YEAR 1 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 Environment and Natural Resources
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Data Collection Period October 2015
Submitted: March 2016

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March 2016

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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 Environment and Natural Resources (NCDENR) 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 4021 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**).

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**). Tributary 1A was constructed as designed. Several log sills were not installed on Tributary 3. These primarily were sills that were to be placed on the upper reach between the wetland areas the channel to help maintain stability. This area had developed significant vegetation following the establishment of the Conservation Easement and had already stabilized. Therefore, the log sills were determined to be unnecessary.

In late November shortly after completion of the construction there was a significant bankfull flow event. While the channel held up well during the flow event, there were several locations where scouring occurred on the floodplain of Tributary 1A and 3. Due to the wet spring, repairs were not performed until June. Soil was removed from the adjacent slopes to rebuild the floodplains. The floodplains were regraded to eliminate the low points that allowed for

concentration of flows. Small berms perpendicular to the channel were placed periodically in the floodplain to disrupt flows and direct flows back into the channel. Following the grading activities, the disturbed areas were reseeded with both a temporary and a permanent seed mix, and covered with straw.

A log sill that had been installed at a headcut at the lower end of Tributary 1B was also rebuilt. During the high flow events a scour hole had formed upstream of the sill. The sill was rebuilt and larger stone was placed both in the plunge pool below the sill as well as above the sill. The coir matting was reinstalled and the disturbed areas were reseeded.

These repair areas are shown on **Figure 3** in **Appendix B** as vegetation problem areas as the repairs removed the woody stems from these areas. These areas will be replanted in February of 2016 during the dormant growth period.

Vegetation throughout the site is becoming established. The vegetation monitoring plots show an average density of 452 stems per acre down from baseline planting of 693 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. Only one plot does not meet the vegetation success criteria. No volunteer woody stems were observed during the first monitoring year.

Chinese privet (*Ligustrum sinense*) is present in the buffer along Tributary 1B. An extensive removal effort occurred during construction in 2014 but scattered stems remain and will need to be treated. The largest area of privet is towards the end of the reach near Wickers Branch. These areas will be addressed during spring and summer of 2016.

The stream channels appear to be stable with no areas of bank erosion observed. One riffle near the lower end of Tributary 1A shows evidence of slight degradation and has lost some of its bedload. Tributary 1A and 1B were dry during site visits on May 6 and August 18, 2015. Water was observed in the pools but flow was not present in the riffles. Flow was present during monitoring surveys in October.

The adjacent fields were planted in corn prior to establishing all the signage along the edge of the easement. This resulted in slight encroachments along the edges of the easement in several locations as it was difficult to determine the exact edge of the easement due to contours in the land. Additional signage will be installed prior to the 2016 planting season to help eliminate the encroachment. The areas of encroachment are shown on **Figure 3** in **Appendix B**.

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

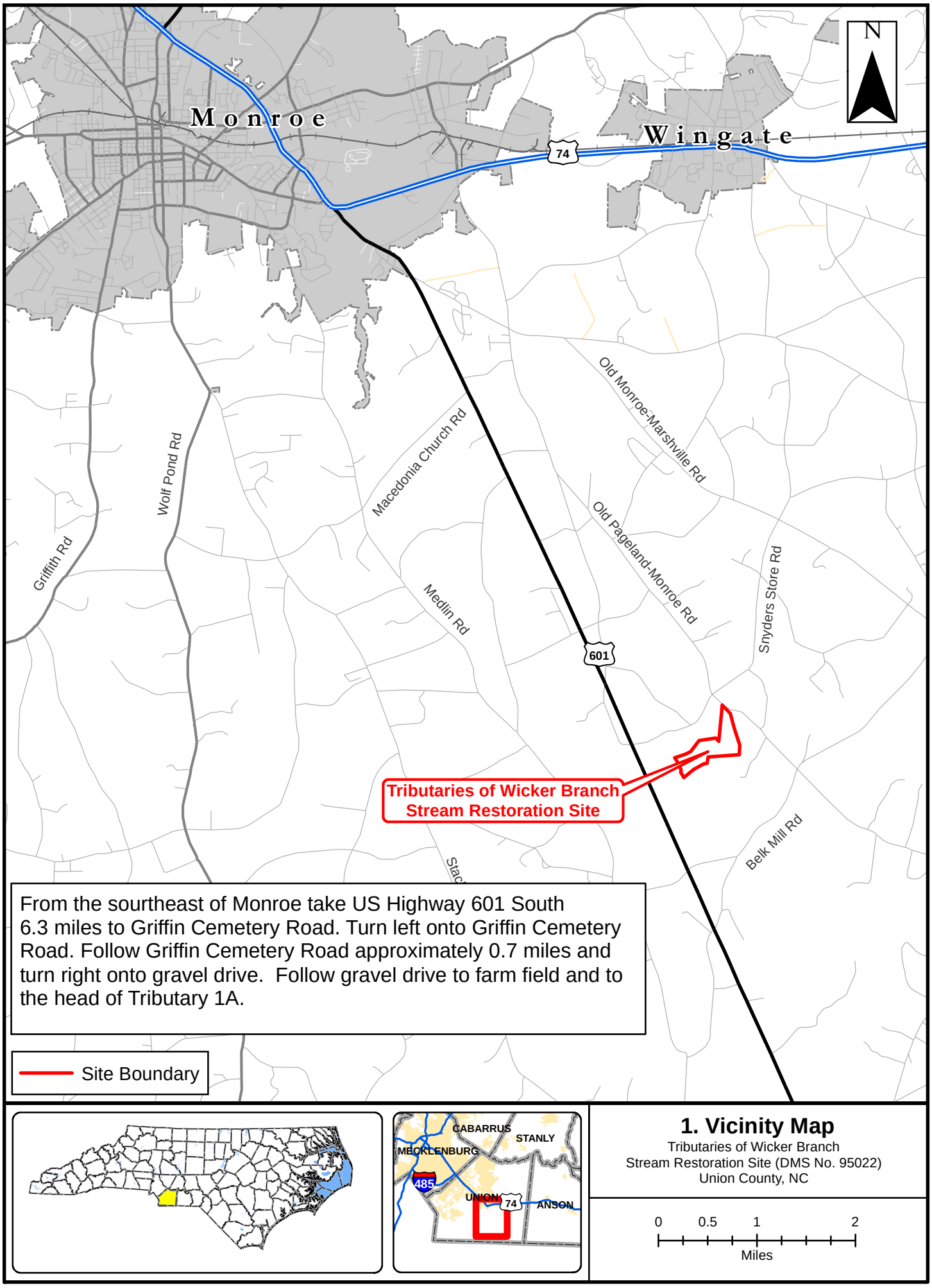
Figure 2 Stream Assets Map

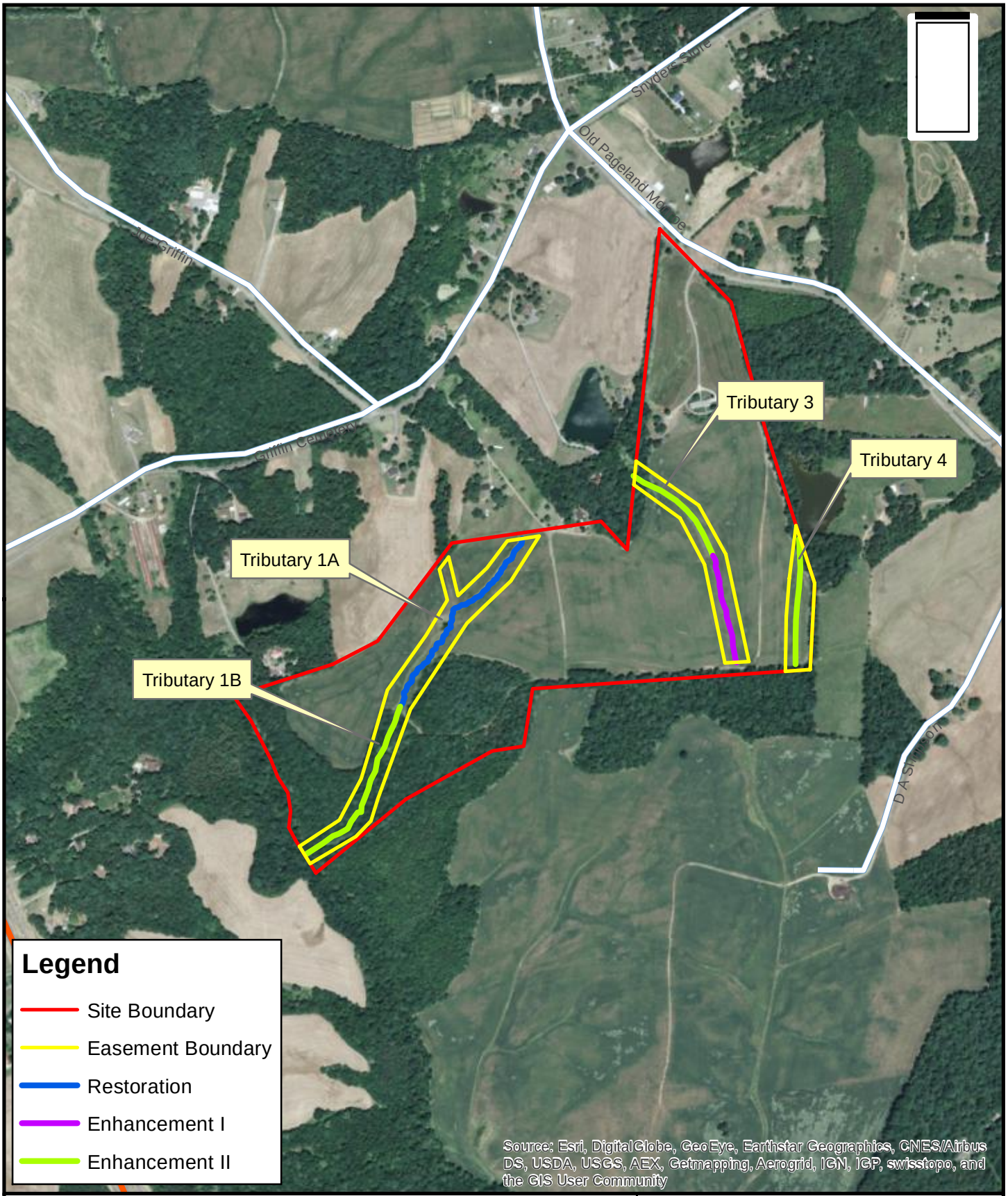
Table 1: Project Components and Mitigation Credits

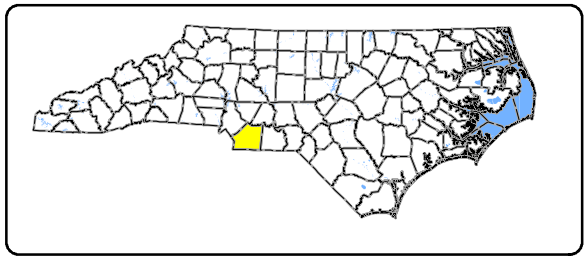
Table 2: Project Activity and Reporting History

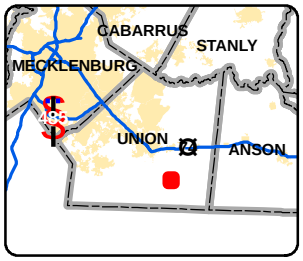
Table 3: Project Contacts

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	2540	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
Tributary 1B		1095	Enhancement II	Enhancement II	1095	3:1	365
Tributary 2		330	N/A	N/A	330	N/A	0
Tributary 3		264	Enhancement II	Enhancement II	264	2.5:1	106
Tributary 3		640	Enhancement I	Enhancement I	640	1.5:1	427
Tributary 4		631	Enhancement II	Enhancement II	631	2.5:1	252

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	Oct-15	Mar-16
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contact Table Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022	
Owner NCDENR - Division of Mitigation Services	Harry Tsomides NCDENR - 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
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 Geographics, CNT the GIS User Community

Year 1 Conditions

- Photo Locations
- Invasives
- Enchroachment
- Vegetation Problem Area

Vegetation Plots

- Criteria Met
- Criteria Not Met

Legend

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

0 50 100

Scale in Feet

Existing Condition Plan View

Tributaries of Wicker Branch Stream Restoration

Union County, NC

DMS Project No. 95022

FIGURE 3

Tributary 1A

VP - 1

0+00

1+00

2+00

3+00

4+00

XS-1

5+00

Photo Monitoring Point 1

Photo Monitoring Point 6

VP - 3

VP - 2

6+00

7+00

8+00

9+00

XS-4

10+00

11+00

12+00

VP - 4

Tributary 2

Tributary 1A

Photo Monitoring Point 2

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Year 1 Conditions

- Stationing
- Photo Locations
- Invasives
- Enchroachment
- Vegetation Problem Areas

Vegetation Plots

- Criteria Met
- Criteria Not Met

Legend

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

0 50 100 Scale in Feet

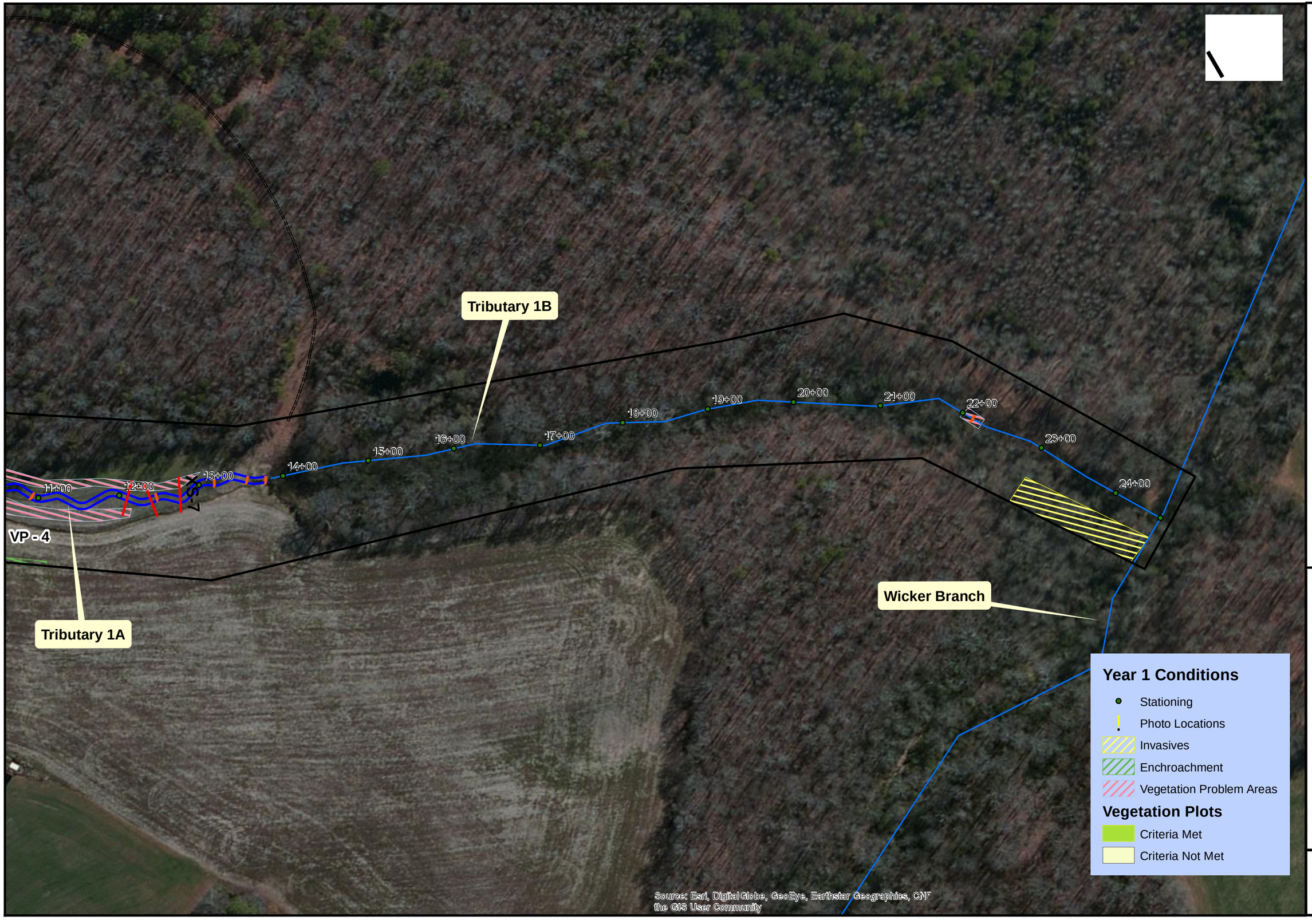
Existing Condition Plan View

Tributaries of Wicker Branch Stream Restoration

Union County, NC

DMS Project No. 95022

FIGURE 3a



Legend

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

0 50 100 Scale in Feet

Year 1 Conditions

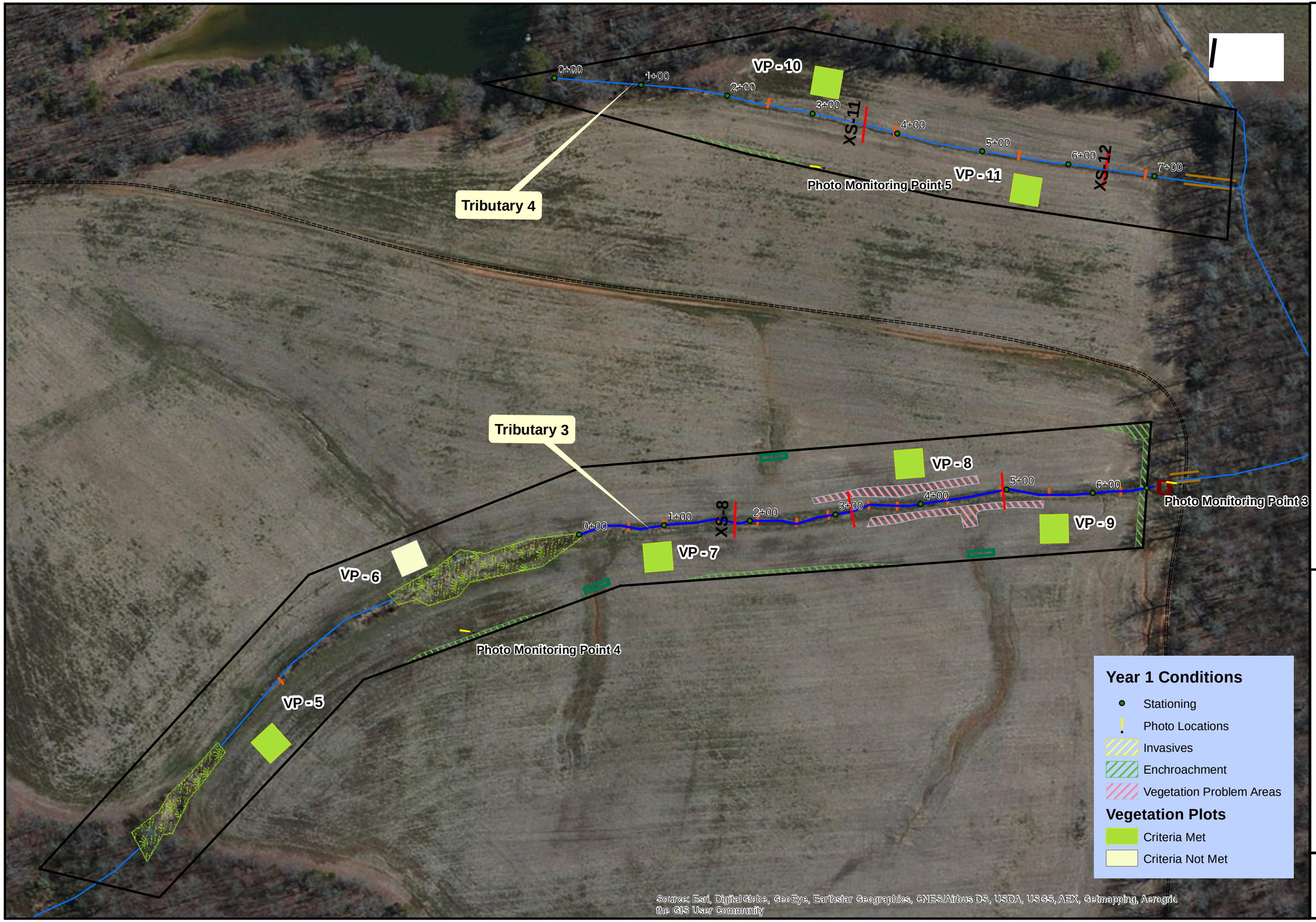
- Stationing
- Photo Locations
- Invasives
- Enchroachment
- Vegetation Problem Areas

Vegetation Plots

- Criteria Met
- Criteria Not Met

Existing Condition Plan View
Tributaries of Wicker Branch Stream Restoration
Union County, NC
DMS Project No. 95022

FIGURE 3b



Legend

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

0 50 100 Scale in Feet

Year 1 Conditions

- Stationing
- Photo Locations
- Invasives
- Enchroachment
- Vegetation Problem Areas

Vegetation Plots

- Criteria Met
- Criteria Not Met

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)			1	10	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	49	50			98%			
	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.	33	33			100%			
	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	6	0.30	2.6%
			Total	6	0.30	2.6%
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	6	0.30	2.6%

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	4	0.10	0.6%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Green Hatch	8	0.16	1.0%

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.

Photo Monitoring Point 1 – 10/16/15

Photo Monitoring Point 2 – 10/16/15

Photo Monitoring Point 3 – 10/16/15

Photo Monitoring Point 4 – 10/16/15

Photo Monitoring Point 5 – 10/16/15

Photo Monitoring Point 6 – 10/16/15

Cross Section 1 (looking upstream) – 10/15/15

Cross Section 4 (looking upstream) – 10/15/15

Cross Section 2 (looking upstream) – 10/15/15

Cross Section 5 (looking upstream) – 10/15/15

Cross Section 3 (looking upstream) – 10/15/15

Cross Section 6 (looking upstream) – 10/15/15

Cross Section 7 (looking upstream) – 10/15/15

Cross Section 10 (looking upstream) – 10/15/15

Cross Section 8 (looking upstream) – 10/15/15

Cross Section 11 (looking upstream) – 10/15/15

Cross Section 9 (looking upstream) – 10/15/15

Cross Section 12 (looking upstream) – 10/15/15

Vegetation Monitoring Plot 1 – 10/14/15

Vegetation Monitoring Plot 4 – 10/14/15

Vegetation Monitoring Plot 2 – 10/14/15

Vegetation Monitoring Plot 5 – 10/14/15

Vegetation Monitoring Plot 3 – 10/1415

Vegetation Monitoring Plot 6 – 10/14/15

Vegetation Monitoring Plot 7 – 10/14/15

Vegetation Monitoring Plot 10 – 10/14/15

Vegetation Monitoring Plot 8 – 10/14/15

Vegetation Monitoring Plot 11 – 10/14/15

Vegetation Monitoring Plot 9 – 10/14/15

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 (MY1 2015)																				
			95022-01-0001			95022-01-0002			95022-01-0003			95022-01-0004			95022-01-0005			95022-01-0006			95022-01-0007		
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
Cercis canadensis	eastern redbud	Tree	1	1	1	2	2	2	3	3	3	5	5	5	2	2	2				1	1	1
Cornus amomum	silky dogwood	Shrub	4	4	4	1	1	1				2	2	2	3	3	3				1	1	1
Diospyros virginiana	common persimmon	Tree	1	1	1				1	1	1												
Liriodendron tulipifera	tuliptree	Tree	1	1	1	3	3	3				1	1	1	1	1	1	1	1	1	3	3	3
Quercus	oak	Tree	1	1	1																		
Quercus alba	white oak	Tree	3	3	3	2	2	2	3	3	3				5	5	5	1	1	1	2	2	2
Quercus falcata	southern red oak	Tree	2	2	2	1	1	1				2	2	2				2	2	2	1	1	1
Robinia pseudoacacia	black locust	Tree				1	1	1													4	4	4
Salix nigra	black willow	Tree											1	1									
Sambucus canadensis	Common Elderberry	Shrub	3	3	3	2	2	2	3	3	3	1	1	1									
Unknown		Shrub or Tree																					
		Stem count	16	16	16	12	12	12	10	10	10	11	12	12	11	11	11	4	4	4	12	12	12
		size (ares)	1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	8	8	8	7	7	7	4	4	4	5	6	6	4	4	4	3	3	3	6	6	6
		Stems per ACRE	647.5	647.5	647.5	485.6	485.6	485.6	404.7	404.7	404.7	445.2	485.6	485.6	445.2	445.2	445.2	161.9	161.9	161.9	485.6	485.6	485.6

			Current Plot Data (MY1 2015)												Annual Means					
			95022-01-0008			95022-01-0009			95022-01-0010			95022-01-0011			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
Cercis canadensis	eastern redbud	Tree	1	1	1	4	4	4	1	1	1	1	1	1	21	21	21	26	26	26
Cornus amomum	silky dogwood	Shrub	1	1	1				4	4	4	2	2	2	18	18	18	21	21	21
Diospyros virginiana	common persimmon	Tree	4	4	4										6	6	6	7	7	7
Liriodendron tulipifera	tuliptree	Tree	2	2	2	3	3	3				1	1	1	16	16	16	38	38	38
Quercus	oak	Tree													1	1	1	2	2	2
Quercus alba	white oak	Tree	3	3	3	3	3	3				4	4	4	26	26	26	41	41	41
Quercus falcata	southern red oak	Tree	1	1	1				1	1	1				10	10	10	20	20	20
Robinia pseudoacacia	black locust	Tree				1	1	1	1	1	1				7	7	7	9	9	9
Salix nigra	black willow	Tree														1	1		1	1
Sambucus canadensis	Common Elderberry	Shrub							3	3	3	3	3	3	15	15	15	21	21	21
Unknown		Shrub or Tree										1	1	1	1	1	1	1	1	1
		Stem count	12	12	12	11	11	11	10	10	10	12	12	12	121	122	122	186	187	187
		size (ares)	1			1			1			1			11			11		
		size (ACRES)	0.02			0.02			0.02			0.02			0.27			0.27		
		Species count	6	6	6	4	4	4	5	5	5	6	6	6	10	11	11	10	11	11
		Stems per ACRE	485.6	485.6	485.6	445.2	445.2	445.2	404.7	404.7	404.7	485.6	485.6	485.6	445.2	448.8	448.8	684.3	688	688

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

APPENDIX D: STREAM GEOMORPHOLOGY DATA

Cross-Sections

Longitudinal Profiles

Pebble Counts

Table 8: Baseline Stream Data Summary

Table 9a: Cross-Section Morphology Data

Table 9b: Stream Reach Morphology Data

Cross-section Plot Exhibit

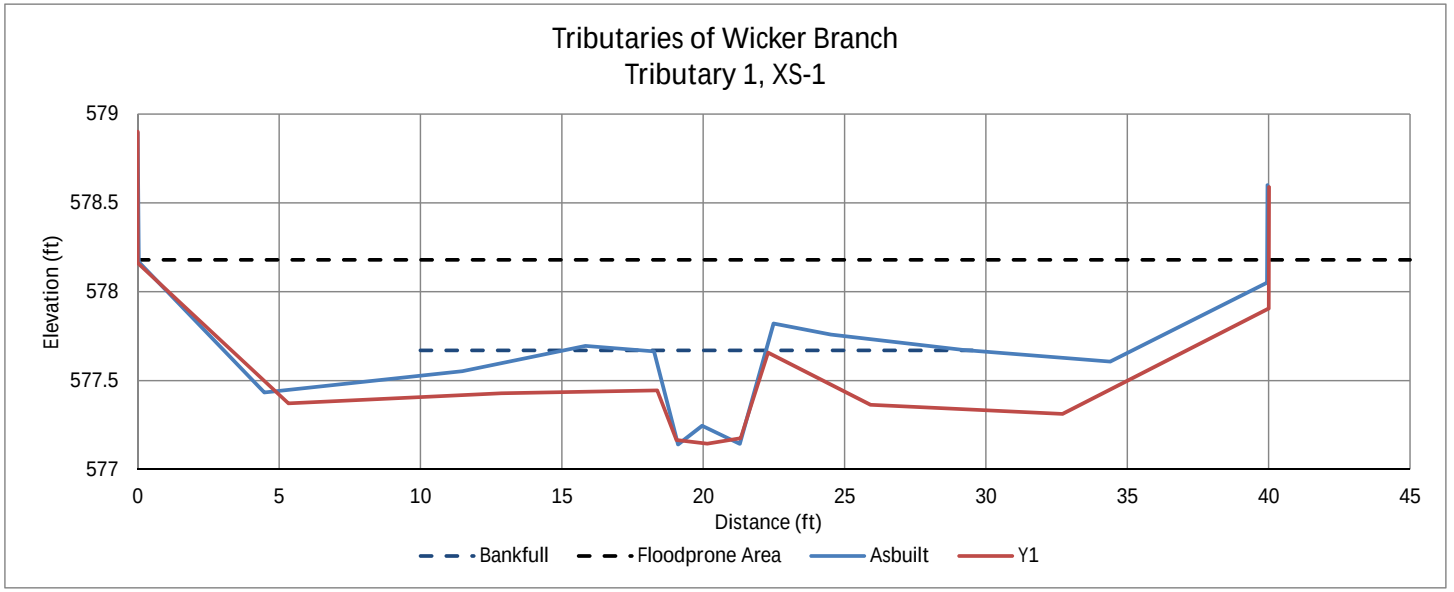
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-1, Sta. 4+65
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	578.901	LTPIN
0.00	578.162	LPIN
5.33	577.372	GR
12.86	577.429	GR
18.37	577.445	TOB
19.06	577.166	TOE
20.15	577.145	TW
21.32	577.176	TOE
22.30	577.657	TOB
25.92	577.364	GR
32.71	577.313	GR
40.00	577.906	RPIN
40.02	578.589	RTPIN

Summary Data

Bankfull Elevation	577.67
Bankfull Width (ft)	3.93
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.41
Bankfull Max Depth (ft)	0.51
Bankfull Cross Sectional Area (ft^2)	1.62
Bankfull Width/Depth Ratio	10.45
Bankfull Entrenchment Ratio	10.06
Bankfull Bank Height Ratio	1

Photo: Cross-section 1 looking upstream



Cross-section Plot Exhibit

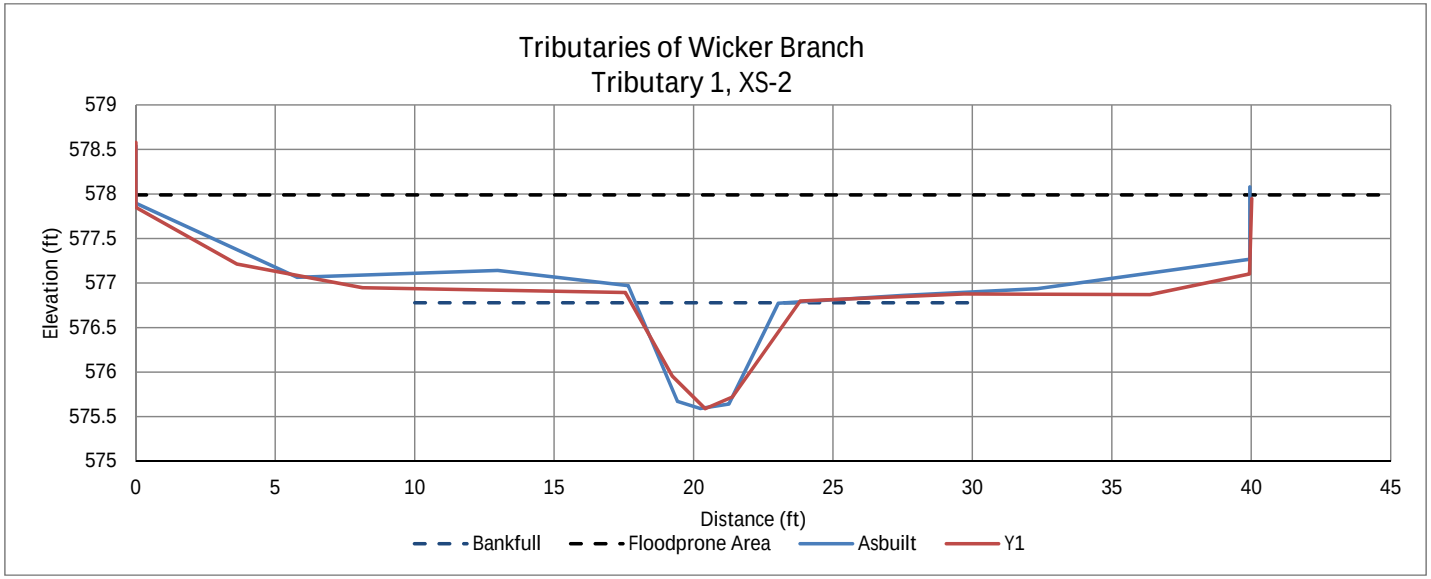
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-2, Sta. 5+05
Feature	Pool
Drainage Area (sq mi)	0.15
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	578.58	LTPIN
0.00	577.85	LPIN
3.62	577.21	GR
8.12	576.95	GR
17.55	576.90	TOB
19.23	575.96	TOE
20.42	575.59	TW
21.39	575.72	TOE
23.82	576.80	TOB
29.70	576.88	GR
36.36	576.87	GR
39.93	577.10	RPIN
40.02	577.95	RTPIN

Summary Data

Bankfull Elevation	576.78
Bankfull Width (ft)	6.09
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.7
Bankfull Max Depth (ft)	1.21
Bankfull Cross Sectional Area (ft^2)	4.27
Bankfull Width/Depth Ratio	8.7
Bankfull Entrenchment Ratio	6.57
Bankfull Bank Height Ratio	1

Photo: Cross-section 2 looking upstream



Cross-section Plot Exhibit

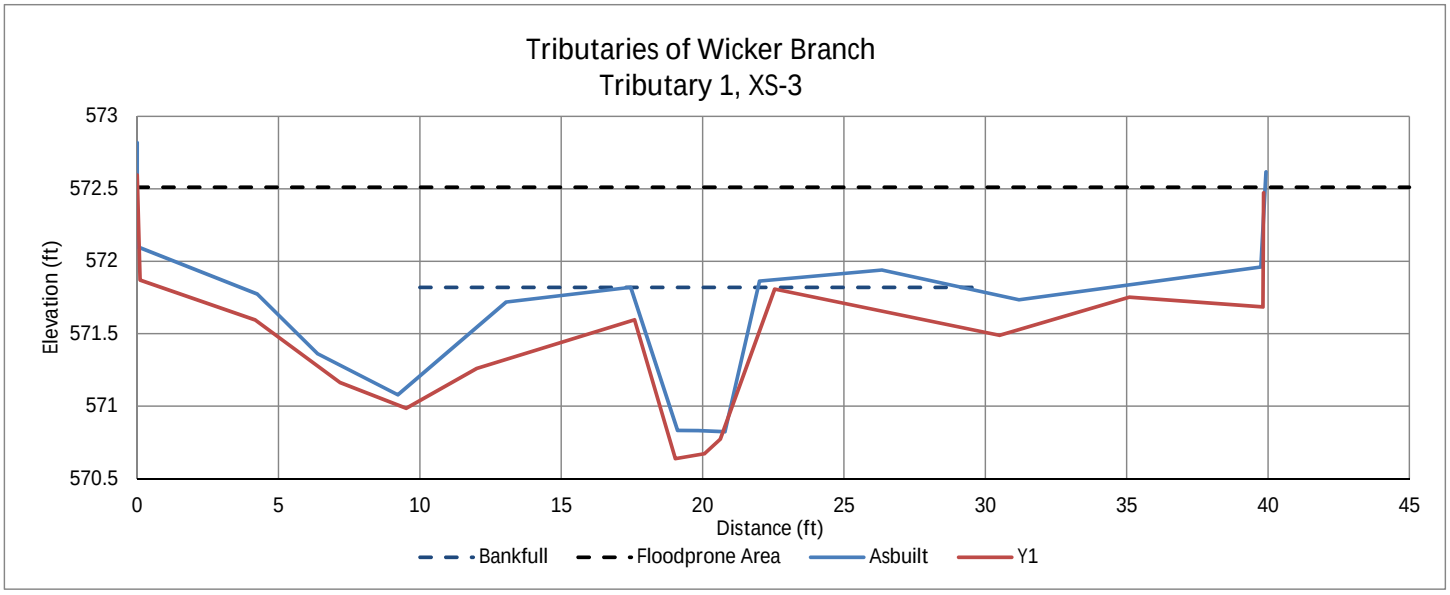
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-3, Sta. 9+34
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	572.59	LTPIN
0.10	571.87	LPIN
4.17	571.60	GR
7.17	571.16	GR
9.51	570.99	GR
12.01	571.26	GR
17.59	571.60	TOB
19.03	570.64	TOE
20.07	570.67	TW
20.62	570.77	TOE
22.55	571.81	TOB
30.50	571.49	GR
35.08	571.75	GR
39.82	571.69	RPIN
39.84	572.47	RTPIN

Summary Data

Bankfull Elevation	571.82
Bankfull Width (ft)	4.57
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.61
Bankfull Max Depth (ft)	0.69
Bankfull Cross Sectional Area (ft^2)	2.8
Bankfull Width/Depth Ratio	7.49
Bankfull Entrenchment Ratio	8.72
Bankfull Bank Height Ratio	1

Photo: Cross-section 3 looking upstream



Cross-section Plot Exhibit

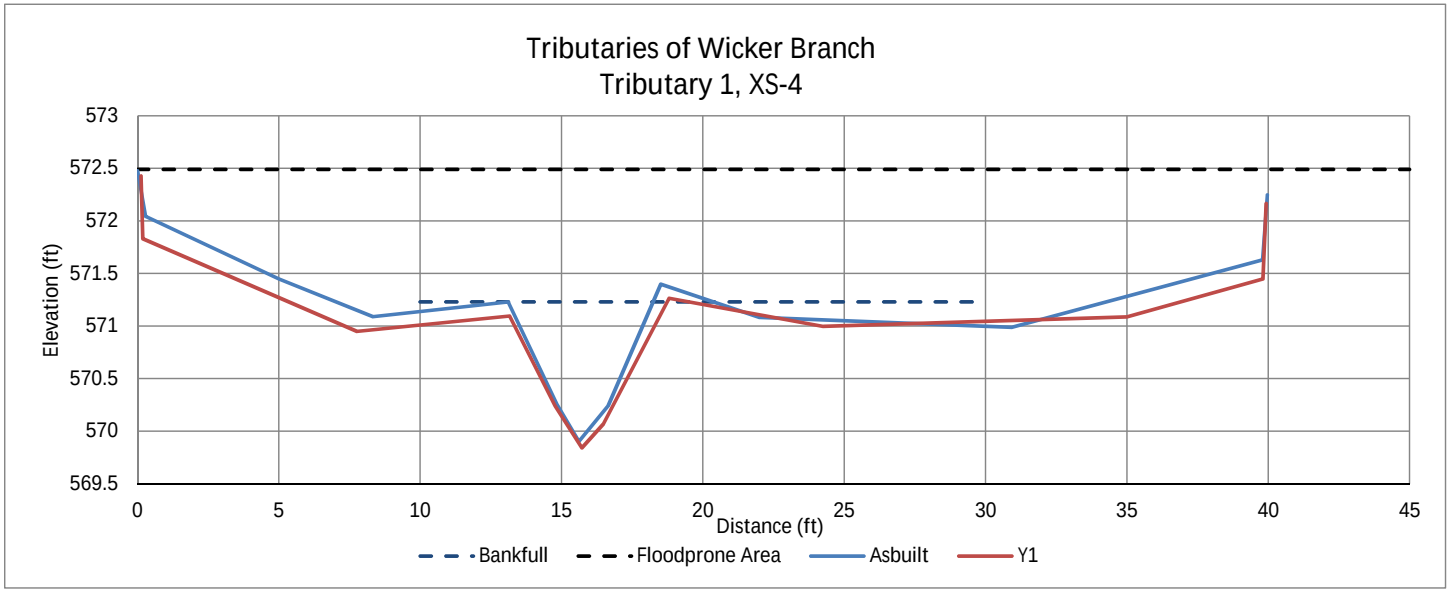
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-4, Sta. 9+72
Feature	Pool
Drainage Area (sq mi)	0.15
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.13	572.43	LTPIN
0.19	571.83	LPIN
7.76	570.95	GR
13.16	571.10	TOB
14.78	570.24	TOE
15.72	569.84	TW
16.48	570.07	TOE
18.80	571.27	TOB
24.25	571.00	GR
34.99	571.09	GR
39.81	571.45	RPIN
39.92	572.17	RTPIN

Summary Data

Bankfull Elevation	571.23
Bankfull Width (ft)	5.31
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.68
Bankfull Max Depth (ft)	1.26
Bankfull Cross Sectional Area (ft^2)	3.59
Bankfull Width/Depth Ratio	7.81
Bankfull Entrenchment Ratio	7.49
Bankfull Bank Height Ratio	1

Photo: Cross-section 4 looking upstream



Cross-section Plot Exhibit

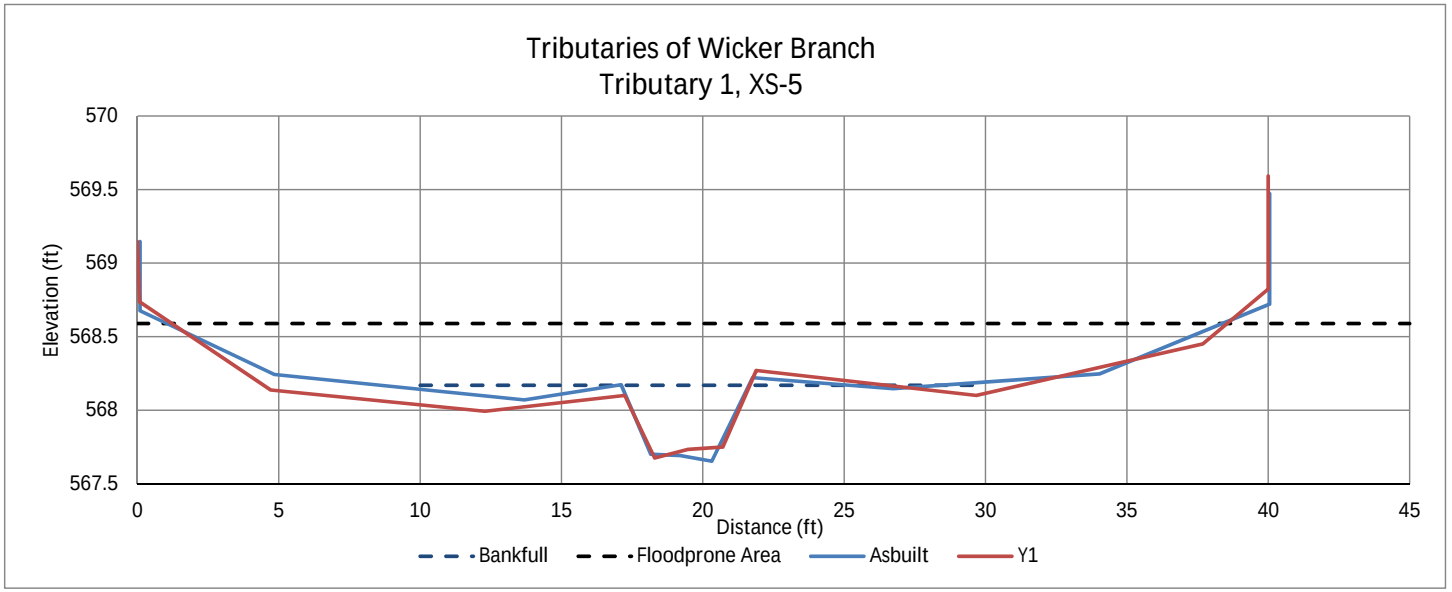
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-5, Sta. 12+10
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	569.15	LTPIN
0.08	568.74	LPIN
4.71	568.14	GR
12.29	567.99	GR
17.23	568.10	TOB
18.29	567.68	TOE
19.45	567.73	TW
20.70	567.75	TOE
21.89	568.27	TOB
29.67	568.10	GR
37.68	568.45	GR
40.00	569.59	RTPIN
40.00	568.82	RPIN

Summary Data

Bankfull Elevation	568.17
Bankfull Width (ft)	4.27
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.3
Bankfull Max Depth (ft)	0.42
Bankfull Cross Sectional Area (ft^2)	1.7
Bankfull Width/Depth Ratio	14.23
Bankfull Entrenchment Ratio	8.44
Bankfull Bank Height Ratio	1

Photo: Cross-section 5 looking upstream



Cross-section Plot Exhibit

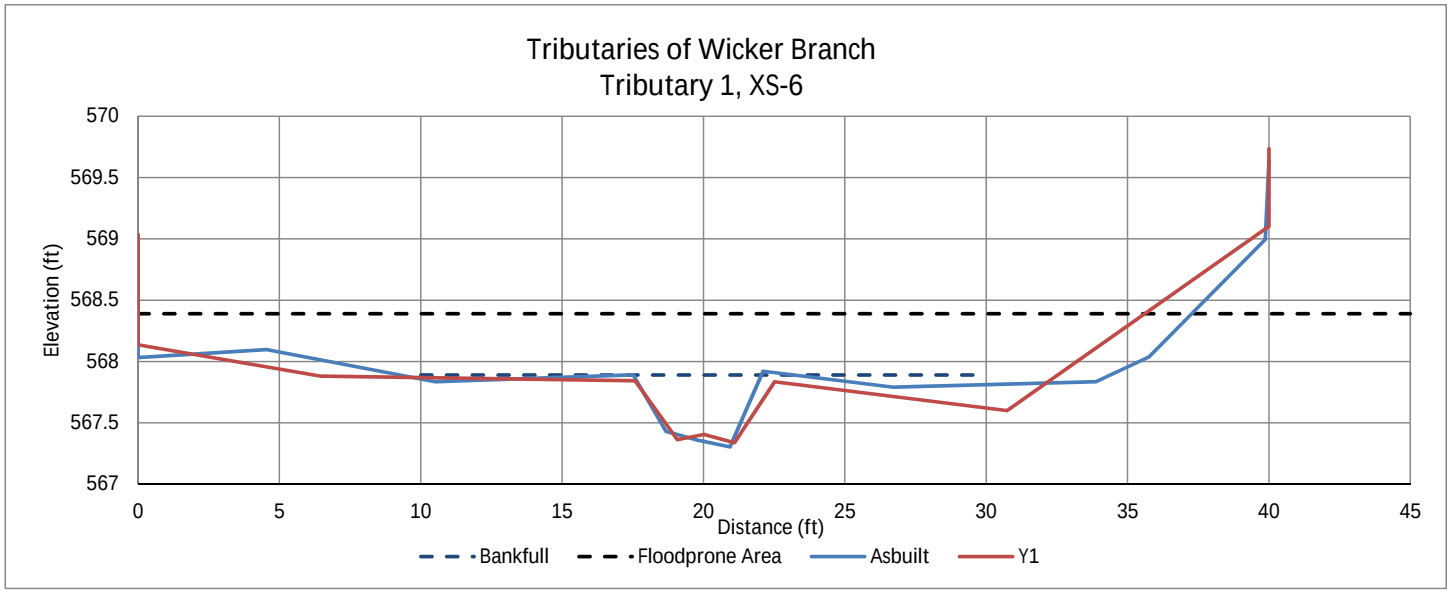
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-6, Sta. 12+37
Feature	Riffle
Drainage Area (sq mi)	0.15
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	569.04	LTPIN
0.00	568.14	LPIN
6.46	567.88	GR
17.58	567.84	TOB
19.07	567.36	TOE
20.02	567.41	TW
21.09	567.34	TOE
22.51	567.84	TOB
30.74	567.60	GR
40.00	569.10	RPIN
40.00	569.74	RTPIN

Summary Data

Bankfull Elevation	567.89
Bankfull Width (ft)	4.93
Floodprone Width (ft)	50
Bankfull Mean Depth (ft)	0.33
Bankfull Max Depth (ft)	0.5
Bankfull Cross Sectional Area (ft^2)	1.64
Bankfull Width/Depth Ratio	14.94
Bankfull Entrenchment Ratio	7.16
Bankfull Bank Height Ratio	1

Photo: Cross-section 6 looking uptream



Cross-section Plot Exhibit

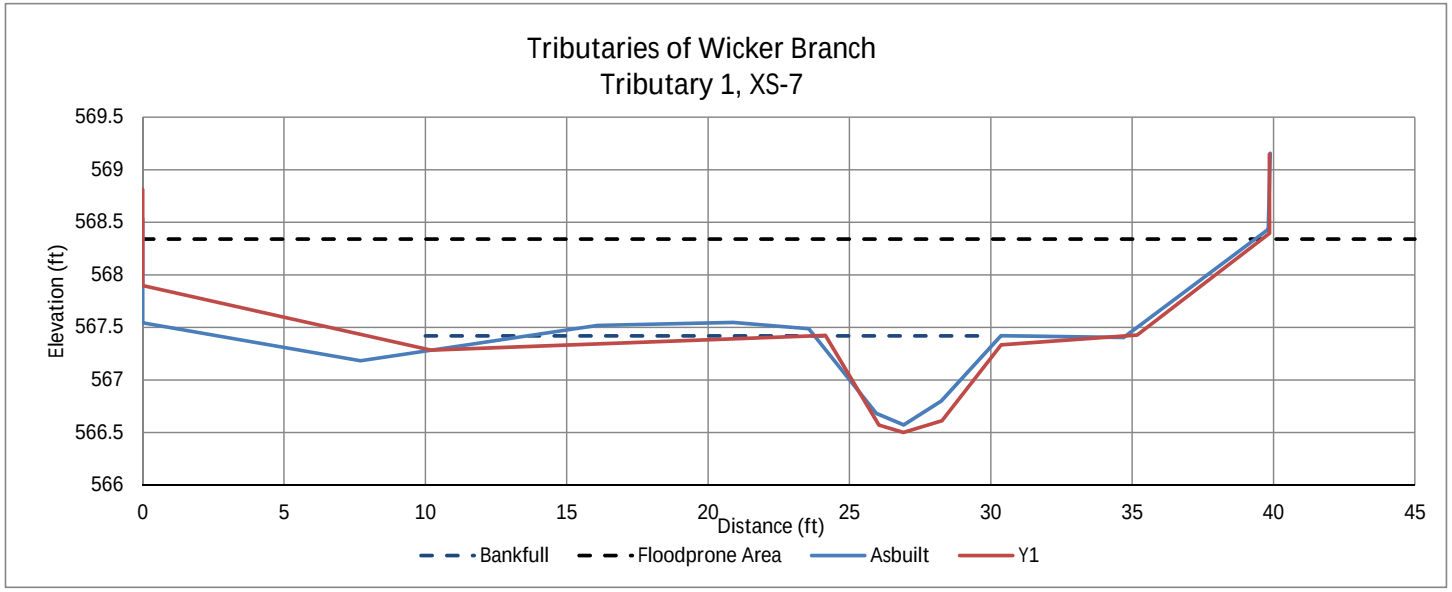
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-7, Sta. 12+72
Feature	Pool
Drainage Area (sq mi)	0.15
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	568.81	LTPIN
0.00	567.90	LPIN
10.21	567.28	GR
24.15	567.42	TOB
26.04	566.57	TOE
26.90	566.50	TW
28.27	566.61	TOE
30.36	567.33	TOB
35.17	567.43	GR
39.86	568.40	RPIN
39.85	569.15	RTPIN

Summary Data

Bankfull Elevation	567.42
Bankfull Width (ft)	6.21
Floodprone Width (ft)	40
Bankfull Mean Depth (ft)	0.59
Bankfull Max Depth (ft)	0.92
Bankfull Cross Sectional Area (ft^2)	3.69
Bankfull Width/Depth Ratio	1053
Bankfull Entrenchment Ratio	6.37
Bankfull Bank Height Ratio	1

Photo: Cross-section 7 looking upstream



Cross-section Plot Exhibit

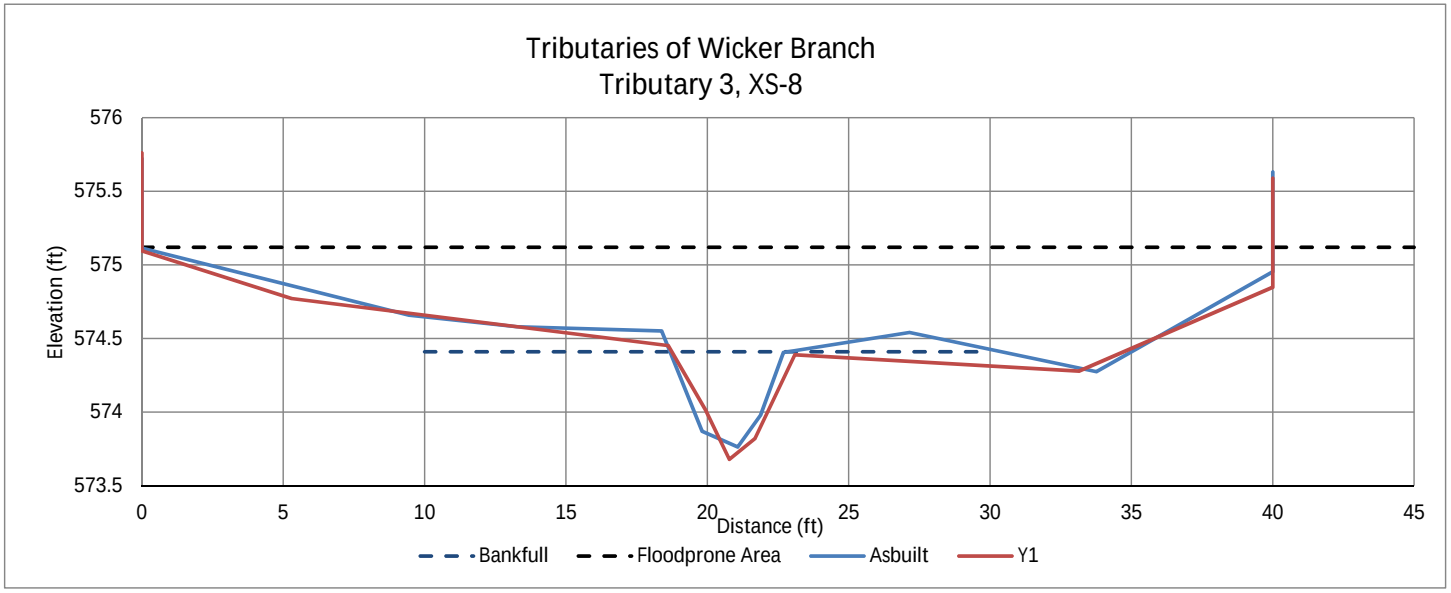
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-8, Sta. 1+83
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	575.76	LTPIN
0.00	575.10	LPIN
5.30	574.77	GR
18.61	574.45	TOB
19.93	574.02	TOE
20.78	573.68	TW
21.68	573.82	TOE
23.09	574.39	TOB
33.14	574.28	GR
40.00	574.85	RPIN
40.00	575.59	RTPIN

Summary Data

Bankfull Elevation	574.41
Bankfull Width (ft)	4.3
Floodprone Width (ft)	32
Bankfull Mean Depth (ft)	0.38
Bankfull Max Depth (ft)	0.71
Bankfull Cross Sectional Area (ft^2)	1.65
Bankfull Width/Depth Ratio	11.32
Bankfull Entrenchment Ratio	9.31
Bankfull Bank Height Ratio	1

Photo: Cross-section 8 looking downstream



Cross-section Plot Exhibit

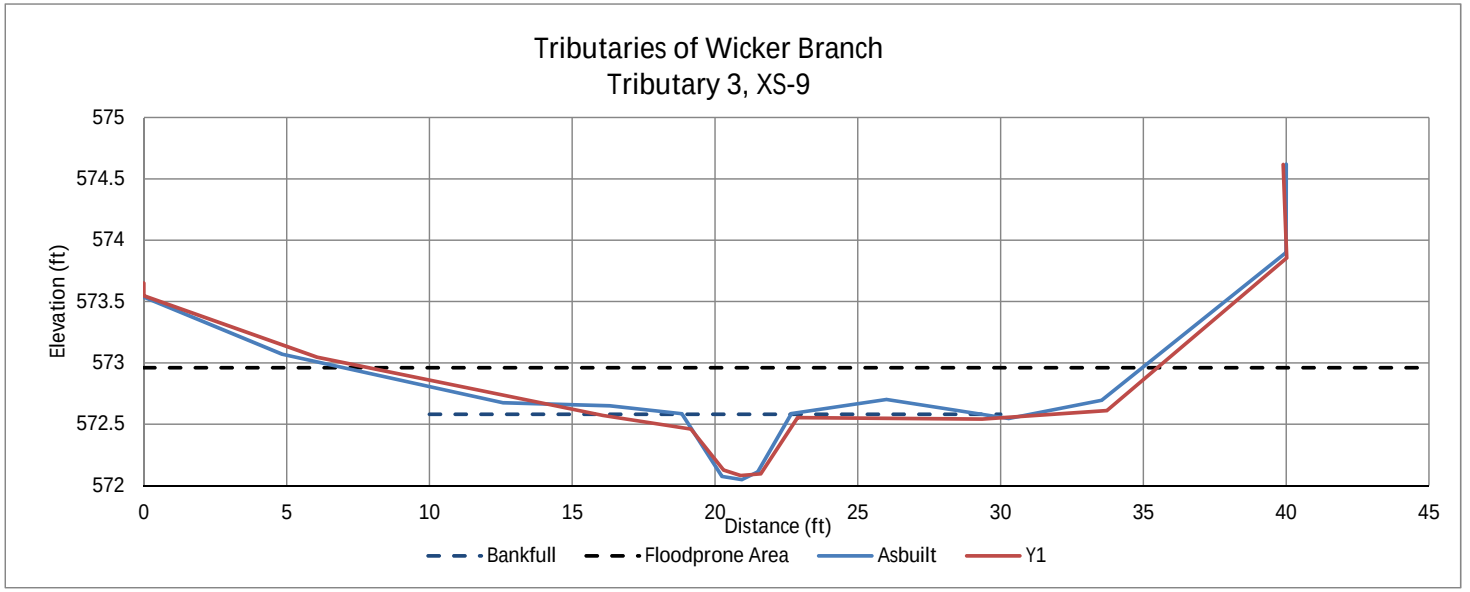
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-9, Sta 3+19
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	573.65	LTPIN
0.00	573.55	LPIN
6.07	573.05	GR
16.08	572.57	GR
19.15	572.46	TOB
20.30	572.13	TOE
20.89	572.08	TW
21.60	572.10	TOE
22.89	572.55	TOB
29.35	572.54	GR
33.71	572.61	GR
40.02	574.62	RTPIN
39.89	573.86	RPIN

Summary Data

Bankfull Elevation	572.58
Bankfull Width (ft)	3.48
Floodprone Width (ft)	31
Bankfull Mean Depth (ft)	0.24
Bankfull Max Depth (ft)	0.38
Bankfull Cross Sectional Area (ft^2)	0.85
Bankfull Width/Depth Ratio	14.5
Bankfull Entrenchment Ratio	6.89
Bankfull Bank Height Ratio	1

Photo: Cross-section 9 looking upstream



Cross-section Plot Exhibit

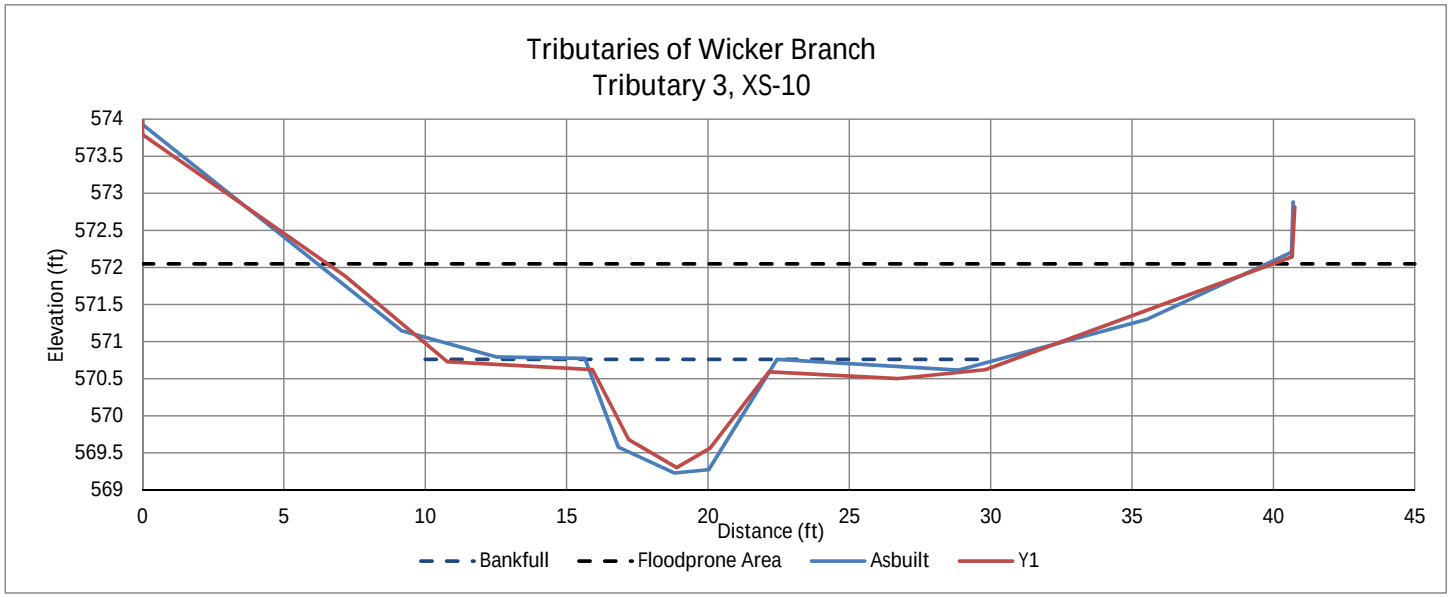
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-10, Sta. 4+95
Feature	Pool
Drainage Area (sq mi)	0.05
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	574.53	LTPIN
0.00	573.79	LPI
7.17	571.88	GR
10.78	570.73	GR
15.92	570.62	TOB
17.19	569.68	TOE
18.89	569.30	TW
20.07	569.56	TOE
22.15	570.59	BKF
26.70	570.50	GR
29.81	570.62	GR
40.67	572.15	RPIN
40.75	572.82	RTPIN

Summary Data

Bankfull Elevation	570.76
Bankfull Width (ft)	6.19
Floodprone Width (ft)	35
Bankfull Mean Depth (ft)	0.79
Bankfull Max Depth (ft)	1.29
Bankfull Cross Sectional Area (ft^2)	4.87
Bankfull Width/Depth Ratio	7.84
Bankfull Entrenchment Ratio	5.1
Bankfull Bank Height Ratio	1

Photo: Cross-section 10 looking upstream



Cross-section Plot Exhibit

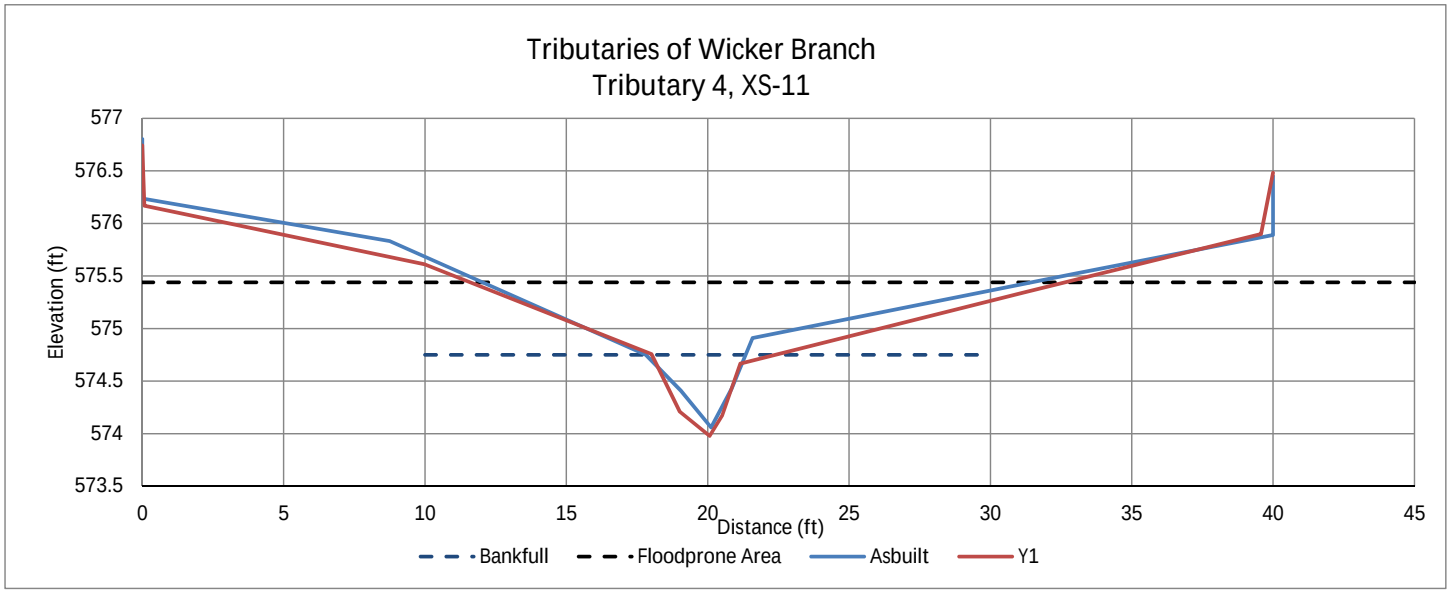
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-11, Sta. 3+61
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

Station	Elevation	
0.00	576.74	LTPIN
0.08	576.17	LPIN
9.99	575.61	GR
18.01	574.76	BKF
19.01	574.21	TOE
20.07	573.98	TW
20.51	574.17	TOE
21.15	574.67	TOB
31.22	575.35	GR
39.57	575.90	RPIN
40.00	576.48	RTPIN

Summary Data

Bankfull Elevation	574.75
Bankfull Width (ft)	2.98
Floodprone Width (ft)	19.5
Bankfull Mean Depth (ft)	0.41
Bankfull Max Depth (ft)	0.69
Bankfull Cross Sectional Area (ft^2)	1.22
Bankfull Width/Depth Ratio	7.27
Bankfull Entrenchment Ratio	6.39
Bankfull Bank Height Ratio	1

Photo: Cross-section 11 looking upstream



Cross-section Plot Exhibit

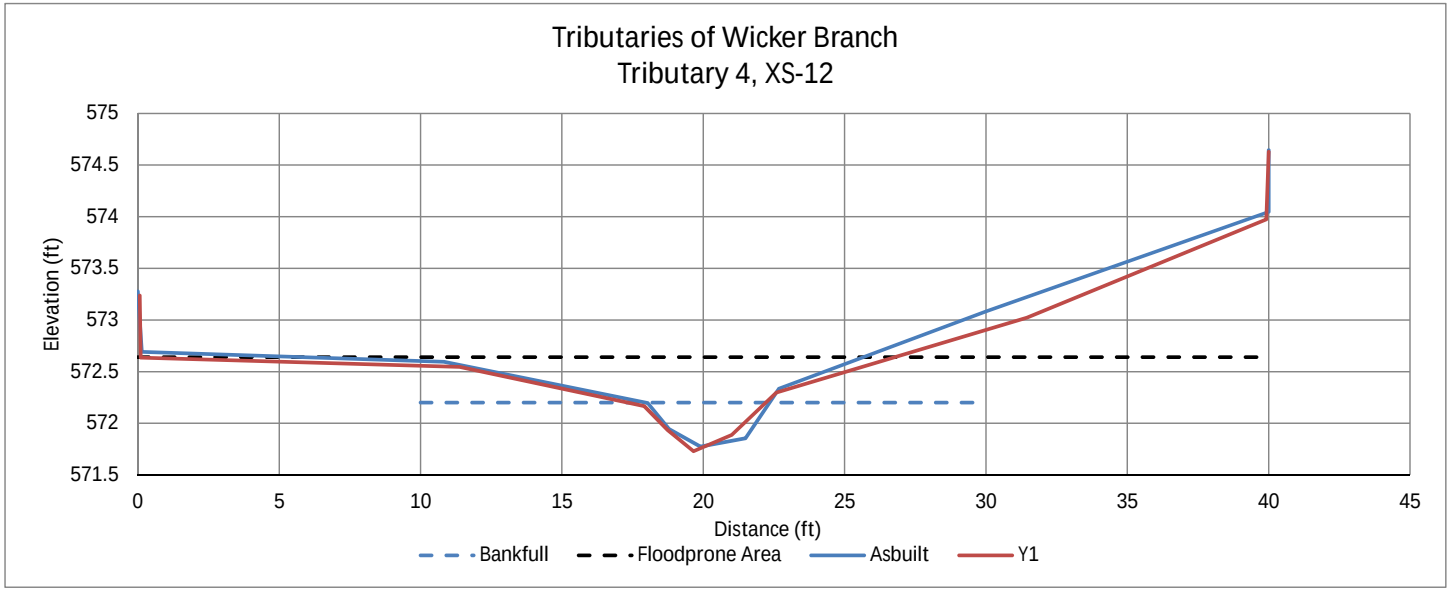
River Basin	Yadkin-Pee Dee
Watershed	Wicker Branch
X-Sec ID	XS-12, Sta. 6+42
Feature	Riffle
Drainage Area (sq mi)	0.05
Date	10/15/2015
Field Crew	Steven Pires, Celia Foushee

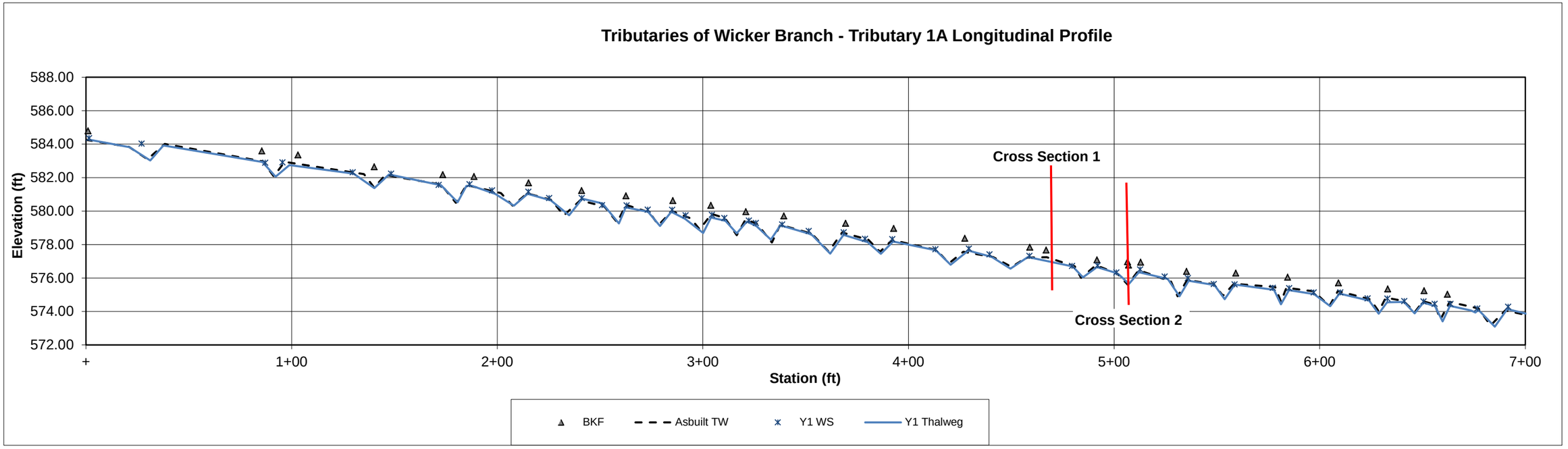
Station	Elevation	
0.07	573.24	LTPIN
0.10	572.64	LPIN
11.39	572.55	GR
17.91	572.17	BKF
18.74	571.93	TOE
19.65	571.73	TW
21.01	571.89	TOE
22.58	572.30	TOB
31.44	573.02	GR
39.92	573.97	RPIN
40.00	574.63	RTPIN

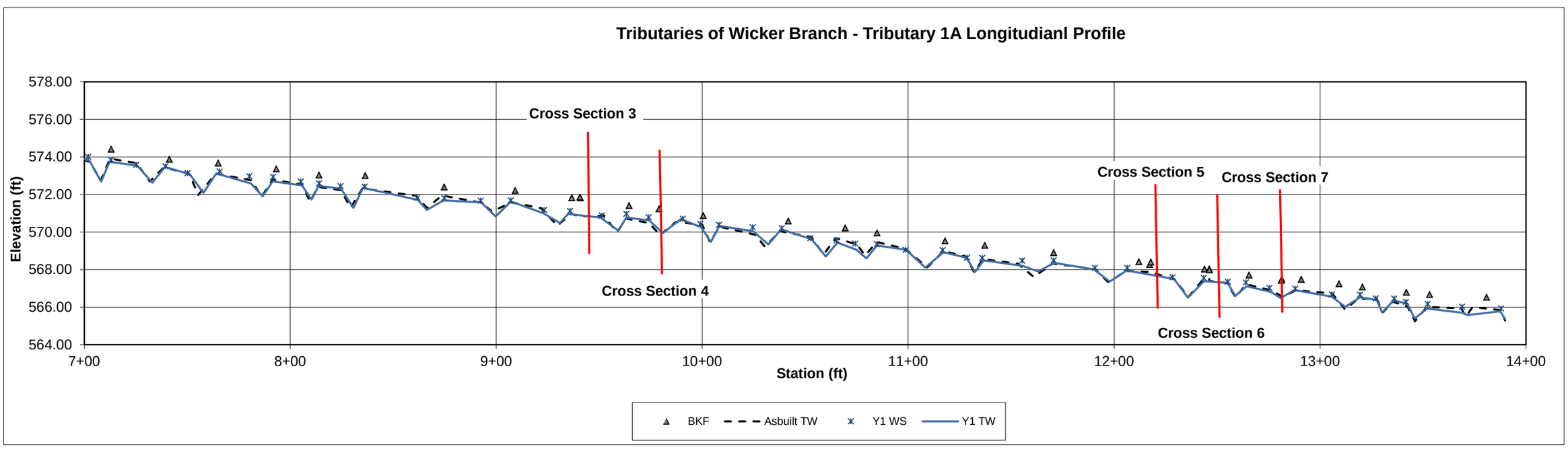
Summary Data

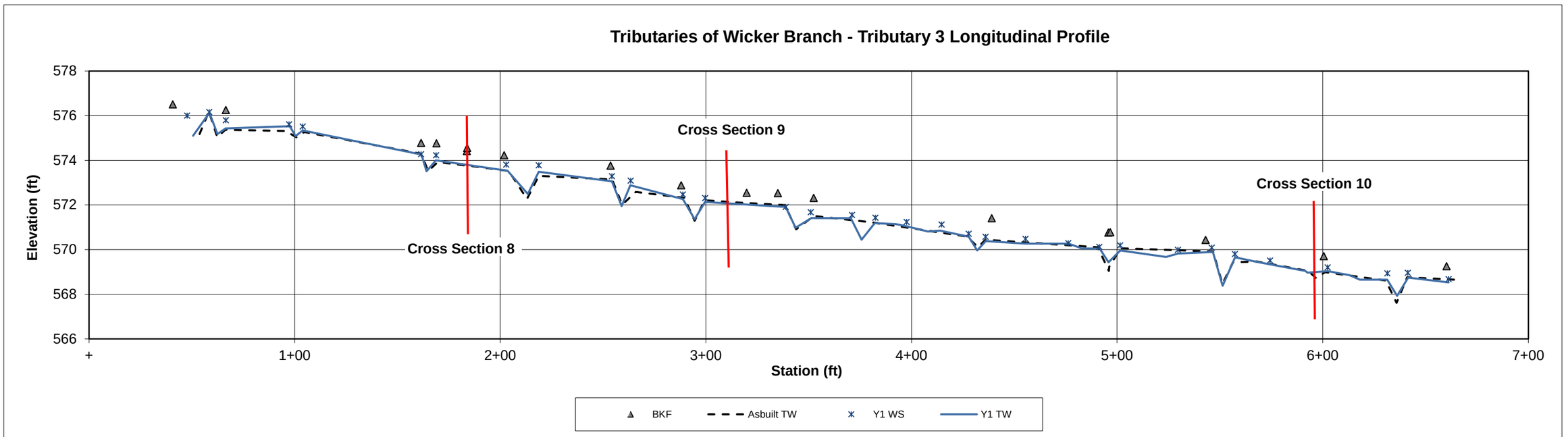
Bankfull Elevation	572.2
Bankfull Width (ft)	4.17
Floodprone Width (ft)	18.3
Bankfull Mean Depth (ft)	0.25
Bankfull Max Depth (ft)	0.44
Bankfull Cross Sectional Area (ft^2)	1.05
Bankfull Width/Depth Ratio	16.68
Bankfull Entrenchment Ratio	5.4
Bankfull Bank Height Ratio	1

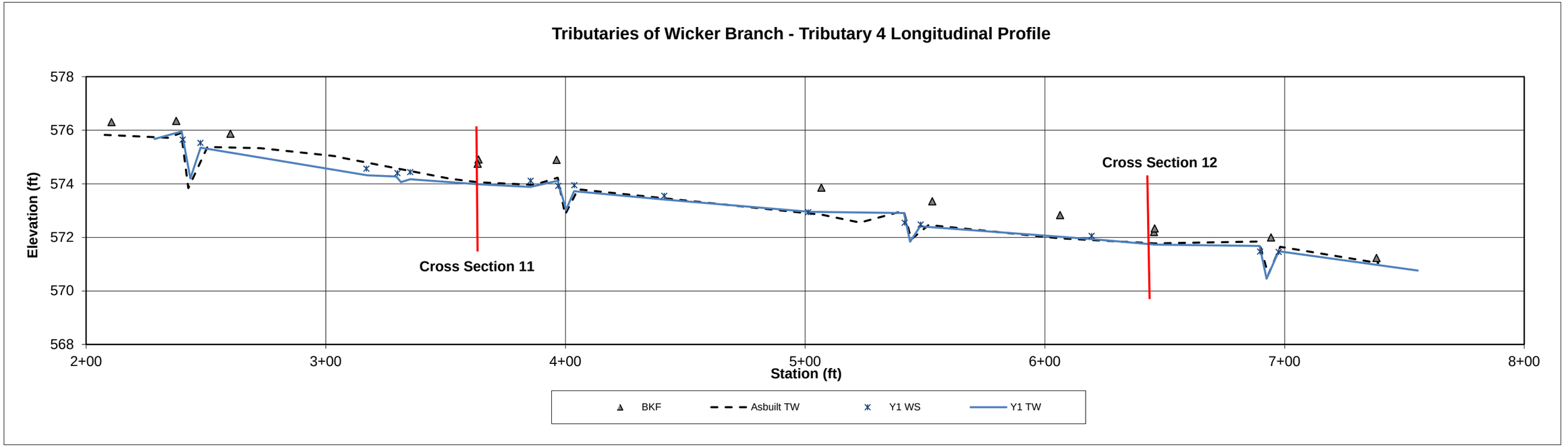
Photo: Cross-section 12 looking upstream




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 WS
Y1 Thalweg


Tributaries of Wicker Branch - Tributary 1A Longitudianl 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 WS
Y1 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 WS
Y1 TW

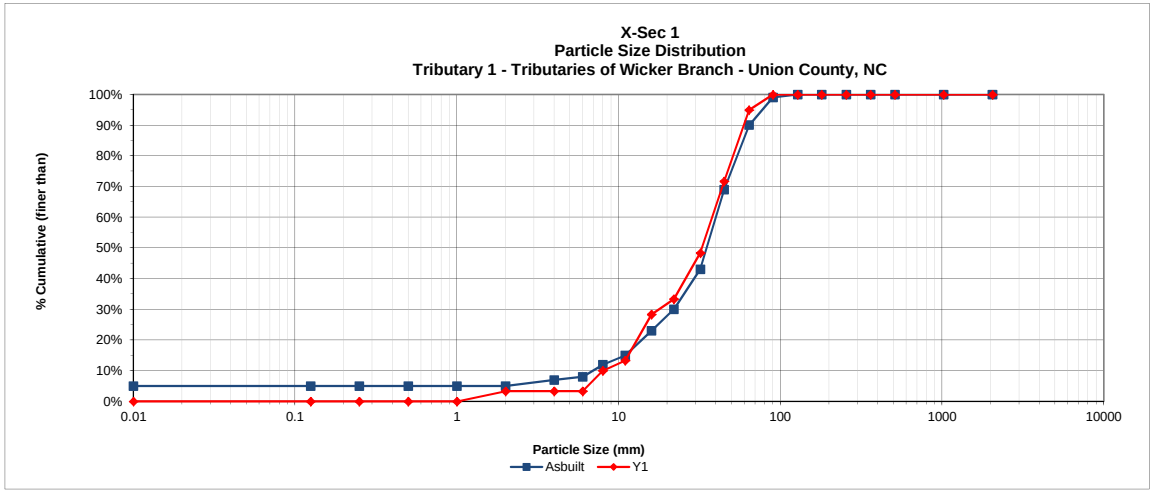

Tributaries of Wicker Branch - Tributary 4 Longitudinal Profile
Elevation (ft)
578
576
574
572
570
568
2+00
3+00
4+00
5+00
6+00
7+00
8+00
Station (ft)
Cross Section 11
Cross Section 12
BKF
Asbuilt TW
Y1 WS
Y1 TW

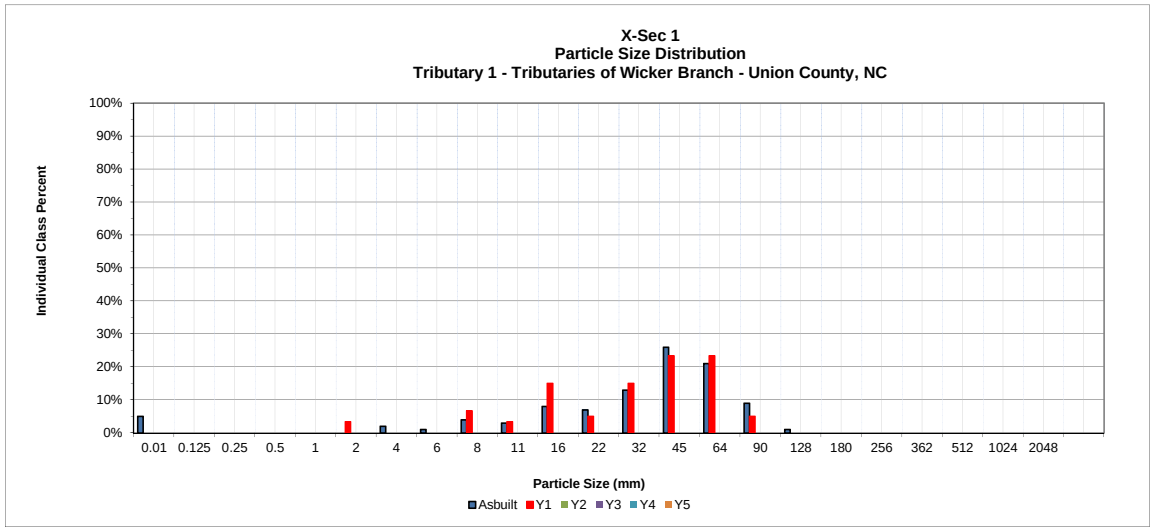
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	0	0%	0%
S	Very Fine	.062 - .125	0	0%	0%
A	Fine	.125 - .25	0	0%	0%
N	Medium	.25 - .50	0	0%	0%
D	Coarse	.50 - 1.0	0	0%	0%
S	Very Coarse	1.0 - 2.0	2	3%	3%
	Very Fine	2.0 - 4.0	0	0%	3%
G	Fine	4.0 - 5.7	0	0%	3%
R	Fine	5.7 - 8.0	4	7%	10%
A	Medium	8.0 - 11.3	2	3%	13%
V	Medium	11.3 - 16.0	9	15%	28%
E	Coarse	16.0 - 22.6	3	5%	33%
L	Coarse	22.6 - 32.0	9	15%	48%
S	Very Coarse	32.0 - 45.0	14	23%	72%
	Very Coarse	45.0 - 64.0	14	23%	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	32.9
D84	55
D95	64



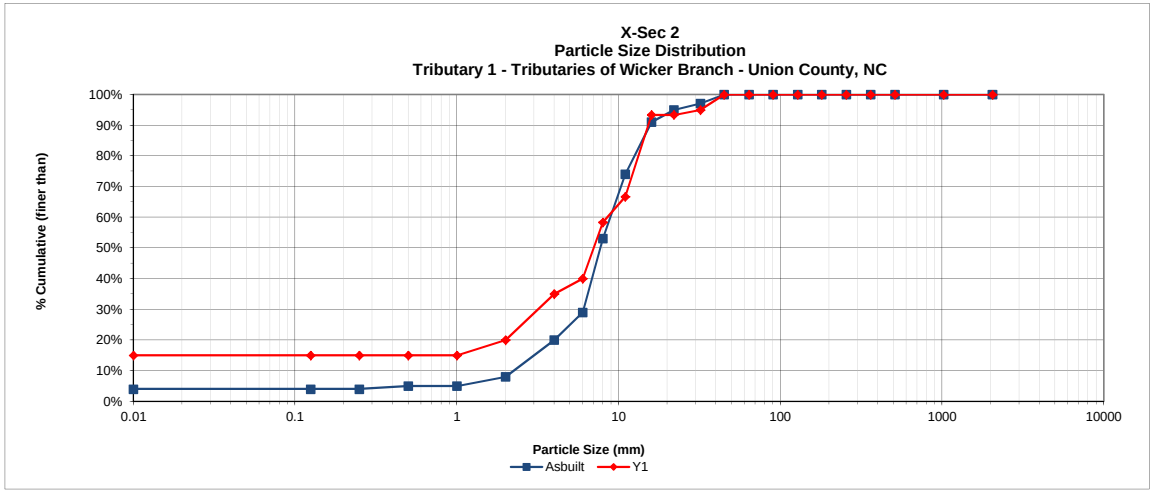


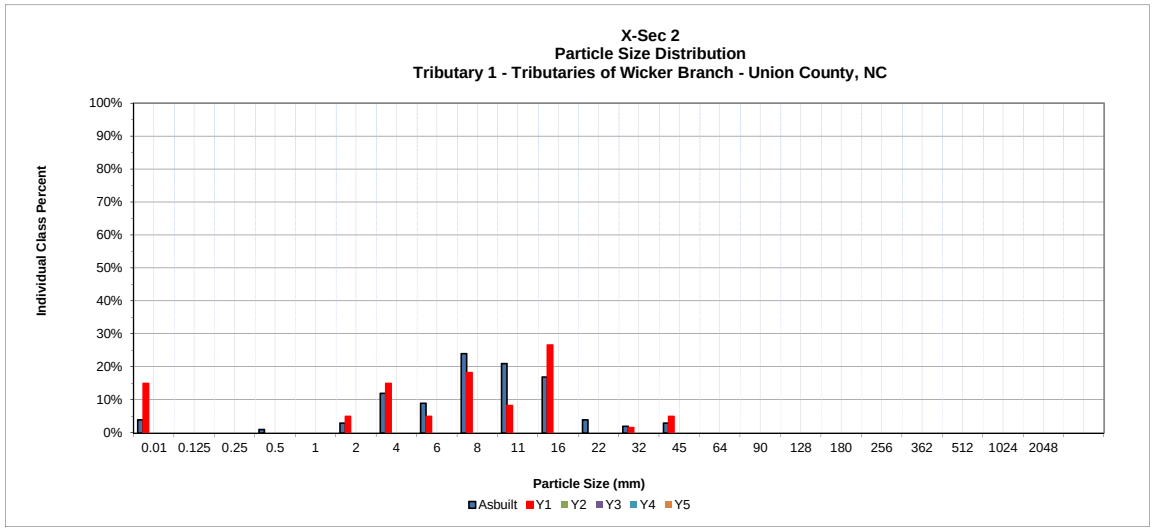
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	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	3	5%	20%
	Very Fine	2.0 - 4.0	9	15%	35%
G	Fine	4.0 - 5.7	3	5%	40%
R	Fine	5.7 - 8.0	11	18%	58%
A	Medium	8.0 - 11.3	5	8%	67%
V	Medium	11.3 - 16.0	16	27%	93%
E	Coarse	16.0 - 22.6	0	0%	93%
L	Coarse	22.6 - 32.0	1	2%	95%
S	Very Coarse	32.0 - 45.0	3	5%	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	6.9
D84	14
D95	32



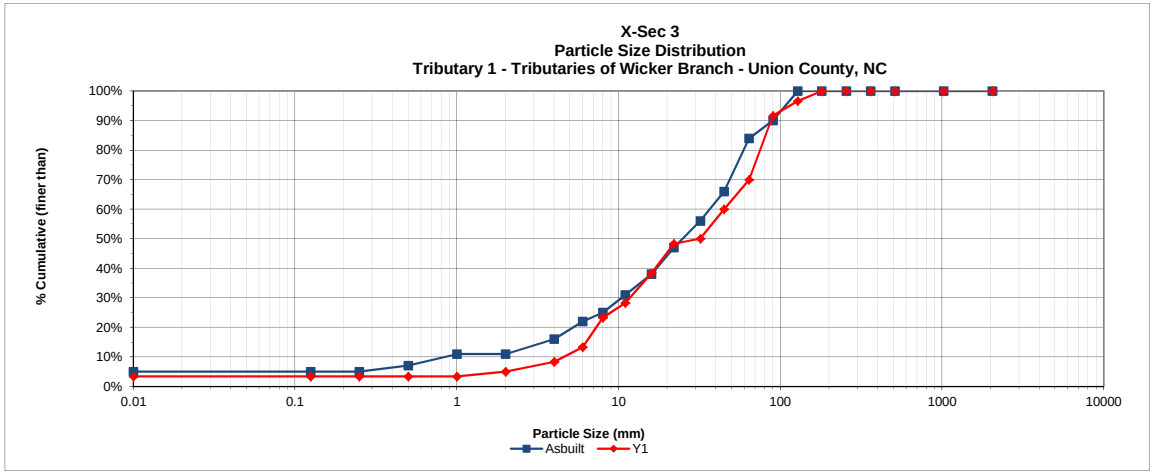


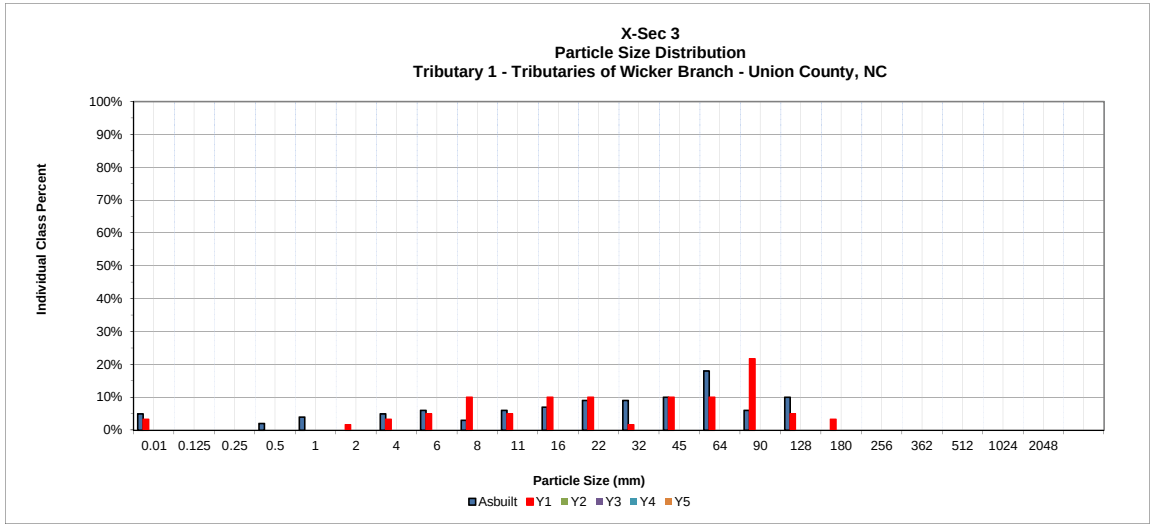
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	2	3%	3%
S	Very Fine	.062 - .125	0	0%	3%
A	Fine	.125 - .25	0	0%	3%
N	Medium	.25 - .50	0	0%	3%
D	Coarse	.50 - 1.0	0	0%	3%
S	Very Coarse	1.0 - 2.0	1	2%	5%
	Very Fine	2.0 - 4.0	2	3%	8%
G	Fine	4.0 - 5.7	3	5%	13%
R	Fine	5.7 - 8.0	6	10%	23%
A	Medium	8.0 - 11.3	3	5%	28%
V	Medium	11.3 - 16.0	6	10%	38%
E	Coarse	16.0 - 22.6	6	10%	48%
L	Coarse	22.6 - 32.0	1	2%	50%
S	Very Coarse	32.0 - 45.0	6	10%	60%
	Very Coarse	45.0 - 64.0	6	10%	70%
C	Small	64 - 90	13	22%	92%
O	Small	90 - 128	3	5%	97%
B	Large	128 - 180	2	3%	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	32
D84	81
D95	115



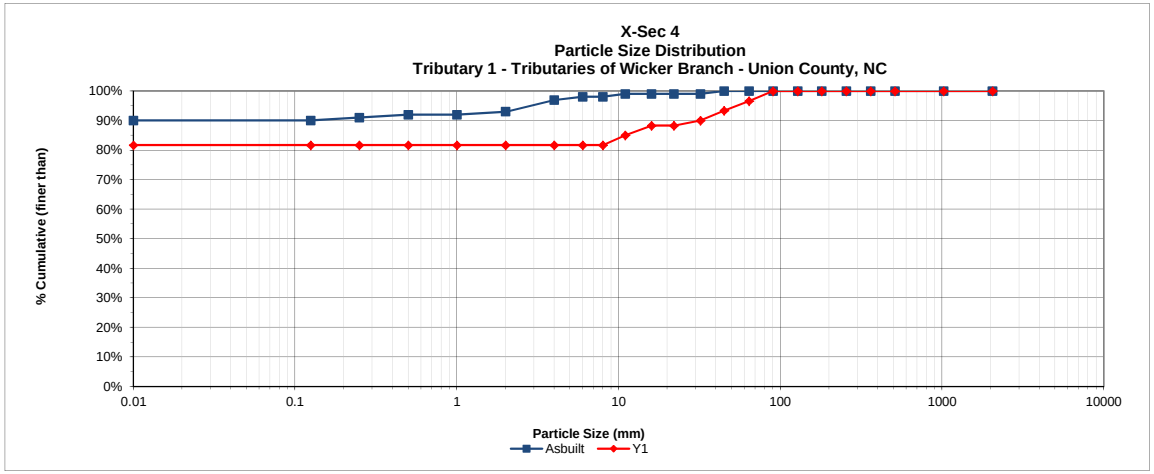


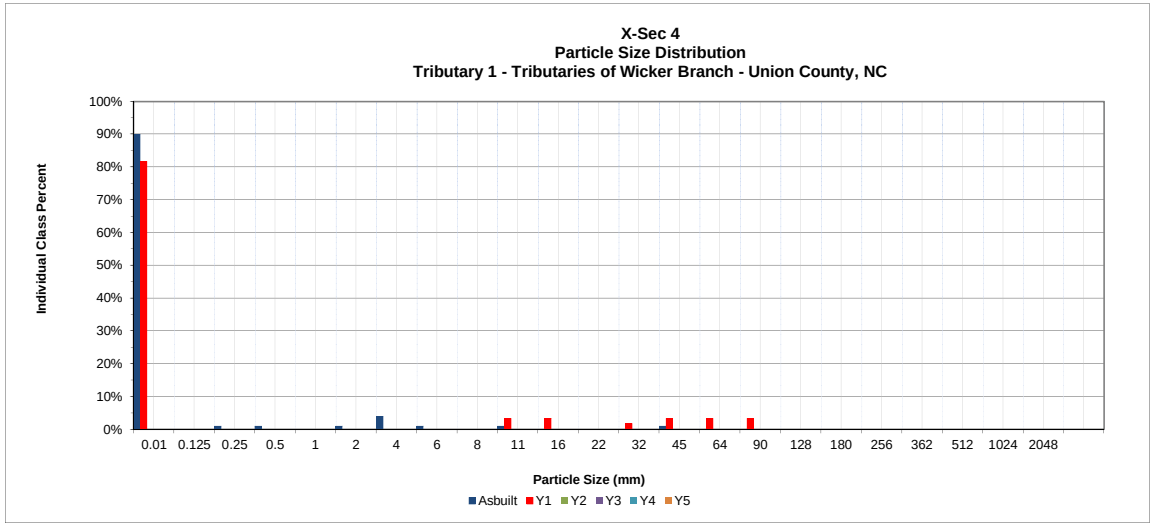
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	49	82%	82%
S	Very Fine	.062 - .125	0	0%	82%
A	Fine	.125 - .25	0	0%	82%
N	Medium	.25 - .50	0	0%	82%
D	Coarse	.50 - 1.0	0	0%	82%
S	Very Coarse	1.0 - 2.0	0	0%	82%
	Very Fine	2.0 - 4.0	0	0%	82%
G	Fine	4.0 - 5.7	0	0%	82%
R	Fine	5.7 - 8.0	0	0%	82%
A	Medium	8.0 - 11.3	2	3%	85%
V	Medium	11.3 - 16.0	2	3%	88%
E	Coarse	16.0 - 22.6	0	0%	88%
L	Coarse	22.6 - 32.0	1	2%	90%
S	Very Coarse	32.0 - 45.0	2	3%	93%
	Very Coarse	45.0 - 64.0	2	3%	97%
C	Small	64 - 90	2	3%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	0.04
D84	10.31
D95	54



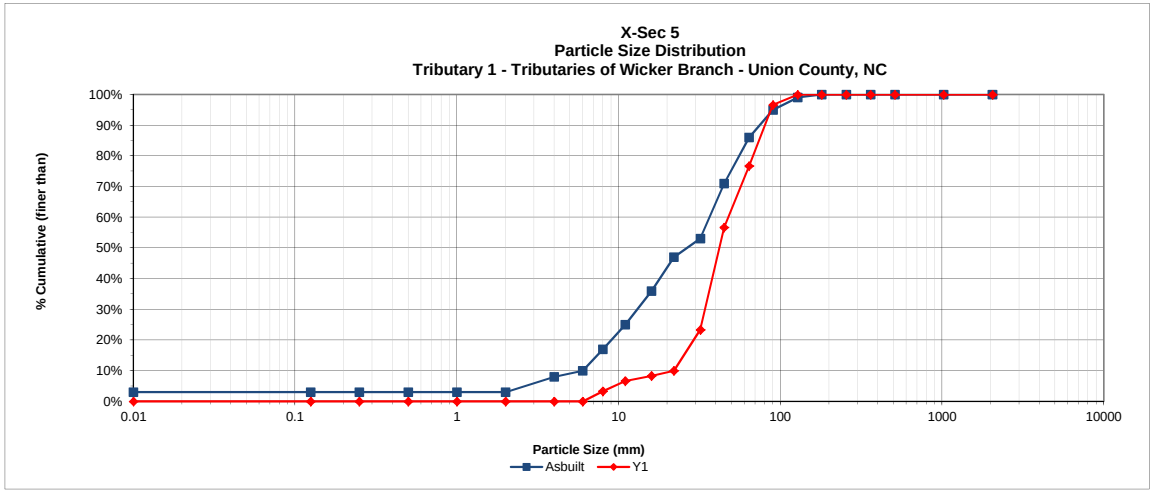


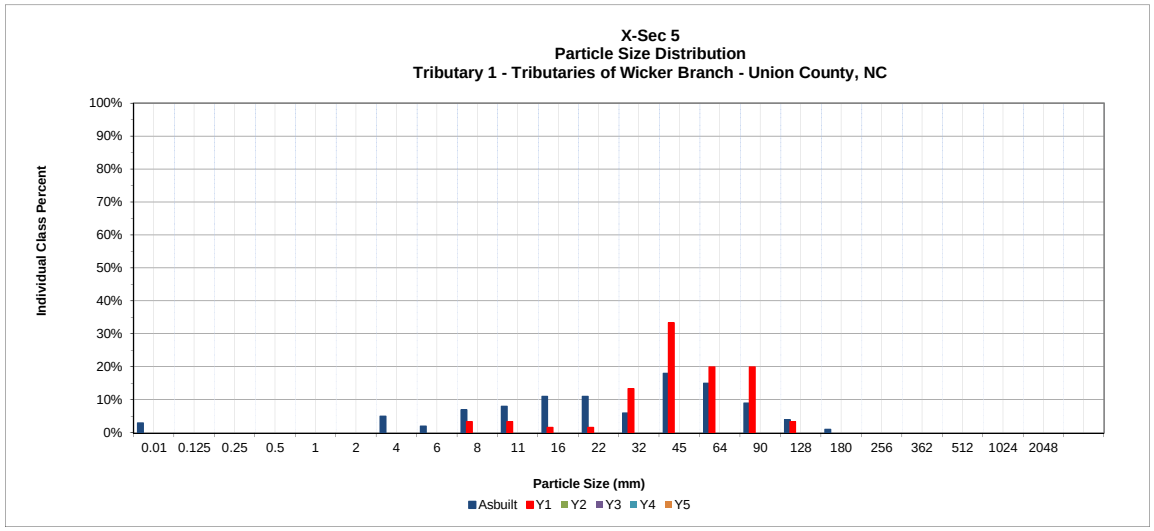
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	0	0%	0%
S	Very Fine	.062 - .125	0	0%	0%
A	Fine	.125 - .25	0	0%	0%
N	Medium	.25 - .50	0	0%	0%
D	Coarse	.50 - 1.0	0	0%	0%
S	Very Coarse	1.0 - 2.0	0	0%	0%
	Very Fine	2.0 - 4.0	0	0%	0%
G	Fine	4.0 - 5.7	0	0%	0%
R	Fine	5.7 - 8.0	2	3%	3%
A	Medium	8.0 - 11.3	2	3%	7%
V	Medium	11.3 - 16.0	1	2%	8%
E	Coarse	16.0 - 22.6	1	2%	10%
L	Coarse	22.6 - 32.0	8	13%	23%
S	Very Coarse	32.0 - 45.0	20	33%	57%
	Very Coarse	45.0 - 64.0	12	20%	77%
C	Small	64 - 90	12	20%	97%
O	Small	90 - 128	2	3%	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	42
D84	73
D95	88



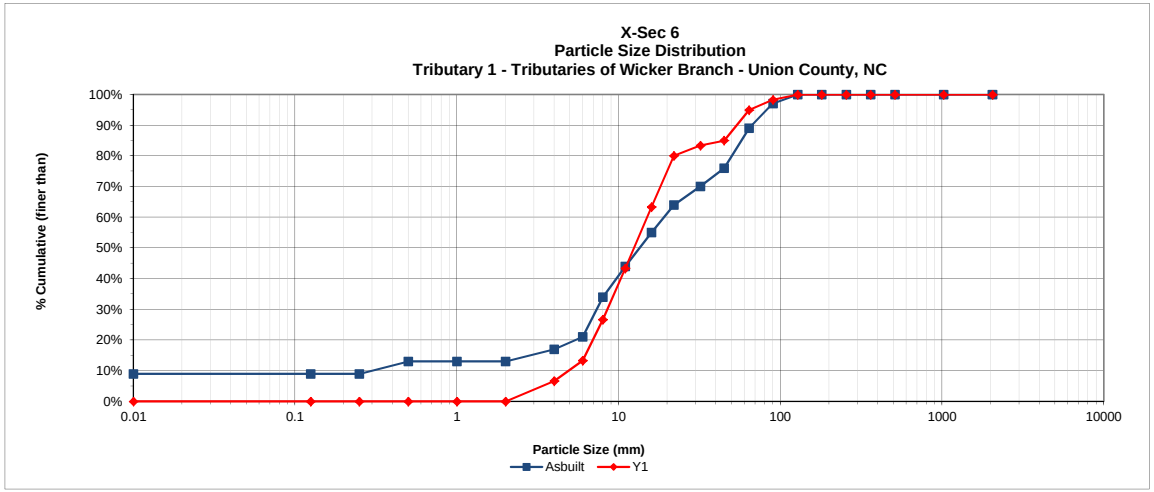


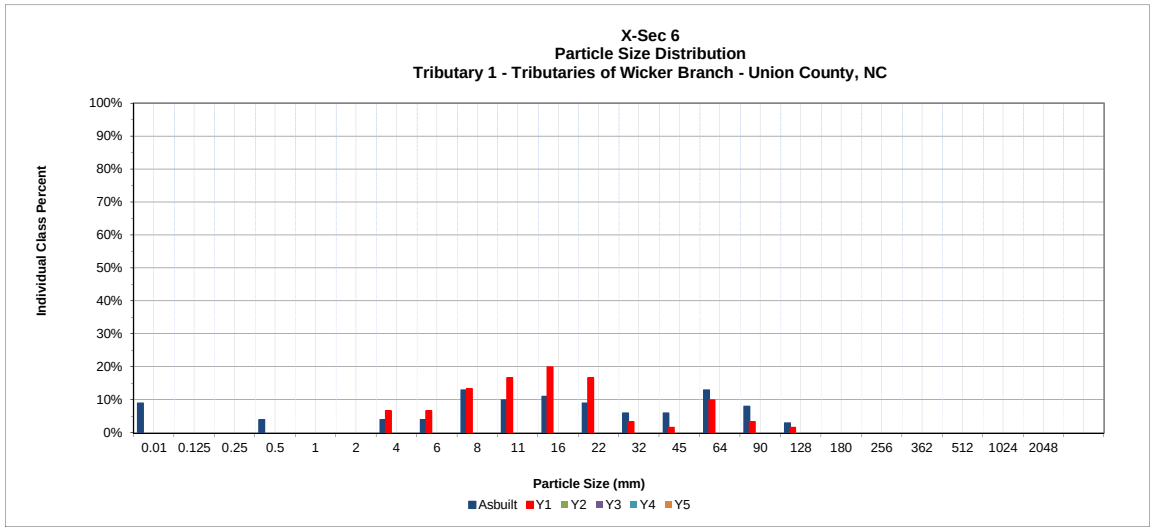
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	0	0%	0%
S	Very Fine	.062 - .125	0	0%	0%
A	Fine	.125 - .25	0	0%	0%
N	Medium	.25 - .50	0	0%	0%
D	Coarse	.50 - 1.0	0	0%	0%
S	Very Coarse	1.0 - 2.0	0	0%	0%
	Very Fine	2.0 - 4.0	4	7%	7%
G	Fine	4.0 - 5.7	4	7%	13%
R	Fine	5.7 - 8.0	8	13%	27%
A	Medium	8.0 - 11.3	10	17%	43%
V	Medium	11.3 - 16.0	12	20%	63%
E	Coarse	16.0 - 22.6	10	17%	80%
L	Coarse	22.6 - 32.0	2	3%	83%
S	Very Coarse	32.0 - 45.0	1	2%	85%
	Very Coarse	45.0 - 64.0	6	10%	95%
C	Small	64 - 90	2	3%	98%
O	Small	90 - 128	1	2%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			60	100%	

Summary Data	
D50	12.9
D84	37
D95	64



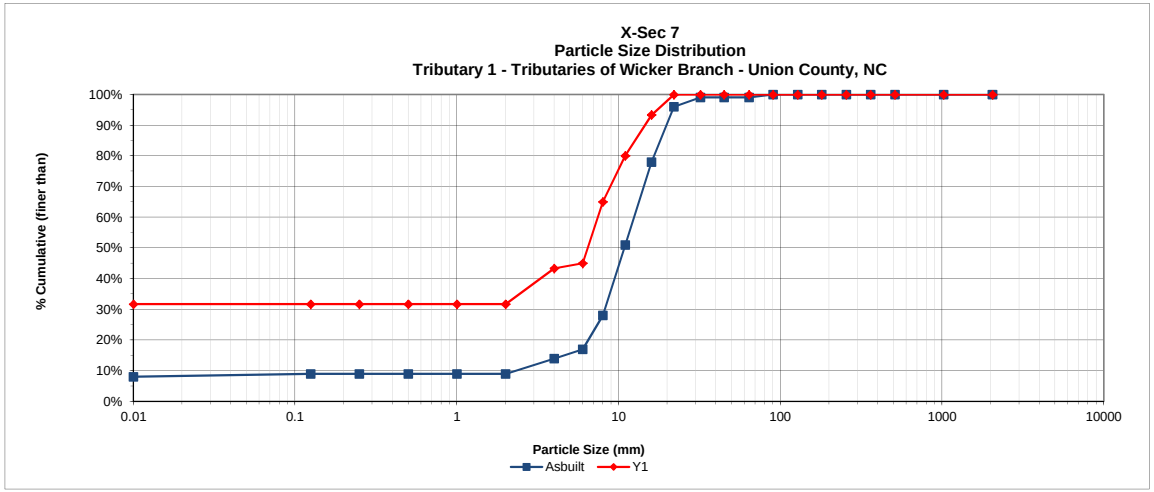


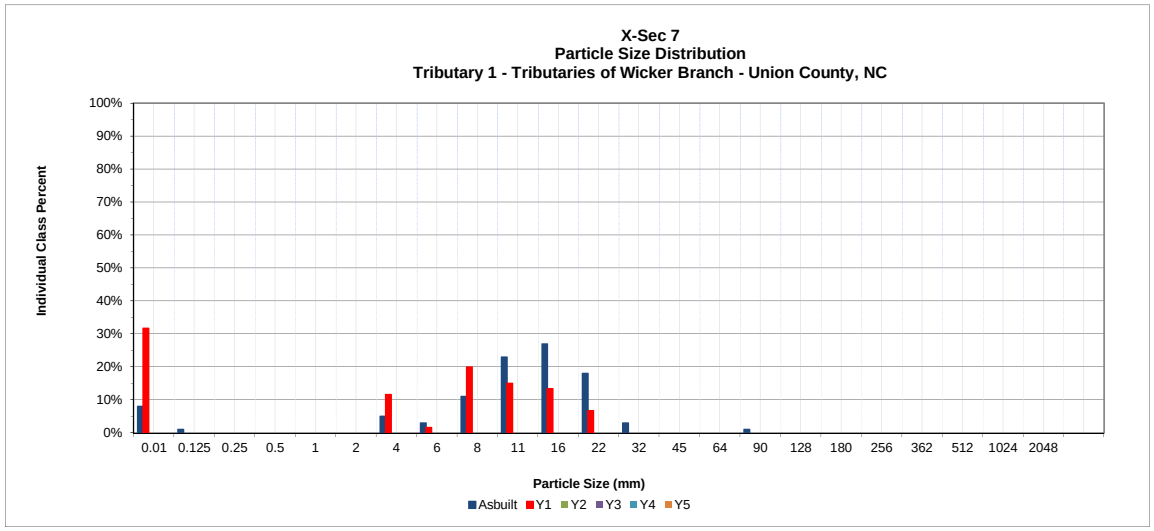
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	19	32%	32%
S	Very Fine	.062 - .125	0	0%	32%
A	Fine	.125 - .25	0	0%	32%
N	Medium	.25 - .50	0	0%	32%
D	Coarse	.50 - 1.0	0	0%	32%
S	Very Coarse	1.0 - 2.0	0	0%	32%
	Very Fine	2.0 - 4.0	7	12%	43%
G	Fine	4.0 - 5.7	1	2%	45%
R	Fine	5.7 - 8.0	12	20%	65%
A	Medium	8.0 - 11.3	9	15%	80%
V	Medium	11.3 - 16.0	8	13%	93%
E	Coarse	16.0 - 22.6	4	7%	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	6.2
D84	12.7
D95	18



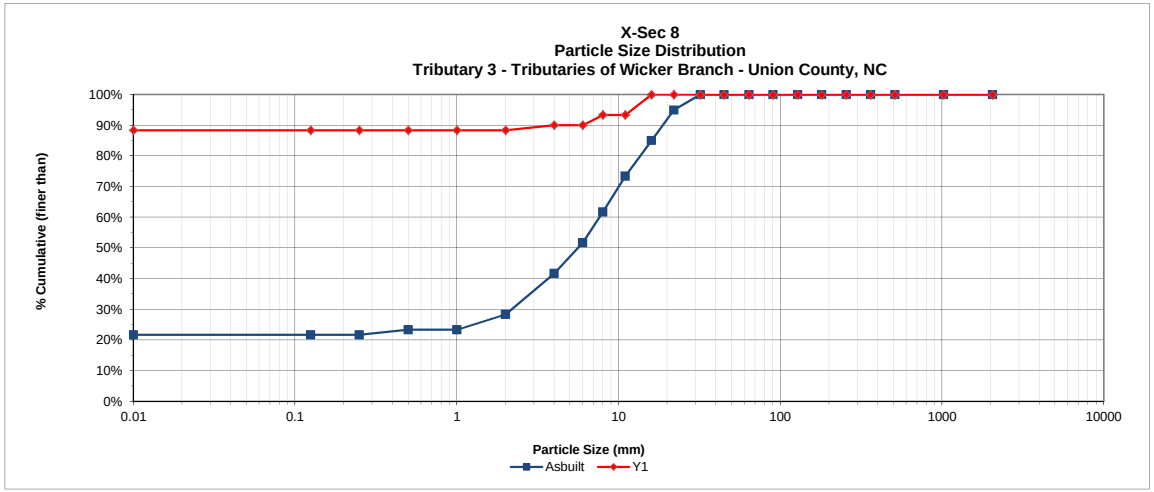


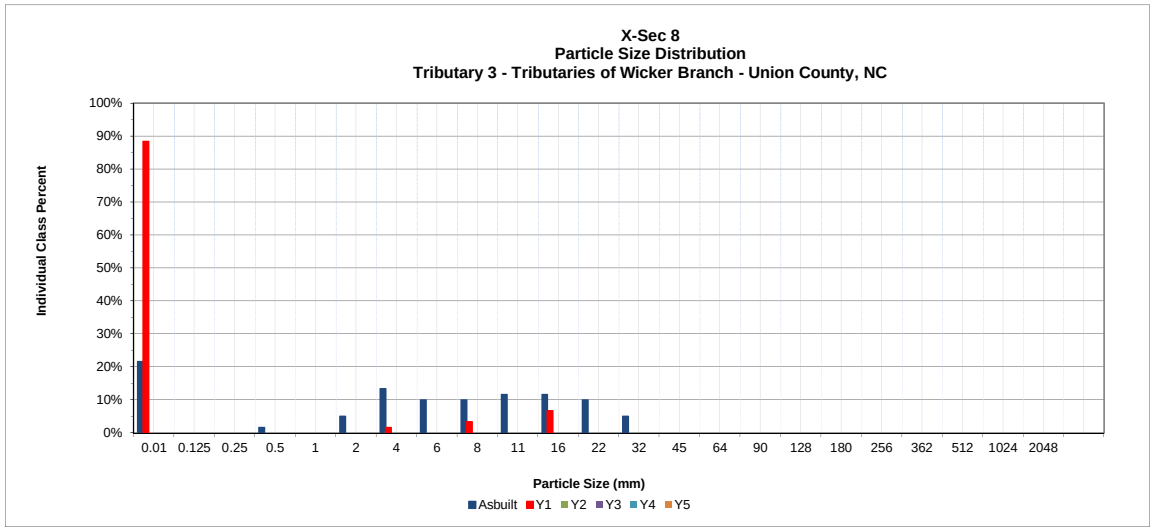
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	53	88%	88%
S	Very Fine	.062 - .125	0	0%	88%
A	Fine	.125 - .25	0	0%	88%
N	Medium	.25 - .50	0	0%	88%
D	Coarse	.50 - 1.0	0	0%	88%
S	Very Coarse	1.0 - 2.0	0	0%	88%
	Very Fine	2.0 - 4.0	1	2%	90%
G	Fine	4.0 - 5.7	0	0%	90%
R	Fine	5.7 - 8.0	2	3%	93%
A	Medium	8.0 - 11.3	0	0%	93%
V	Medium	11.3 - 16.0	4	7%	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	0.04
D84	0.06
D95	12.5



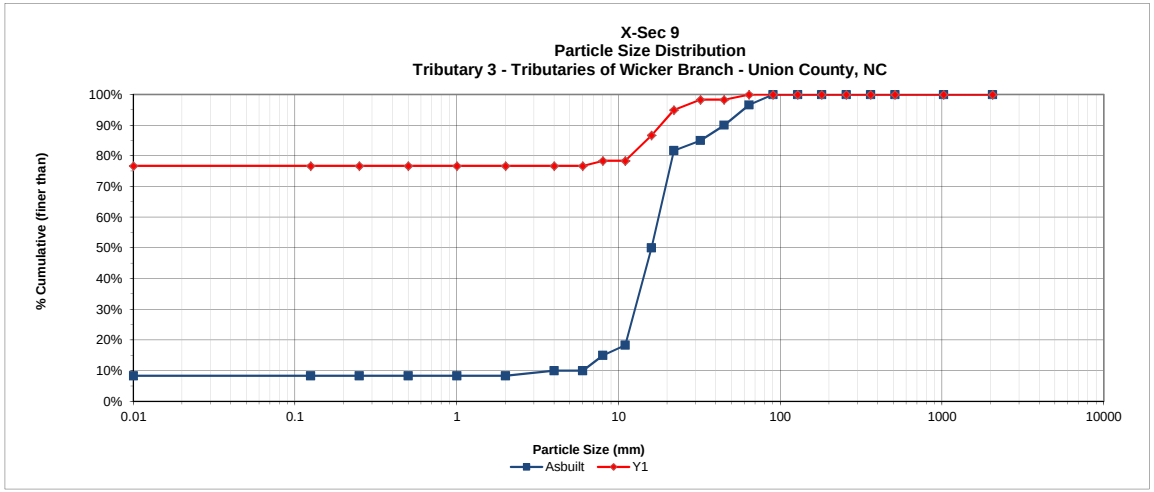


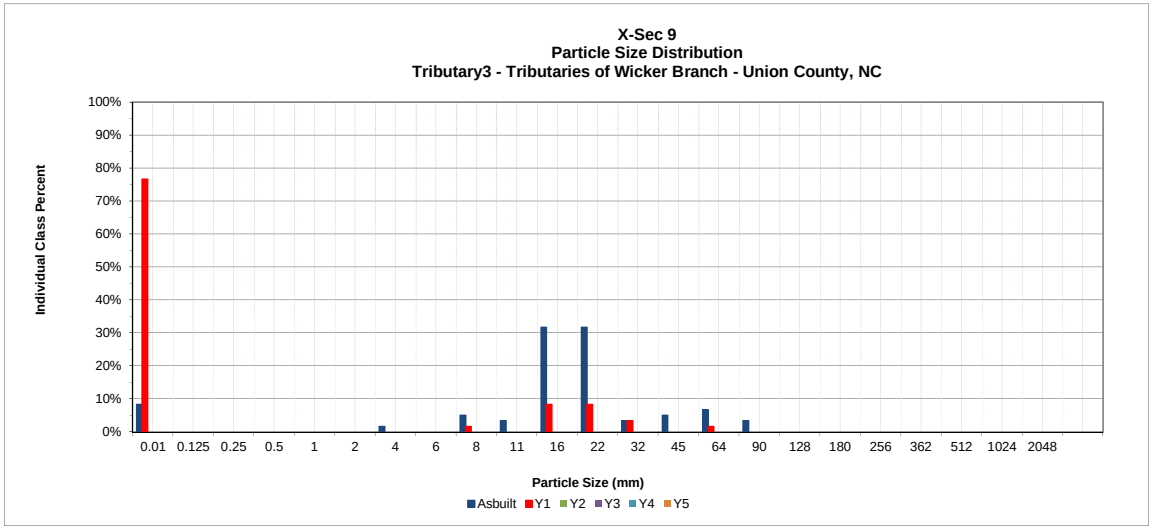
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	46	77%	77%
S	Very Fine	.062 - .125	0	0%	77%
A	Fine	.125 - .25	0	0%	77%
N	Medium	.25 - .50	0	0%	77%
D	Coarse	.50 - 1.0	0	0%	77%
S	Very Coarse	1.0 - 2.0	0	0%	77%
	Very Fine	2.0 - 4.0	0	0%	77%
G	Fine	4.0 - 5.7	0	0%	77%
R	Fine	5.7 - 8.0	1	2%	78%
A	Medium	8.0 - 11.3	0	0%	78%
V	Medium	11.3 - 16.0	5	8%	87%
E	Coarse	16.0 - 22.6	5	8%	95%
L	Coarse	22.6 - 32.0	2	3%	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	0.04
D84	15
D95	23



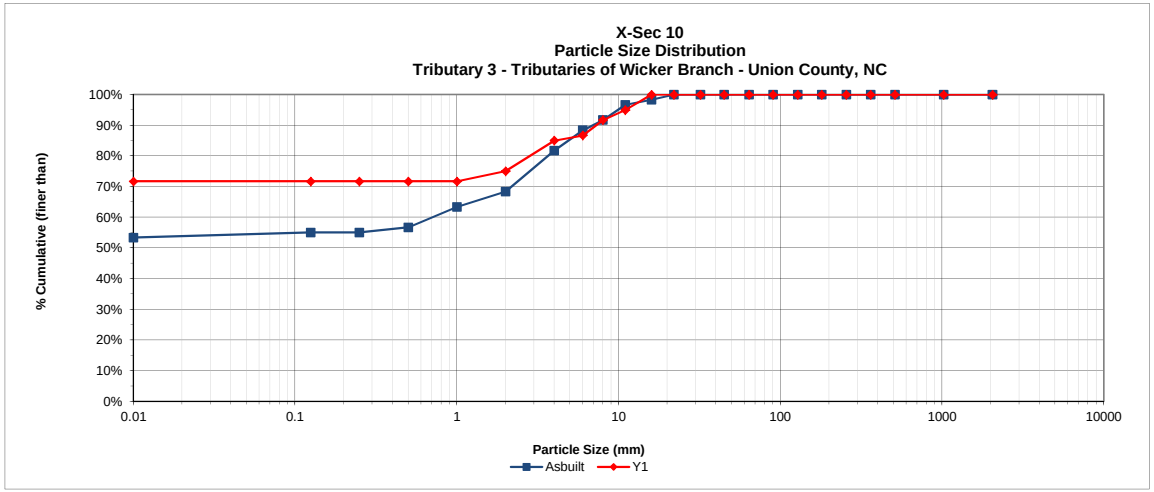


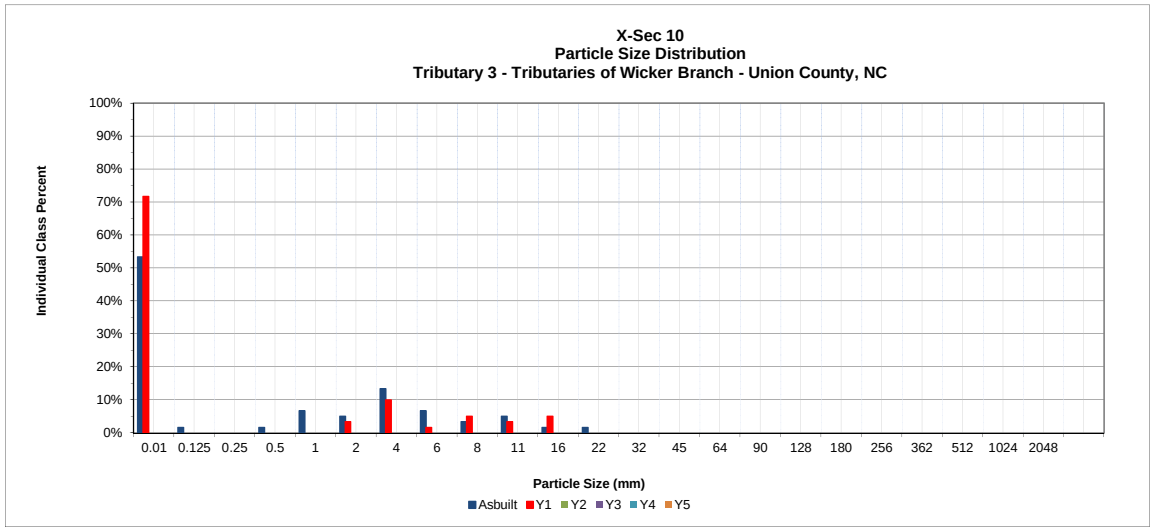
Cross - Section Pebble Count

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

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	43	72%	72%
S	Very Fine	.062 - .125	0	0%	72%
A	Fine	.125 - .25	0	0%	72%
N	Medium	.25 - .50	0	0%	72%
D	Coarse	.50 - 1.0	0	0%	72%
S	Very Coarse	1.0 - 2.0	2	3%	75%
	Very Fine	2.0 - 4.0	6	10%	85%
G	Fine	4.0 - 5.7	1	2%	87%
R	Fine	5.7 - 8.0	3	5%	92%
A	Medium	8.0 - 11.3	2	3%	95%
V	Medium	11.3 - 16.0	3	5%	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	0.04
D84	3.8
D95	11



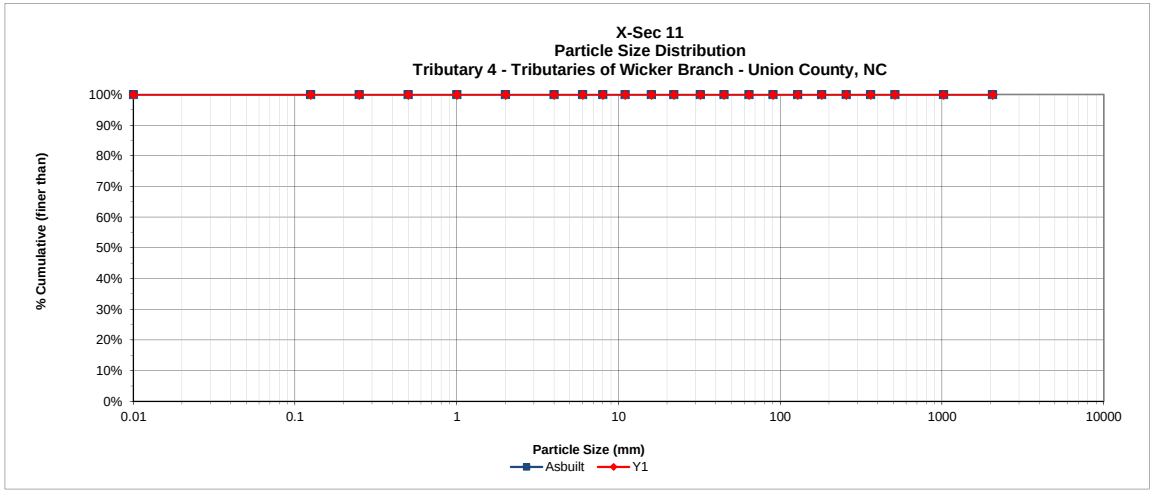


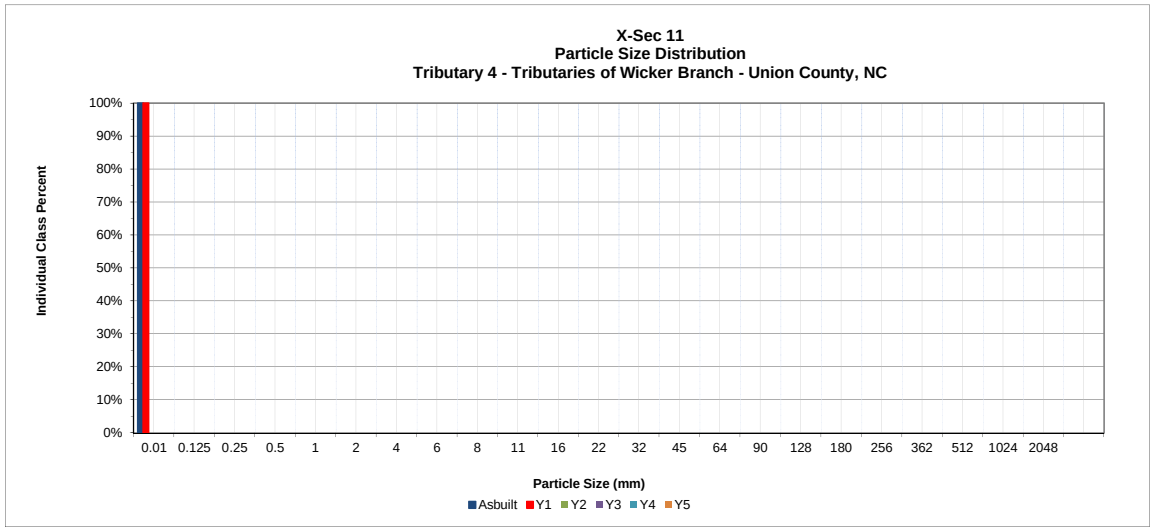
Cross - Section Pebble Count

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



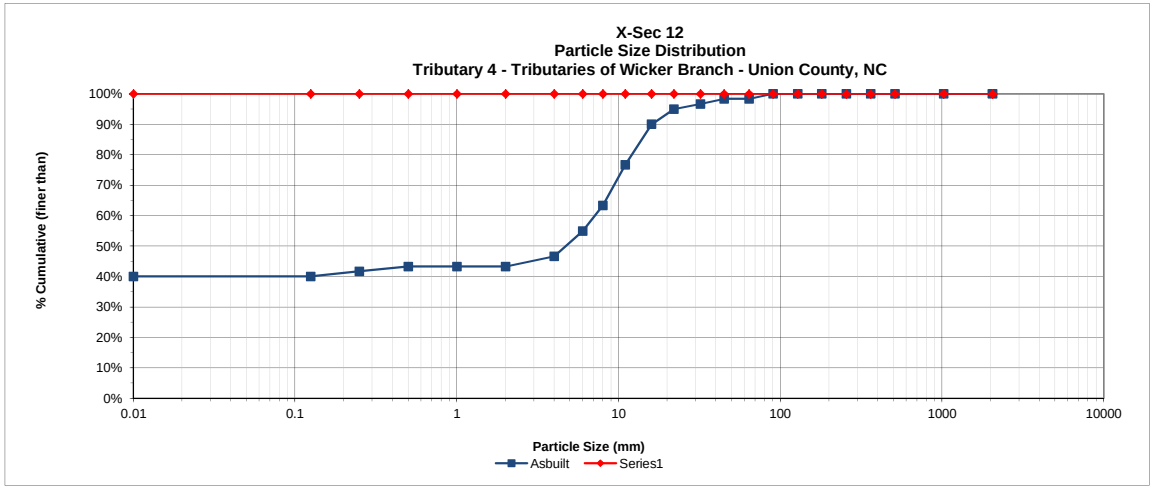


Cross - Section Pebble Count

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

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



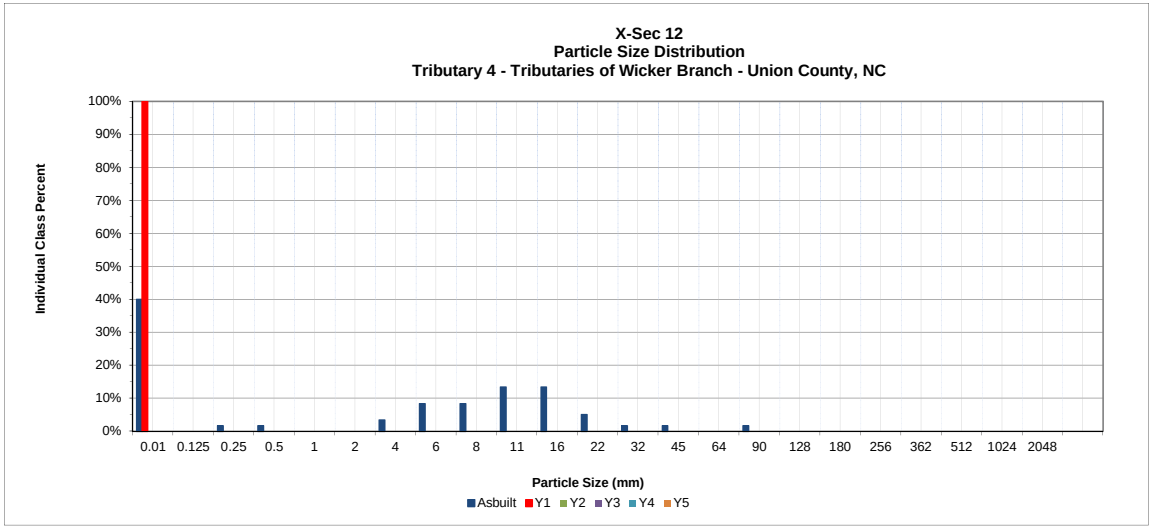


Table 8. Baseline Stream Data Summary
Tributaries of Wicker Branch Stream Restoration/ DMS No. 95022

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						5.13	6.09						4.51	4.57						5.14	5.31						4.76	4.27					
Floodprone Width (ft)	50	50						50	50						50	50						50	50						50	50					
Bankfull Mean Depth (ft)	0.38	0.41						0.78	0.7						0.68	0.61						0.72	0.68						0.32	0.3					
Bankfull Max Depth (ft)	0.53	0.51						1.19	1.21						1	0.69						1.33	1.26						0.79	0.42					
Bankfull Cross Sectional Area (ft^2)	1.51	1.62						3.98	4.27						3.08	2.8						3.72	3.59						1.54	1.7					
Bankfull Width/Depth Ratio	10.45	9.59						6.58	8.7						6.63	7.49						7.14	7.81						14.87	14.23					
Bankfull Entrenchment Ratio	10.06	10.18						7.79	6.57						11.1	8.72						9.7	7.49						10.5	8.44					
Bankfull Bank Height Ratio	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)	35.5	32.9						7.7	6.9						25.7	32						0.03	0.04						27.3	42.4					

	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						6.59	6.21																										
Floodprone Width (ft)	50	50						40	40																										
Bankfull Mean Depth (ft)	0.39	0.33						0.49	0.59																										
Bankfull Max Depth (ft)	0.58	0.5						0.85	0.92																										
Bankfull Cross Sectional Area (ft^2)	1.72	1.64						3.21	3.69																										
Bankfull Width/Depth Ratio	11.26	14.94						13.45	1053																										
Bankfull Entrenchment Ratio	11.4	7.16						6.1	6.37																										
Bankfull Bank Height Ratio	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						11.2	6.3																										

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						3.58	3.48						6.74	6.19					
Floodprone Width (ft)	32	32						31	31						35	35					
Bankfull Mean Depth (ft)	0.41	0.38						0.32	0.24						1.04	0.79					
Bankfull Max Depth (ft)	0.65	0.71						0.49	0.38						1.53	1.29					
Bankfull Cross Sectional Area (ft^2)	1.66	1.65						1.16	0.85						6.98	4.87					
Bankfull Width/Depth Ratio	9.78	11.32						11.19	14.5						6.48	7.84					
Bankfull Entrenchment Ratio	7.9	9.31						8.6	6.89						5.12	5.1					
Bankfull Bank Height Ratio	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						16	0.04						0.06	0.04					

	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						4.29	4.17												
Floodprone Width (ft)	19.5	19.5						18.3	18.3												
Bankfull Mean Depth (ft)	0.34	0.41						0.29	0.25												
Bankfull Max Depth (ft)	0.69	0.69						0.43	0.44												
Bankfull Cross Sectional Area (ft^2)	1.21	1.22						1.23	1.05												
Bankfull Width/Depth Ratio	10.38	7.27						14.79	16.68												
Bankfull Entrenchment Ratio	5.5	6.39						4.26	5.4												
Bankfull Bank Height Ratio	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						4.7	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 0 Trib 3			MY 1 Trib 3			MY 0 Trib 4			MY 1 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)	3.97	4.76	4.41	3.93	4.93	4.43	3.58	6.74	4.77	3.48	6.19	4.66	3.53	4.29	3.91	2.98	4.17	3.57
Floodprone Width (ft)	50	50	50	50	50	50	31.00	35.00	32.67	31	35	32.70	18.30	19.50	18.90	18.3	19.5	18.9
Bankfull Mean Depth (ft)	0.32	0.68	0.44	0.30	0.61	0.41	0.32	1.04	0.59	0.24	0.79	0.47	0.29	0.34	0.32	0.25	0.41	0.33
[1]Bankfull Max Depth (ft)	0.53	1.00	0.73	0.42	0.69	0.53	0.49	1.53	0.89	0.38	1.29	0.79	0.43	0.69	0.56	0.44	0.69	0.56
Bankfull Cross Sectional Area (ft^2)	1.51	3.08	1.96	1.62	2.80	1.94	1.16	6.98	3.27	0.85	4.87	2.45	1.21	1.23	1.22	1.05	1.22	1.13
Width/Depth Ratio	6.63	14.87	10.80	7.49	14.94	11.56	6.48	11.19	9.15	7.84	14.5	11.22	10.38	14.79	12.59	7.27	16.68	11.97
Entrenchment Ratio	10.1	11.4	10.8	7.16	10.18	8.63	5.12	8.60	7.21	5.1	9.31	7.10	4.26	5.50	4.88	5.4	6.39	5.89
[1]Bank Height Ratio			1			1			1			1			1			1
Profile																		
Riffle Length (ft)	8.2	47	15.7	6.3	46	14.4	22.2	74.9	40.6	22.2	74.9	40.6	133	145	138	130	145	136
Riffle Slope (ft/ft)	0.0125	0.475	0.0253	0.007	0.047	0.024	0.0048	0.0179	0.0115	0.0048	0.019	0.013	0.007	0.014	0.009	0.006	0.014	0.009
Pool Length (ft)	4.9	17.8	11.3	7.8	17.9	13.1	7.7	17.7	10.3	7.6	17.8	10.4	7.6	11.2	9.3	7.4	11.1	9.2
Pool Max depth (ft)	1.27	1.78	1.53	1.15	1.92	1.49	1.01	1.97	1.56	1	1.95	1.52	1.39	2.35	1.78	1.37	2.35	1.77
Pool Spacing (ft)	13	61	26.6	13.8	60	26.9	34.7	88	52	34.8	88.1	52	140	150	145	140	150	145
Pattern																		
Channel Beltwidth (ft)	18	25	22	18	25	22	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)	6	20	12	6	20	12	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)	1.36	4.54	2.72	1.35	4.51	2.71	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)	34	106	50	34	106	50	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			5.0			5.0	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/ft^2																		
Max part size (mm) mobilized at bankfull																		
Stream Power (transport capacity) W/m^2																		
Additional Reach Parameters																		
Rosgen Classification	C4			C4			C4			C4			N/A			N/A		
Bankfull Velocity (fps)																		
Bankfull Discharge (cfs)																		
Valley length (ft)	1285			1285			1184			1184			631			631		
Channel Thalweg length (ft)	1390			1390			1184			1184			631			631		
Sinuosity (ft)	1.1			1.1			1.0			1.0			1.0			1.0		
Water Surface Slope (Channel) (ft/ft)	0.0127			0.0127			0.0119			0.0119			0.00972			0.00972		
BF slope (ft/ft)	0.0129			0.0129			0.0119			0.0119			0.0095			0.0095		
[3]Bankfull Floodplain Area (acres)																		
[4]Proportion over wide (%)																		
Channel Stability or Habitat Metric																		
Biological or Other																		

*Note on Tributaries 3 and 4 Pattern Data. These two tributaries are relatively straight channels. 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