32	0.3	0.3	0.3			
Bankfull Max Depth (ft)	0.53	0.51	0.5	0.37				1.19	1.21	1.38	1.21				1	0.69	1.22	0.9				1.33	1.26	1.5	1.28				0.79	0.42	0.45	0.42			
Bankfull Cross Sectional Area (ft^2)	1.51	1.62	1.28	0.92				3.98	4.27	4.03	3.96				3.08	2.8	4.06	2.36				3.72	3.59	5.17	4.1				1.54	1.7	1.3	1.1			
Bankfull Width/Depth Ratio	10.45	9.59	7.31	11.64				6.58	8.7	8.5	4.81				6.63	7.49	6.4	7.59				7.14	7.81	7.4	24.1				14.87	14.23	11.5	13.6			
Bankfull Entrenchment Ratio	10.06	10.18	16.29	15.34				7.79	6.57	8.5	10.4				11.1	8.72	9.8	11.8				9.7	7.49	8.1	5				10.5	8.44	13.2	12.6			
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1				1	1	0.9	0.9				1	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)	35.5	32.9	31.2	14.5				7.7	6.9	0.8	13.6				25.7	32	73	64				0.03	0.04	0.05	0.06				27.3	42.4	45	11.3			

	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section							Cross Section							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+	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				6.59	6.21	9.94	10.5																								
Floodprone Width (ft)	50	50	50	50				40	40	40	40																								
Bankfull Mean Depth (ft)	0.39	0.33	0.4	0.34				0.49	0.59	0.4	0.4																								
Bankfull Max Depth (ft)	0.58	0.5	0.5	0.43				0.85	0.92	0.97	0.87																								
Bankfull Cross Sectional Area (ft^2)	1.72	1.64	1.73	1.35				3.21	3.69	3.98	3.92																								
Bankfull Width/Depth Ratio	11.26	14.94	10.97	11.7				13.45	10.53	24.8	28.5																								
Bankfull Entrenchment Ratio	11.4	7.16	11.4	11.4				6.1	6.37	4.02	3.8																								
Bankfull Bank Height Ratio	1	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)	13.8	12.9	41	5.2				11.2	6.3	0.8	3																								

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)						
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)	4	4.3	4.2	4.9				3.58	3.48	3.3	3.2				6.74	6.19	6.61	6.39			
Floodprone Width (ft)	32	32	40	40				31	31	32	33				35	35	33	32			
Bankfull Mean Depth (ft)	0.41	0.38	0.33	0.25				0.32	0.24	0.31	0.32				1.04	0.79	0.84	0.8			
Bankfull Max Depth (ft)	0.65	0.71	0.6	0.6				0.49	0.38	0.49	0.54				1.53	1.29	1.22	1.2			
Bankfull Cross Sectional Area (ft^2)	1.66	1.65	1.38	1.25				1.16	0.85	1.01	1.03				6.98	4.87	5.53	5.09			
Bankfull Width/Depth Ratio	9.78	11.32	12.8	19.9				11.19	14.5	10.6	10				6.48	7.84	7.87	7.99			
Bankfull Entrenchment Ratio	7.9	9.31	9.48	8				8.6	6.89	9.77	10.35				5.12	5.1	4.96	5.02			
Bankfull Bank Height Ratio	1	1	1	1				1	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)	5.42	0.04	0.03	4				16	0.04	0.04	0.03				0.06	0.04	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				4.29	4.17	4.18	3.15										
Floodprone Width (ft)	19.5	19.5	18	14				18.3	18.3	24	11										
Bankfull Mean Depth (ft)	0.34	0.41	0.35	0.36				0.29	0.25	0.28	0.3										
Bankfull Max Depth (ft)	0.69	0.69	0.62	0.53				0.43	0.44	0.5	0.48										
Bankfull Cross Sectional Area (ft^2)	1.21	1.22	1.12	1.27				1.23	1.05	1.19	0.94										
Bankfull Width/Depth Ratio	10.38	7.27	9.2	9.83				14.79	16.68	14.93	10.5										
Bankfull Entrenchment Ratio	5.5	6.39	5.42	3.94				4.26	5.4	5.83	3.5										
Bankfull Bank Height Ratio	1	1	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				4.7	0.03	0.03	0.03										

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						
Floodprone Width (ft)	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						
[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						
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						
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						
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						
[1]Bank Height Ratio			1			1			1			1						
Profile																		
Riffle Length (ft)	8.2	47	15.7	6.3	46	14.4	10	47	16	6.7	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						
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						
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						
Pool Spacing (ft)	13	61	26.6	13.8	60	26.9	12.7	60	27.6	14	60	27.1						
Pattern																		
Channel Beltwidth (ft)	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						
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						
Meander Wavelength (ft)	34	106	50	34	106	50	34	106	50	34	106	50						
Meander Width Ratio			5.0			5.0			5.4			5.7						
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								
Bankfull Velocity (fps)																		
Bankfull Discharge (cfs)																		
Valley length (ft)	1285			1285			1285			1285								
Channel Thalweg length (ft)	1390			1390			1390			1390								
Sinuosity (ft)	1.1			1.1			1.1			1.1								
Water Surface Slope (Channel) (ft/ft)	0.0127			0.0127			0.0127			0.0127								
BF slope (ft/ft)	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						
Floodprone Width (ft)	31.00	35.00	32.67	31	35	32.70	32	40	35	32	40	35.00						
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						
[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						
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						
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						
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						
[1]Bank Height Ratio			1			1			1			1						
Profile																		
Riffle Length (ft)	22.2	74.9	40.6	22.2	74.9	40.6	24	73	43	25	76	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						
Pool Length (ft)	7.7	17.7	10.3	7.6	17.8	10.4	6	12	9.4	6	9	7.6						
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						
Pool Spacing (ft)	34.7	88	52	34.8	88.1	52	31	84	52	31	83	50						
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*						
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*						
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*						
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*						
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*						
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								
Bankfull Velocity (fps)																		
Bankfull Discharge (cfs)																		
Valley length (ft)	1184			1184			1184			1184								
Channel Thalweg length (ft)	1184			1184			1184			1184								
Sinuosity (ft)	1.0			1.0			1.0			1.0								
Water Surface Slope (Channel) (ft/ft)	0.0119			0.0119			0.0119			0.0119								
BF slope (ft/ft)	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						
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						
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						
[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						
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						
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						
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						
[1]Bank Height Ratio			1			1			1									
Profile																		
Riffle Length (ft)	133	145	138	130	145	136	140	160	148	134	146	139						
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						
Pool Length (ft)	7.6	11.2	9.3	7.4	11.1	9.2	7.1	13	10.6	5	9	7						
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						
Pool Spacing (ft)	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*						
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*						
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*						
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*						
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*						
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								
Bankfull Velocity (fps)																		
Bankfull Discharge (cfs)																		
Valley length (ft)	631			631			631			631								
Channel Thalweg length (ft)	631			631			631			631								
Sinuosity (ft)	1.0			1.0			1.0			1.0								
Water Surface Slope (Channel) (ft/ft)	0.00972			0.00972			0.00972			0.00972								
BF slope (ft/ft)	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

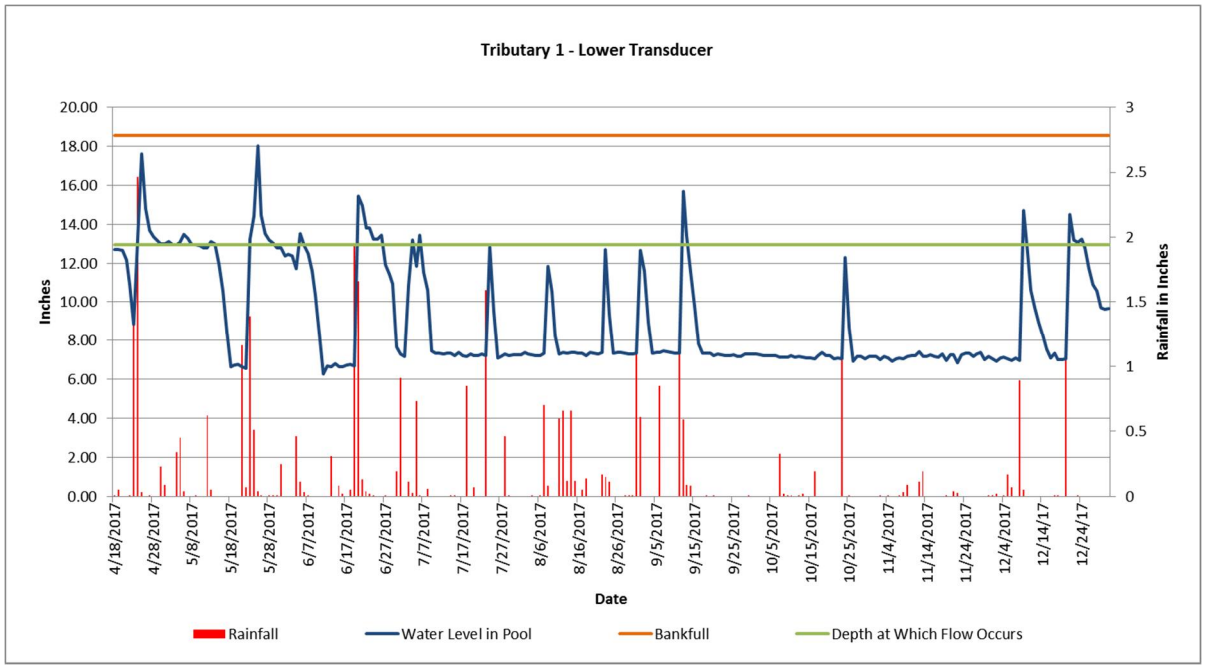
Table 10 – Verification of Bankfull Events

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			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

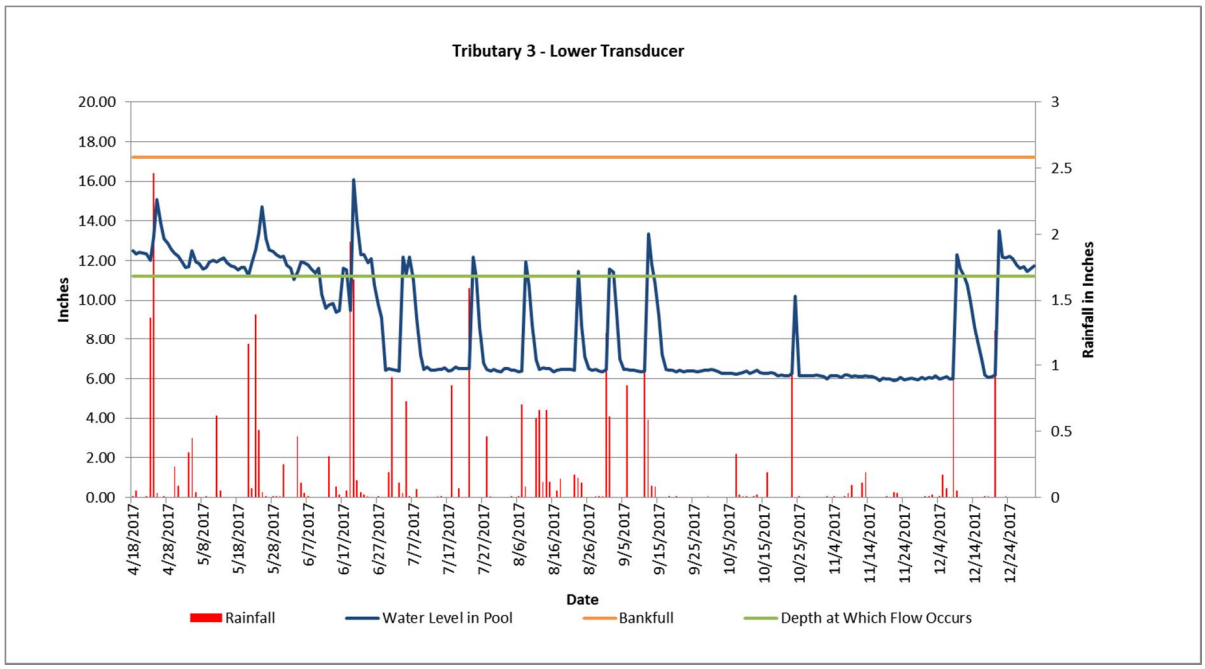
Photo of wrack lines from 11/23/2014 bankfull event

Tributary 1 Crest Gauge

Tributary 3 Crest Gauge



Tributary 1 had 22 days of continuous flow from 4/24/2017 to 5/15/2017



Tributary 3 had at least 52 days of continuous flow from 4/18/2017 to 6/10/2017