CHARLES WILLIAMS STREAM, WETLAND, AND BUFFER SITE
DMS Project No. 80

MONITORING YEAR 5 (2017)
Construction Completed February 2013
Planting Completed February 2014

Randolph County, NC
State Construction Project No. 07-07125-01A

Prepared for the
NC Department of Environmental Quality
Division of Mitigation Services

1652 Mail Service Center
Raleigh, NC 27699-1652

Environmental Quality

December 2017

Prepared by:

ECOLOGICAL ENGINEERING

1151 SE Cary Parkway, Suite 101
Cary, NC 27518
919.557.0929
www.ecologicaleng.com

David G. Cooper, Project Scientist

Under Contract With:

SUNGATE DESIGN GROUP

This assessment and report are consistent with NCDEQ Division of Mitigation Services Template Version 1.4 (11/07/11) for Monitoring Reports.

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1.0 EXECUTIVE SUMMARY/ PROJECT ABSTRACT

The Charles Williams Stream, Wetland and Buffer Site, hereinafter referred to as the "Project Site" or "Site," is located in Randolph County, North Carolina, within US Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC) 03030003 and NC Division of Water Resources (NCDWR) sub-basin 03-06-09 of the Cape Fear River Basin (Figure 1). The project involved the enhancement of 1,850 linear feet of an unnamed tributary (UT) to Sandy Creek, 2.2 acres of wetlands and 8.8 acres of riparian buffer. The Site is protected for perpetuity under a conservation easement purchased from Mr. Charles Williams in 2006. Project restoration components, activity and reporting history, contacts and attribute data are all provided in Appendix A.

1.1 Goals and Objectives

The Project's goals were to:

- reduce nutrient and sediment water quality stressors;
- provide for uplift in water quality functions;
- improve instream and wetland aquatic habitats, including riparian terrestrial habitats; and,
- provide for greater overall instream and wetland habitat complexity and quality.

Stream enhancement, the primary component, served as the dominant input for achieving this goal.

No restoration goals were identified in the Cape Fear River Basinwide Management Plan (NCDWQ, 2005) with regard to the Sandy Creek watershed. There were no sources or stressors listed for the watershed area associated with the Project Site. The NC Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS) develops River Basin Restoration Priorities (RBRP) to guide its restoration activities within each of the state's 54 cataloging units. RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds are called Targeted Local Watersheds (TLWs) and receive priority for DMS planning and restoration project funds. The 2009 Draft Cape Fear River RBRP identified HUC 03030003020010, which includes the Project Site, as a Targeted Local Watershed. The following information is taken directly from the RBRP. "…This is a largely rural hydrologic unit (HU). The main stream, Sandy Creek, flows through Randolph County to Sandy Creek Reservoir, a drinking water supply for Ramseur and Franklinville. As of 2006, the HU had no streams on DWQ's list of impaired waters; however, the reservoir shows indications of high nutrient levels, likely related to the large number of animal operations in the HU. The HU is a Water Supply Watershed and a long portion of Sandy Creek is recognized by the State's Natural Heritage Program as a Significant Natural Heritage Area. DMS has been active in the HU with five projects that include components of preserving wetlands (3 acres) and streams (5,100 linear feet) and restoring wetlands (15 acres) and streams (15,000 linear feet). Piedmont Land Conservancy has also been active in protecting streamside buffers in the HU. Continued implementation of practices to reduce nutrient inputs to Sandy Creek Reservoir is recommended for this HU."

1.2 Background Summary

The Project Site is situated in northeastern Randolph County, approximately four miles west of Liberty and six miles north of Ramseur (Figure 1). It is bordered to the north and west by undeveloped land, to the east by SR 2442 (Ramseur-Julian Road), and to the south by Sandy Creek. Northeastern Randolph Middle School is on the property opposite of Sandy Creek, to the south. The Project Site can be accessed by using the following directions from US Highway 64.

- Turn north on US 421 in Siler City, towards the Town of Liberty.
- Proceed approximately 9.5 miles and turn south (left) onto NC 49.
- Proceed approximately 0.7 miles along NC 49 and turn north (right) onto SR 2459 (Sandy Creek Church Road).
- Follow Sandy Creek Church Road approximately 4.5 miles until it intersects with Ramseur-Julian Road and turn north (right),
- Follow Ramseur-Julian Road approximately 0.3 miles, crossing over Sandy Creek. The Charles Williams Site is on the west (left) side of the roadway, immediately north of Sandy Creek.

Situated in the Piedmont physiographic province and the Cape Fear River Basin, the Project Site encompasses 18 acres of former pasture and existing riparian forest. Elevations across the Site range between approximately 550 and 560 feet above Mean Sea Level. The following chart depicts pre-implementation existing condition information regarding the Site.

Pre-Implementation Existing Conditions Summary

Physiographic Province	Piedmont	**County**	Randolph
River Basin Name	Cape Fear	**Property Owner Name**	Charles Williams
USGS 8-digit HUC	03030003		
USGS 14-digit HUC	03030002020010	**Stream #1 Name**	UT to Sandy Creek
NCDWQ Subbasin	03-06-09	**Drainage Area**	4.9 sq. mi.
Underlying Mapped Soil(s)	Chewacla loam	**NCDWQ Score**	(Perennial)
Drainage Class	Somewhat poorly drained	**Rosgen Classification**	C5
Hydric Status	B		
Slope	0-2 %		
Available Water Capacity	Moderate to High		
FEMA Classification	Zone AE		
Invasive Vegetation Observed	Multiflora rose (*Rosa multiflora*) Chinese privet (*Ligustrum sinense*)		

1.3 Vegetation Condition and Comparison to Success Criteria

While stream construction was completed in 2013, final planting was not completed until February, 2014. For this reason, stream monitoring is in its 5th and final year, while vegetation monitoring is in its 4th year. A final vegetation monitoring will be performed in 2018 to complete Year 5 of vegetation monitoring.

Vegetation success criteria are consistent with the US Army Corps of Engineers (USACE) Wilmington Regulatory District's guidance for stream and wetland mitigation and the NCDWR guidance for riparian buffer credit. The USACE guidance requires the survival of a minimum of 320 planted woody stems/acre after Monitoring Year 3 (MY3). A mortality rate of 10% is allowed after MY4 assessments (288 stems/acre) and, correspondingly, after MY5 assessments (260 stems/acre). The NCDWR guidance requires survival of at least 320 native, planted, hardwood stems/acre (trees only) at the end of the MY 5 to successfully earn riparian buffer credit.

Vegetation is currently being assessed using plot layouts consistent with the Carolina Vegetation Survey (CVS) Level II Vegetation Protocol. Stem count data is obtained from 12 permanently placed 10-meter^2 vegetation plots (Figures 3a and 3b). Assessments include counts of both planted and natural stems. Due to low stem counts during MY2, supplemental planting of species in the original planting list at approximately 300 stems per acre was performed between December 2014 and March 2015. Additional supplemental planting of 230 total stems was also performed on February 6, 2017.

Based on the current monitoring effort, 6 of 8 vegetation plots met the minimum success criteria established for MY4 stream/wetland mitigation criteria and 8 of 12 plots met the criteria for riparian buffer credit. Appendices B and C depict more detailed information regarding the vegetation condition, including annual photograph comparisons.

Due to the random placement of vegetation plots, only one of the eight plots associated with stream/wetland credit is currently placed within the wetland enhancement area (Vegetation Plot #6). The remaining seven plots are situated in areas not originally proposed as wetland enhancement.

1.4 Stream Stability/Condition and Comparison to Success Criteria

Enhancement (Level I) of the UT utilized natural channel design methodologies consistent with Priority Level IV stream restoration protocols. These protocols specifically include the stabilization of the existing channel in place. To document successful stabilization, a minimum of two bankfull events must be documented within the standard five-year monitoring period. In order for the hydrology-based monitoring to be considered complete, the two events must occur in separate monitoring years.

Evidence of overbank events was documented on February 10, 2017 and July 20, 2017. Evidence of overbank events consisted of wrack material and sediment staining above the bankfull indicators along the channel, alluvial deposits outside the channel, and flattened vegetation far into the floodplain. The crest gauge documented bankfull events at 31.5" and 28" during MY5. Annual photograph comparisons of the stream channel are depicted in Appendix B and hydrologic data associated with this year's monitoring assessment are provided in Appendix E.

1.5 Wetland Condition and Performance Relative to Success Criteria

Wetland enhancement work was performed throughout the existing wetland areas. Prior to enhancement, these wetlands were severely degraded as a result of continuous soil compaction and grazing from livestock. The enhancement work included livestock removal via exclusion fencing and supplemental plantings. Benefits of the enhancement include water quality improvement by trapping nutrients such as nitrogen and phosphorous, toxic substances, and disease-causing microorganisms. Wetlands also slow and intercept surface runoff, protect stream banks from erosion, protect upland areas from flooding, and provide valuable habitat for wildlife.

1.6 Other Information

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

During MY2 monitoring, a recently constructed beaver dam was observed within the channel at approximately station 14+34.75, near cross-section 1. In May of 2015 during MY3 monitoring, another recently constructed beaver dam was observed immediately upstream of the culverted road crossing at approximately station 19+51.50. During June of 2015, these dams were removed by hand and beaver trapping was conducted by APHIS. No additional beaver activity was observed within the easement area until October 4, 2016, at which time the beaver dam upstream of the road crossing was observed to have been reconstructed. During 2017/MY5 monitoring, the beaver dam upstream of

the road crossing was gone again, but the dam near cross-section 1 had been reconstructed as of September 8, 2017. This dam was again removed in November, 2017 and was not observed to have been reconstructed as of December 8, 2017. Please refer to Appendix B for representative photographs.

During late MY3 or early MY4, the large beaver impoundment at the upstream end of the project area was breached. It is not clear whether the breach was intentional, or whether the dam naturally breached as a result of a storm event. In February 2016, evidence of very high water and strong overbank flow was observed, likely from this breach, but a full assessment of the channel was not possible at the time due to high water and turbidity. Banks were observed to be generally stable and vegetated, and no structure instability or failure was observed. The large beaver dam was not reconstructed as of September 8, 2017 during MY5 monitoring.

Prior to MY3, stream stability monitoring longitudinal profile survey data representing the state of the UT from the upstream, northern easement boundary downstream to the southern easement boundary was collected at widely spaced intervals, providing a low resolution depiction of channel morphology. Survey data from MY3 on was collected at a higher resolution, allowing a more detailed comparison of the stream bed over time. Please refer to Appendix D for a comparison of MY5 longitudinal profile data with previous monitoring data. Although the more detailed longitudinal profile added survey points to the profile, key grade control locations (heads of runs, riffles, and structures) have maintained their elevations over the course of monitoring. A comparison of high resolution MY3, MY4, and MY5 data shows possible sediment accumulation near the downstream end of the UT, likely caused by the large water release from the upstream beaver impoundment. Also visible in the longitudinal profile for MY5 is an area of apparent downcutting in the vicinity of stream station 11+00 – 11+50. This reach is not far downstream of the large, removed beaver dam, and it is possible that sediment is being transported downstream from this area during high flow events now that the dam has been removed. The remainder of the longitudinal profile indicates that the grade of the stream bed is holding. Based on the data available to us at this time, including the fact that no obvious visual evidence of instability (bank scour, erosion, etc.) was observed, the downcutting is not expected to progress. An additional Appendix F is provided to depict the detailed longitudinal profile of the channel thalweg. For ease of comparison, this appendix consists of four sheets, each showing a reach of the channel thalweg at a larger scale than the chart in Appendix D.

2.0 METHODOLOGY

This monitoring report follows methodology consistent with DMS's Procedural Guidance and Content Requirements for Monitoring Reports (Version 1.4, dated 11/07/11), available at the DMS website (http://portal.ncdenr.org/web/eep).

All surveys were performed via total station and survey grade Global Positioning System (GPS). Each survey point has three-dimensional coordinates and is tied to survey control points. Longitudinal profile stationing was originally developed based on the design stationing, and follows the UT from the northern to the southern property boundary (upstream to downstream) as depicted on the survey plat. Based on comments from DMS during the review of the draft MY2 monitoring report, the MY3 longitudinal profile survey incorporated more detailed data collection to more accurately represent changes in channel morphology over time. The same level of detail was collected during MY4 and MY5 channel surveys. As the MY3 survey was a more complete longitudinal profile, channel stationing is more accurate than that shown in previous longitudinal profiles. In order to compensate for differences in stationing, channel survey shots from previous monitoring years were viewed in plan view and compared to MY3 channel stations. Stationing of previous years' shots was adjusted to reflect the more accurate MY3 channel stationing. Similarly, stationing of MY4 and MY5 data points was also adjusted based on the MY3 channel stationing. Appendix D includes an overlay of channel survey data based on this adjusted stationing.

Particle size distribution protocols followed the Wolman Pebble Count Procedure, which requires an observer with a metric ruler to measure particles based on their intermediate axis. This information is correlated into a graph depicting a particle size analysis of each cross section.

Vegetation assessments were conducted using the CVS protocol (Version 4.2). As part of this protocol, vegetation is assessed using 100-meter^2 plots, or modules. The scientific method requires that measurements be as unbiased as possible, and that they be repeatable. Plots are designed to achieve both of these objectives; in particular, different people should be able to inventory the same plot and produce similar data (Lee et. al., 2006). According to Lee et. al. (2006), there are many different goals in recording vegetation, and both time and resources for collecting plot data are extremely variable. To provide appropriate flexibility in project design, the CVS protocol supports five distinct types of vegetation plot records, which are referred to as levels in recognition of the increasing level of detail and complexity across the sequence. The lower levels require less detail and fewer types of information about both vegetation and environment, and thus are generally sampled with less time and effort (Lee et. al., 2006). Level 1 (Planted Stem Inventory Plots) and Level 2 (Total Woody Stem Inventory Plots) inventories were completed on all 12 of the vegetation plots at the Project Site.

A crest gauge was installed near the downstream end of the Site along the UT to verify the on-site occurrences of bankfull events. In addition to the crest gauge, observations of recently deposited overbank wrack and/or sediment serve to validate gauge observations, as necessary. Documentation of the highest stage during the monitoring interval is assessed during each site visit and the gauge is reset. The data related to bankfull verification are summarized in each year's report. Based on the elevation of the crest gauge, any readings observed higher than 22 inches on the gauge reflect a bankfull or above bankfull event.

3.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts and T.R. Wentworth, 2006. CVS Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

NCDENR Division of Water Quality (NCDWQ) , 2005. Cape Fear River Basinwide Management Plan. Available at: http://portal.ncdenr.org/web/wq/ps/bpu/basin/capefear.

NCDENR Ecosystem Enhancement Program, 2013. Charles Williams Stream, Wetland, and Buffer Site Baseline Monitoring Document and As-built Baseline Report. Prepared by Ecological Engineering, LLP.

NCDEQ Division of Mitigation Services, 2015. Charles Williams Stream, Wetland, and Buffer Site Monitoring Year 3 Final Report. Prepared by Ecological Engineering, LLP.

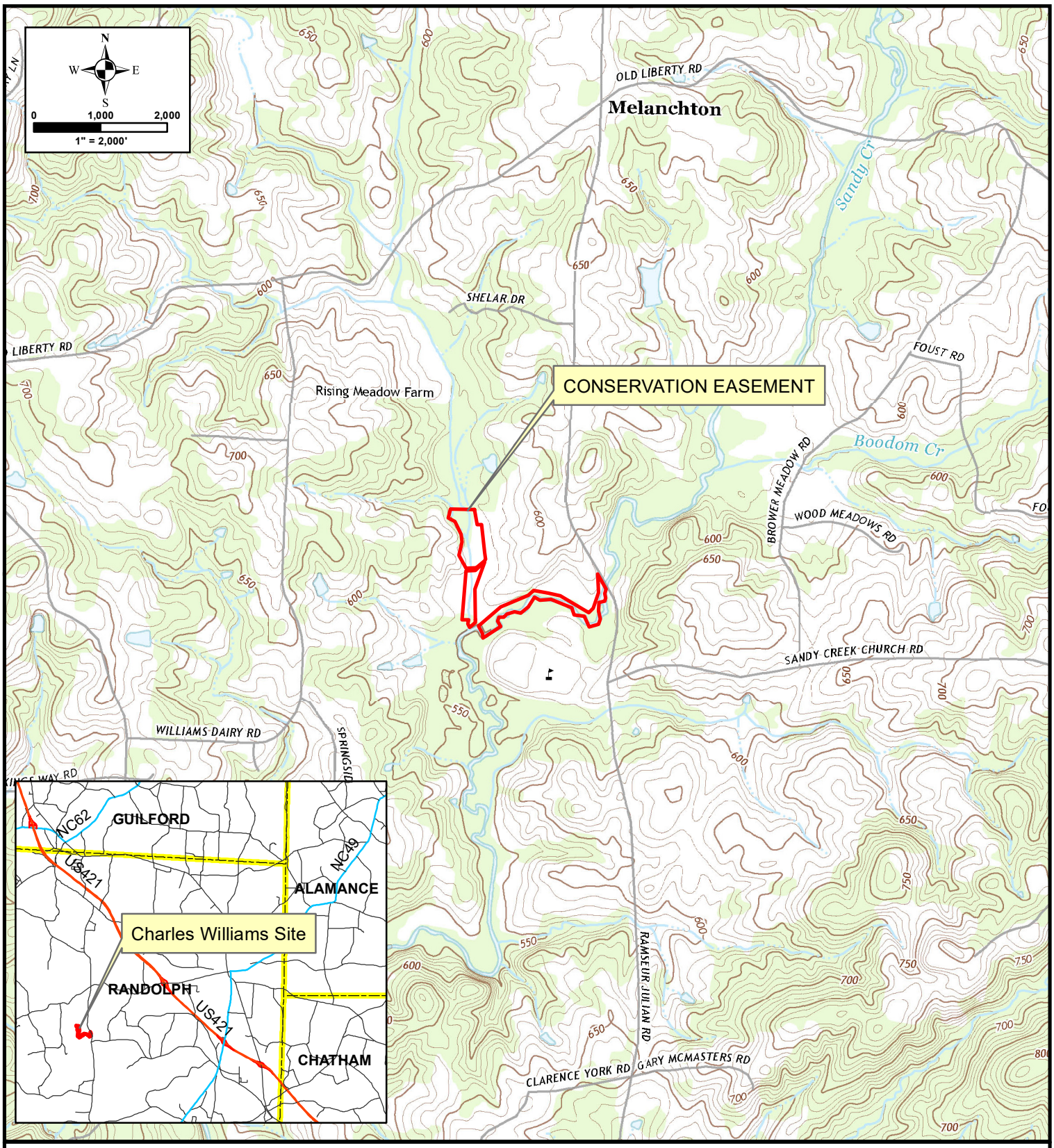
NCDEQ Division of Mitigation Services, 2016. Charles Williams Stream, Wetland, and Buffer Site Monitoring Year 4 Final Report. Prepared by Ecological Engineering, LLP.

NC State Climate Office, 2017. Daily Precipitation Data from Siler City Airport (SILR), Chatham County (www.nc-climate.ncsu.edu).

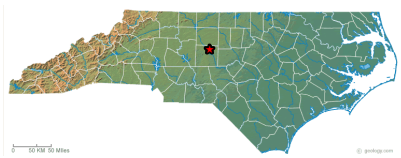
US Army Corps of Engineers, US Environmental Protection Agency, NC Wildlife Resources Commission and NC Department of Environment Division of Water Quality, 2003. Stream Mitigation Guidelines.

APPENDIX A

Project Vicinity Map and Background Tables



DIRECTIONS FROM US HWY 64 IN SILER CITY, NC: Turn north on US 421 in Siler City, towards the Town of Liberty. Proceed approximately 9.5 miles, then turn left onto NC 49. Proceed approximately 0.7 miles, then turn right onto SR 2459 (Sandy Creek Church Road). Proceed approximately 4.5 miles, then turn right onto SR 2442 (Ramseur-Julian Road). Proceed approixmately 0.3 miles, crossing over Sandy Creek. The Charles Williams site is on the west (left) side of the roadway, immediately north of Sandy Creek.



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PROJECT SITE VICINITY MAP
Charles Williams Site - DMS Project No. 80

Randolph Co., NC

December 2017

Map Source:

2013 Grays Chapel and Liberty USGS Quadrangles

FIGURE 1

Table 1. Project Components and Mitigation Credits

Charles Williams Stream, Wetland and Buffer Site / 80

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	**R**	**RE**	**R**	**RE**	**R**	**RE**			
Totals		1,233		1.1			336,430		

Project Components

Project Component	Stationing/Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Stream Enhancement	10+00 to 27+53	1,850 linear feet	EI	RE	1,233	1.5 : 1
Riparian Wetland Enhancement	areas east and west of UT to Sandy Creek	2.2 acres	E	RE	1.1	2 : 1
Buffer Restoration (TOB - 50')	Sandy Creek and UT to Sandy Creek	201,481 square feet	R	R	201,481	1 : 1
Buffer Restoration (50' - 200')	Sandy Creek and UT to Sandy Creek	182,907 square feet	R	R	182,907	1 : 1

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration					384,208	
Enhancement		2.2				
Enhancement I	1,850					
Enhancement II						
Creation						
Preservation						
HQ Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements

BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer.

Table 2. Project Activity and Reporting History

Charles Williams Stream Wetland and Buffer Site / 80

Elapsed Time Since Grading Complete (Feb 2013): 4 years, 9 months

Elapsed Time Since Planting Complete (Feb 2014): 3 years, 9 months

Number of Reporting Years: 5

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	September-08	May-09
Final Design - Construction Plans	November-09	April-12
Construction		February-13
Temporary S&E Mix Applied to Entire Project Area		January-13
Permanent Seed Mix Applied to Entire Project Area		January-13
Live Stake Plantings Applied		January-13
Baseline Monitoring Document	June-13	July-13
Bare-rooted Planting Applied		February-14
Year 1 Monitoring	March-14	May-14
Year 2 Monitoring	September-14	November-14
Year 3 Monitoring	June-15	November-15
Year 4 Monitoring	July-16	November-16
Year 5 Monitoring	July/Sept.-17	November-17
Year 6 Monitoring (vegetation only)		

Table 3. Project Contact Table

Charles Williams Stream Wetland and Buffer Site / 80

Designer	**Firm Information/ Address**
Ecological Engineering, LLP Jenny S. Fleming, PE	1151 SE Cary Parkway, Suite 101, Cary, NC 27518 (919) 557-0929
Construction Contractor	**Firm Information/ Address**
Riverworks, Inc. Bill Wright	8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Hauling Contractor	**Firm Information/ Address**
Strader Fencing, Inc.	5434 Amick Road, Julian, NC 27283 (336) 697-7005
Planting Contractor(s)	**Firm Information/ Address**
Carolina Silvics, Inc. (bare-rooted & containerized) Mary-Margaret S. McKinney, RF, PWS Riverworks, Inc. (livestakes only) George Morris	908 Indian Trail Road, Edenton, NC 27932 (252) 482.8491 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Seeding Contractor	**Firm Information/ Address**
Strader Fencing, Inc. Kenneth L. Strader	5434 Amick Road, Julian, NC 27283 (336) 697-7005
Seed Mix Sources	Green Resource, LLC (336) 855-6363
Nursery Stock Suppliers (live stakes only)	Native Roots Nursery (910) 385-8385 NC Forest Service Tree Nursery (919) 731-7988 Foggy Mountain Nursery (336) 384-5323 Mellow Marsh Farm (919) 742-1200
Monitoring Performer	**Firm Information/ Address**
Ecological Engineering, LLP David Cooper, Heather Smith, Lane Sauls (stream, vegetation & wetland)	1151 SE Cary Parkway, Suite 101, Cary, NC 27518 (919) 557-0929

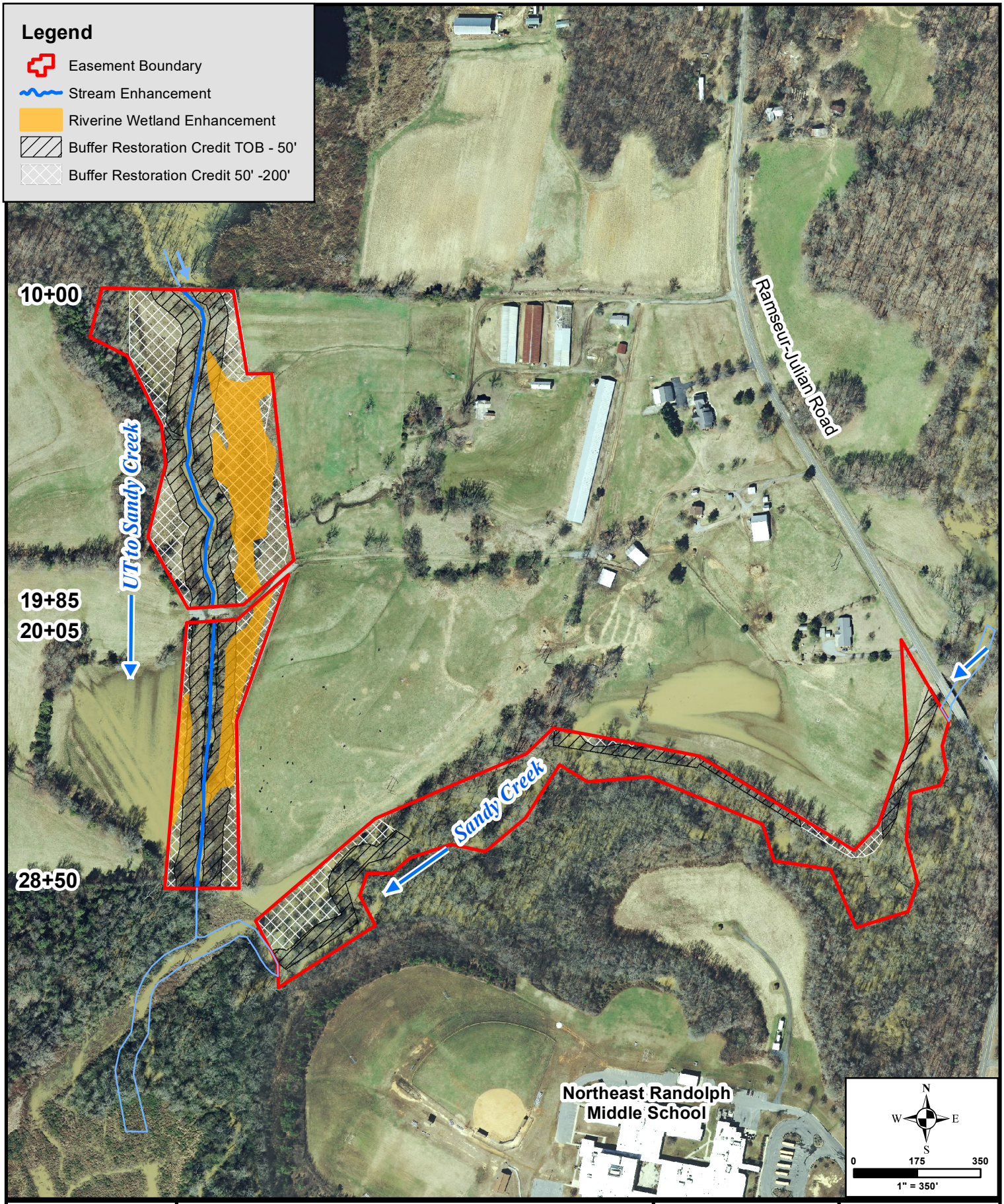
Table 4. Project Baseline Information and Attributes

Charles Williams Stream Wetland and Buffer Site / 80

Project Information			
Project Name		Charles Williams Stream Wetland and Buffer Site	
County		Randolph	
Project Area		18 acres	
Project Coordinates (latitude and longitude)		35°49'31.95" North/ 79°39'02.64" West	
Project Watershed Summary Information			
Physiographic Province		Piedmont	
River Basin		Cape Fear	
USGS Hydrologic Unit 8-digit	03030003	**USGS Hydrologic Unit 14-digit**	03030003020010
DWQ Subbasin		03-06-09	
Project Drainage Area		4.9 sq. mi.	
Project Drainage Area Percentage of Impervious Area		5 to 6%	
CGIA Land Use Classification		Agricultural Land	
Reach Summary Information			
Length of Reach		1,850 linear feet	
Valley Classification		Valley Type VIII	
Drainage Area		4.9 sq. mi.	
NCDWQ Stream ID Score		>50	
NCDWQ Water Quality Classification		WS-III	
Morphological Description (stream type)		C5	
Evolutionary Trend		C-G-F-E-C	
Underlying Mapped Soils		Chewacla loam	
Drainage Classification		Poorly drained	
Soil Hydric Status		Hydric B	
Slope		0 to 2%	
FEMA Classification		Zone AE	
Native Vegetation Community		Piedmont Alluvial Forest	
Percent Composition of Exotic Invasive Species		Less than 5%	
Wetland Summary Information			
Size of Wetland		1.96 acres	
Wetland Type		Riverine	
Mapped Soil Series		Chewacla loam	
Drainage Classification		Somewhat poorly drained	
Soil Hydric Status		Hydric B	
Source of Hydrology		Overbank flooding	
Hydrologic Impairment		None	
Native Vegetation Community		Piedmont Alluvial Forest	
Percent Composition of Exotic Invasive Species		Less than 5%	
Regulatory Considerations			
Waters of the United States - Section 404		Resolved	
Waters of the United States - Section 401		Resolved	
Endangered Species Act		Resolved	
Historic Preservation Act		Resolved	
Coastal Zone/Area Management Acts (CZMA/CAMA)		Not Applicable	
FEMA Floodplain Compliance		Resolved	
Essential Fisheries Habitat		Not Applicable	

APPENDIX B

Visual Assessment Data



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MITIGATION COMPONENTS
Charles Williams Site -
DMS Project No. 80

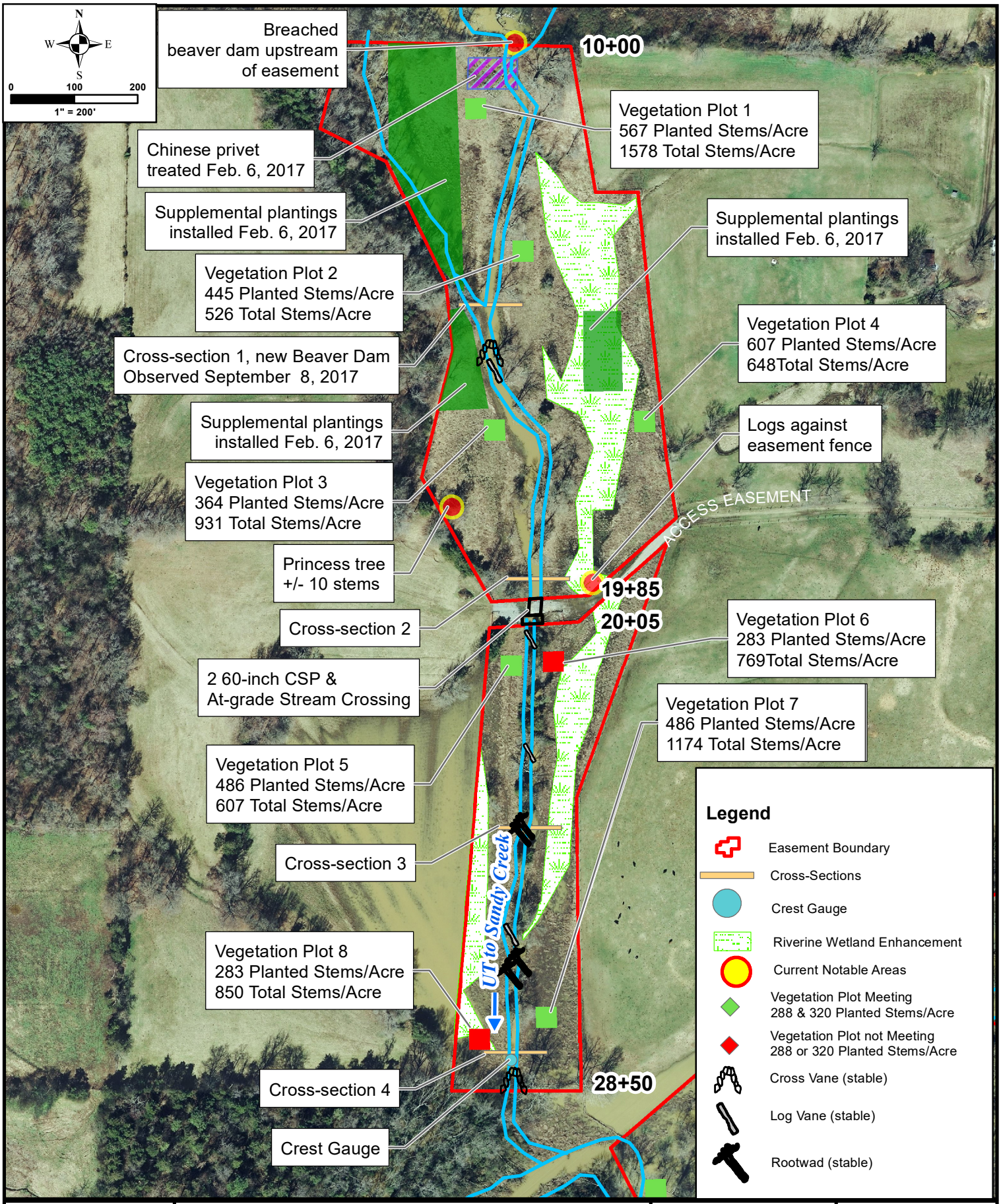
Randolph Co., NC

December 2017

Map Source:

2014 Aerial from NCOneMap.com

FIGURE 2



Environmental Quality

CURRENT CONDITIONS PLAN VIEW
Charles Williams Site - DMS Project No. 80

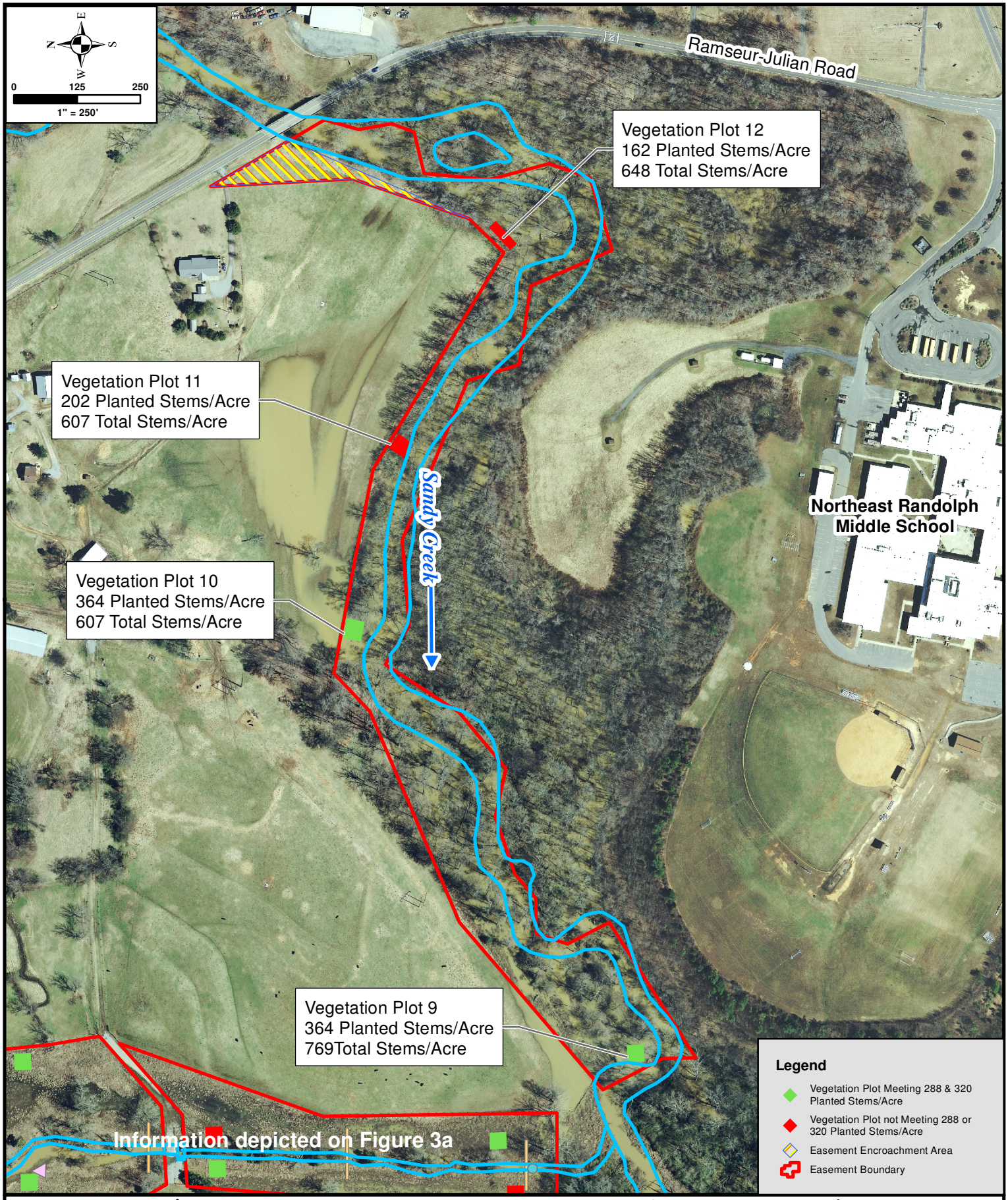
Randolph Co., NC

December 2017

Map Source:

2014 Aerial from NCOneMap.com

FIGURE 3a



Environmental Quality

CURRENT CONDITIONS PLAN VIEW
Charles Williams Site - DMS Project No. 80

Randolph Co., NC

December 2017

Map Source:

2014 Aerial from NCOneMap.com

FIGURE 3b

Table 5. Visual Stream Morphology Assessment

Assessed Length: 1,850 linear feet

Charles Williams Stream, Wetland, and Buffer Site / 80

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
Bed	Vertical Stability	Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100			
		Degradation - Evidence of down-cutting.			1	90	95.1			
	Riffle Condition	Texture/Substrate - Riffle maintains coarser substrate.			0	0	100			
	Meander Pool Condition	Depth - Sufficient (Max. Pool Depth : Mean Bankfull Depth ratio ≥ 1.6).	4	5			80			
		Length - Appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	4	5			80			
	Thalweg Position	Thalweg centering at upstream of meander bend (run).	8	8			100			
		Thalweg centering at downstream of meander bend (glide).	7	8			88			
Bank	Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100	none	none	n/a
	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	none	none	n/a
	Mass Wasting	Bank slumping, calving, or collapse.			0	0	100	none	none	n/a
				Totals	0	0	94.3	n/a	n/a	n/a
Engineered Structures	Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			100			
	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100			
	Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100			
	Bank Protection	Bank erosion within the structures' extent of influence does NOT exceed 15%.	8	8			100			
	Habitat	Pool forming structures maintaining - Max. Pool Depth : Mean Bankfull Depth ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	3	3			100			

Table 6. Vegetation Condition Assessment

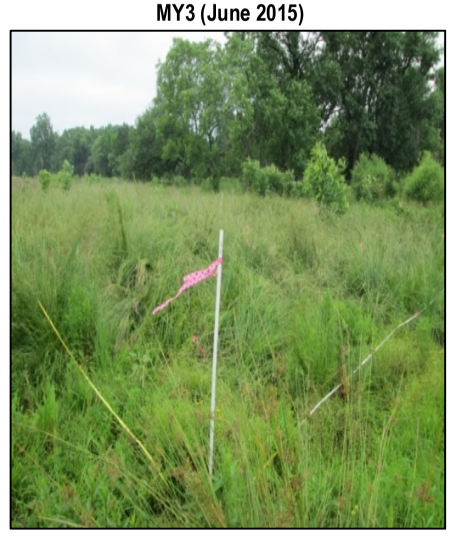
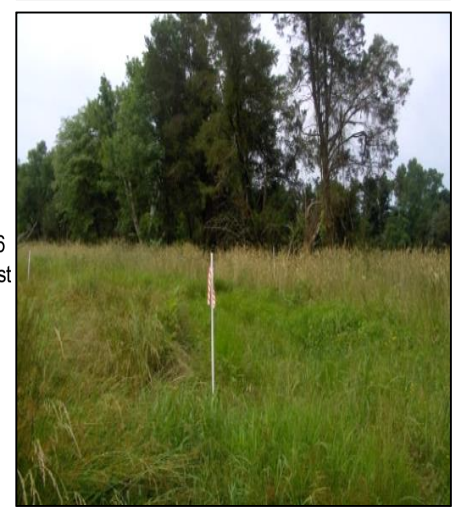
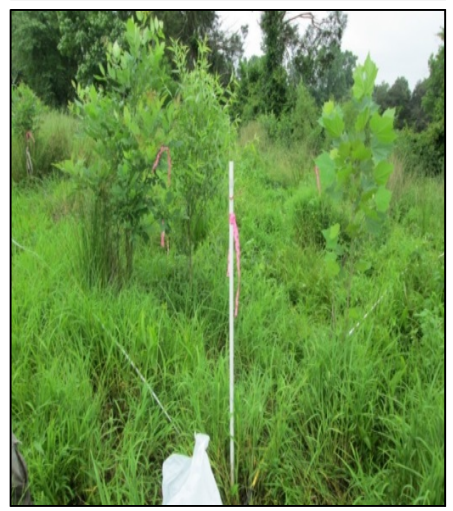
Charles Williams Stream, Wetland, and Buffer Site / 80

Planted Acreage:	16 acres					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	n/a	0	n/a	n/a
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY 3, 4, or 5 stem count criteria.	0.1 acres	Not depicted - natural woody stems bring woody stems up to target levels for veg. plots where planted stem survival is low.	0	n/a	0%
			Total	0	0	1%
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	n/a	n/a
			Cumulative Total	0	0	0%
Estimated Acreage:	**18 acres**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	<1,000 SF	See CCPV	2	<.1 acres	<1 %
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	1,000 SF	See CCPV	1	0.3 acres	1%

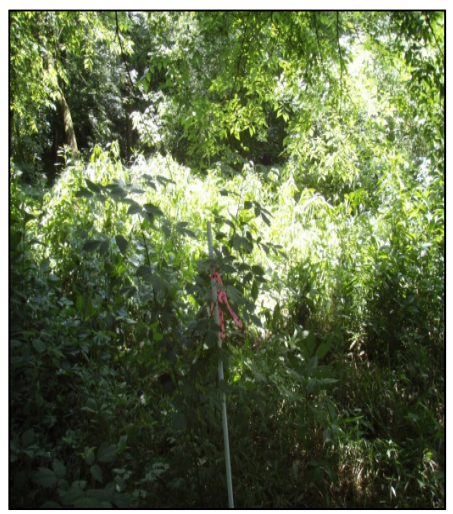
Charles Williams Stream, Wetland, and Buffer Site / 80 - Annual Photograph Comparison

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)	MY4 (June 2016)	MY5 (September 2017)
Vegetation Plot 1 Facing Southwest						
Vegetation Plot 2 Facing Southwest						
Vegetation Plot 3 Facing Southwest						

NOTE: MY0-MY4 photos compressed to make room for larger MY5 photos.

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)	MY4 (June 2016)	MY5 (September 2017)
Vegetation Plot 4 Facing Southwest						
Vegetation Plot 5 Facing Southwest						
Vegetation Plot 6 Facing Southwest						

NOTE: MY0-MY4 photos compressed to make room for larger MY5 photos.

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)	MY4 (June 2016)	MY5 (September 2017)
Vegetation Plot 7 Facing Southwest						
Vegetation Plot 8 Facing Southwest						
Vegetation Plot 9 Facing Southwest						

NOTE: MY0-MY4 photos compressed to make room for larger MY5 photos.

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)	MY4 (June 2016)	MY5 (September 2017)
Vegetation Plot 10 Facing Southwest						
Vegetation Plot 11 Facing Southwest						
Vegetation Plot 12 Facing Southwest						

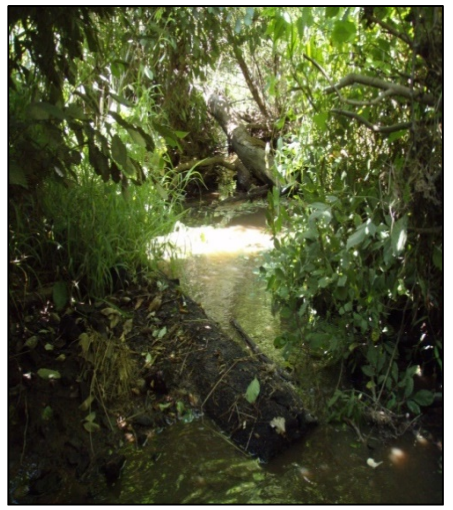
NOTE: MY0-MY4 photos compressed to make room for larger MY5 photos.

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)	MY4 (July 2016)	MY5 (July 2017)
Cross Section 1 Facing West						
Cross Section 1 Facing Downstream						

NOTE: MY0-MY4 photos compressed to make room for larger MY5 photos.

	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)	MY4 (July 2016)	MY5 (July 2017)
Cross Section 2 Facing West						
Cross Section 2 Facing Downstream						
Cross Section 3 Facing West						

NOTE: MY0-MY4 photos compressed to make room for larger MY5 photos.

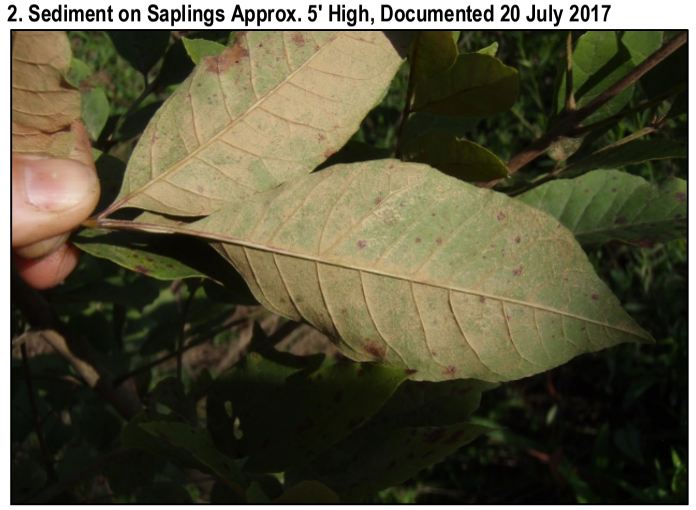
	Baseline MY0 (June 2013)	MY1 (March 2014)	MY2 (September 2014)	MY3 (June 2015)	MY4 (July 2016)	MY5 (July 2017)
Cross Section 3 Facing Downstream						
Cross Section 4 Facing West						
Cross Section 4 Facing Downstream						

NOTE: MY0-MY4 photos compressed to make room for larger MY5 photos.

Overbank Events
MY5

1. Wrack at High Elevation, Documented 20 July 2017

2. Sediment on Saplings Approx. 5' High, Documented 20 July 2017



3. Crest Gauge Reading at 28" Documented 20 July 2017

Beaver Dams
MY5

1. Beaver Dam at Cross-section 1, Reconstsructed as of Sept. 2017, **Removed Nov. 2017**

2. Site of Previous Beaver Dam at Road Crossing, Not Reconstructed as of 8 Sept. 2017

APPENDIX C

Vegetation Plot Data

Planted Vegetation Summary

During MY3 monitoring, new stems were documented from a supplemental planting performed by Carolina Silvics in early 2015. Stem density was observed to be adequate in 12 of the 12 vegetation plots. Please refer to the letter and tables below.

Proposed Supplemental Planting Letter

CAROLINA SILVICS
Natural Resources Professionals

Office: 252-482-8491
Fax: 252-482-8491
Web: www.carolinasilvics.com

October 6, 2014

Mr. Jeff Schaffer
NC Ecosystem Enhancement Program
217 West Jones Street, Suite 3000A
Raleigh, North Carolina 27603

Re: D13002S
Site: Sandy Creek (Charlie Williams), EEP# 80
Randolph County, NC

Dear Mr. Schaffer:

This letter serves as our Site Maintenance Report the above referenced project site and proposes replanting activities at the site.

Messrs. William Skinner and Perry Sugg of Carolina Silvics, Inc. last visited the project site on September 9, 2014. Herbicide applications were performed at this time to control privet (*Ligustrum* spp.) and air yam (*Dioscorea bulbifera*). While on-site they observed many areas of the site where herbaceous vegetation was extremely thick and possibly outcompeting the planted stems. They also observed many dead stems and that the tops of many planted stems appeared to have died-back but were resprouting.

The Fall monitoring data and baseline monitoring data that you have provided shows approximately 65% survival at this site and correlates with what we observed on-site.

Carolina Silvics, Inc. proposes to replant the site between December 15, 2014 and March 15, 2015 with approximately 3,450 stems (an average of 300 stems per acre) from the original planting list for the site. These stems will distributed throughout the site as needed based upon the Fall monitoring report and observed conditions on site. Seedling orders are being finalized now and will be forwarded to you for approval within the next week.

Since survival percentage of stems is less than we would like, we feel that both soil amelioration and competition control measures are needed at this site. Within portions of the site where competition seems particularly heavy, we will manually cut paths several feet wide low to the ground in the existing herbaceous competition and apply Oust® XP (sulfometuron methyl) herbicide to the paths. Herbicide will not be applied to areas of standing water or areas along the channel. Stems

will then be replanted into these paths. Conversely, in areas where general vegetative growth is sparse, we will apply a slow release fertilizer at time of planting to improve general soil fertility in those areas.

We will notify you in advance of our replanting and maintenance activities on this site. We request that a member of your staff be onsite with us as we begin these actives so that proper distribution of the seedlings can be agreed-upon in the field by all parties.

Please know that Carolina Silvics, Inc. is committed to the success of this project and will take the measures necessary to ensure that we remain in contract compliance. If you have any questions regarding this report or our proposed replanting and maintenance activities, please contact me at (252) 482-8491 or mary-margaret@carolinasilvics.com.

Respectfully,

CAROLINA SILVICS, INC.

Mary-Margaret McKinney, RF
President

Office: *252-482-8491*
Fax: *252-482-8491*
Web: *www.carolinasilvics.com*

Original Planting List from DMS

Sandy Creek (Charles Williams)

Species	Type	Riparian		Wetland		Nursery
		Qty	%	Qty	%	
Betula nigra	2-0 BR	300	10%	100	11%	NCFS
Carya glabra	2-0 BR	100	3%			NCFS
Carya tomentosa	2-0 BR	200	7%			NCFS
Fraxinus pennsylvanica	2-0 BR	275	9%	100	11%	NCFS
Liriodendron tulipifera	2-0 BR	400	13%			NCFS
Platanus occidentalis	2-0 BR	225	7%	200	23%	NCFS
Quercus falcata var. pagodiafolia	2-0 BR	300	10%	100	11%	NCFS
Quercus nigra	2-0 BR			100	11%	NCFS
Quercus phellos	2-0 BR	600	20%	200	23%	NCFS
Quercus rubra	2-0 BR	300	10%			NCFS
Amelanchier arborea	1-gal	25	1%			Native Roots
Carpinus caroliniana	1-gal	85	3%			Native Roots
Chionanthus virginicus	1-gal	64	2%			Native Roots
Diospyros virginiana	2-0 BR	200	7%			NCFS
Ilex verticillata	1-gal			37	4%	Native Roots
Magnolia virginiana	1-gal			38	4%	Native Roots
		3,074	100%	875	100%	

Table 7. Vegetation Plot Criteria Attainment

Charles Williams Stream, Wetland, and Buffer Site / 80

Vegetation Plot ID	Stream/Wetland Vegetation Survival Threshold Met?	Buffer Vegetation Survival Threshold Met?	Tract Mean
1	Yes	Yes	
2	Yes	Yes	
3	Yes	Yes	
4	Yes	Yes	
5	Yes	Yes	
6	No	No	Stream/Wetland Veg. = 75%
7	Yes	Yes	Buffer Veg. = 67%
8	No	No	
9	n/a	Yes	
10	n/a	Yes	
11	n/a	No	
12	n/a	No	

Notes:
Supplemental planting at approximately 300 stems per acre was performed between December 2014 and March 2015. 230 additional stems were planted outside vegetation plots on February 6, 2017.

Table 8. CVS Vegetation Plot Metadata

Charles Williams Stream, Wetland, and Buffer Site / 80

Report Prepared By	David Cooper
Date Prepared	10/30/2017 15:45
database name	SandyCreekCharlesWilliams_80_RandolphCounty_Year 5.mdb
database location	P:\10000 Consultants\10227 Sungate\10227-017_Charles Williams Monitoring\MonitoringYear5
computer name	WKST6
file size	59314176
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY	
Project Code	80
project Name	Sandy Creek - Charles Williams
Description	Stream, Wetland and Buffer
River Basin	Cape Fear
length(ft)	1,850
stream-to-edge width (ft)	5 to 12
area (sq m)	1,302
Required Plots (calculated)	12
Sampled Plots	12

Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means)

EEP Project Code 80. Project Name: Sandy Creek - Charles Williams

			Current Plot Data (MY4 2017)																															Annual Means		
			080-01-0001			080-01-0002			080-01-0003			080-01-0004			080-01-0005			080-01-0006			080-01-0007			080-01-0008			080-01-0009			080-01-0010			080-01-0011			080-01-0012			MY4 (2017)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	boxelder	Tree																							14			6			2			7			6			35
Acer rubrum	red maple	Tree			1																																			1
Betula nigra	river birch	Tree						1	1	1	1				2	2	2				2	2	2	1	1	1											6	6	7
Carpinus caroliniana	American hornbeam	Tree																									1	1	1	1	1	1				2	2	2
Carya	hickory	Tree													2	2	2							1	1	1			1							2	3	3	6
Celtis laevigata	sugarberry	Tree																											2							1			3
Cephalanthus occidentalis	common buttonbush	Shrub																					1																1
Diospyros virginiana	common persimmon	Tree				1	1	1							1	1	1				2	2	2				3	3	3	1	1	1				1	1	1	9	9	9
Fraxinus pennsylvanica	green ash	Tree	14	14	27	3	3	3	2	2	2	4	4	5	2	2	3	3	3	3	6	6	21	1	1	1				2	2	2	2	2	5			1	39	39	73
Ilex decidua	possumhaw	shrub																											1										1
Juglans nigra	black walnut	Tree			2						1																				4									7
Liquidambar styraciflua	sweetgum	Tree			9			1									2																				2			14
Liriodendron tulipifera	tuliptree	Tree				2	2	2	1	1	1													1	1	1	1	1	1									5	5	5
Magnolia virginiana	sweetbay	Tree																1	1	1																		1	1	1
Nyssa sylvatica	blackgum	Tree																			1	1	1	2	2	2													3	3	3
Platanus occidentalis	American sycamore	Tree										1	1	1				1	1	1										2	2	2	1	1	1				5	5	5
Quercus	oak	Tree																1	1	1							1	1	1							2	2	2	4	4	4
Quercus laurifolia	laurel oak	Tree										2	2	2																								2	2	2
Quercus lyrata	overcup oak	Tree				2	2	2	1	1	1	4	4	4	2	2	2										1	1	1										10	10	10
Quercus michauxii	swamp chestnut oak	Tree				1	1	1				1	1	1	1	1	1							1	1	1				3	3	3	2	2	2	1	1	1	10	10	10
Quercus phellos	willow oak	Tree				2	2	2	4	4	4	2	2	2	2	2	2	1	1	1	1	1	1				2	2	2										14	14	14
Quercus rubra	northern red oak	Tree										1	1	1																								1	1	1
Salix nigra	black willow	Tree									12									12																				24
Sambucus canadensis	Common Elderberry	Shrub									1																													1
Ulmus rubra	slippery elm	Tree																					1																	1
		Stem count	14	14	39	11	11	13	9	9	23	15	15	16	12	12	15	7	7	19	12	12	29	7	7	21	9	9	19	9	9	15	5	5	15	4	4	16	114	114	240
		size (ares)	1			1			1			1			1			1			1			1			1			1			1			1			12		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.30		
		Species count	1	1	4	6	6	8	5	5	8	7	7	7	7	7	8	5	5	6	5	5	7	6	6	7	6	6	10	5	5	7	3	3	4	3	3	8	15	15	25
		Stems per ACRE	566.6	566.6	1578	445.2	445.2	526.1	364.2	364.2	930.8	607	607	647.5	485.6	485.6	607	283.3	283.3	768.9	485.6	485.6	1174	283.3	283.3	849.8	364.2	364.2	768.9	364.2	364.2	607	202.3	202.3	607	161.9	161.9	647.5	384.5	384.5	809.4

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

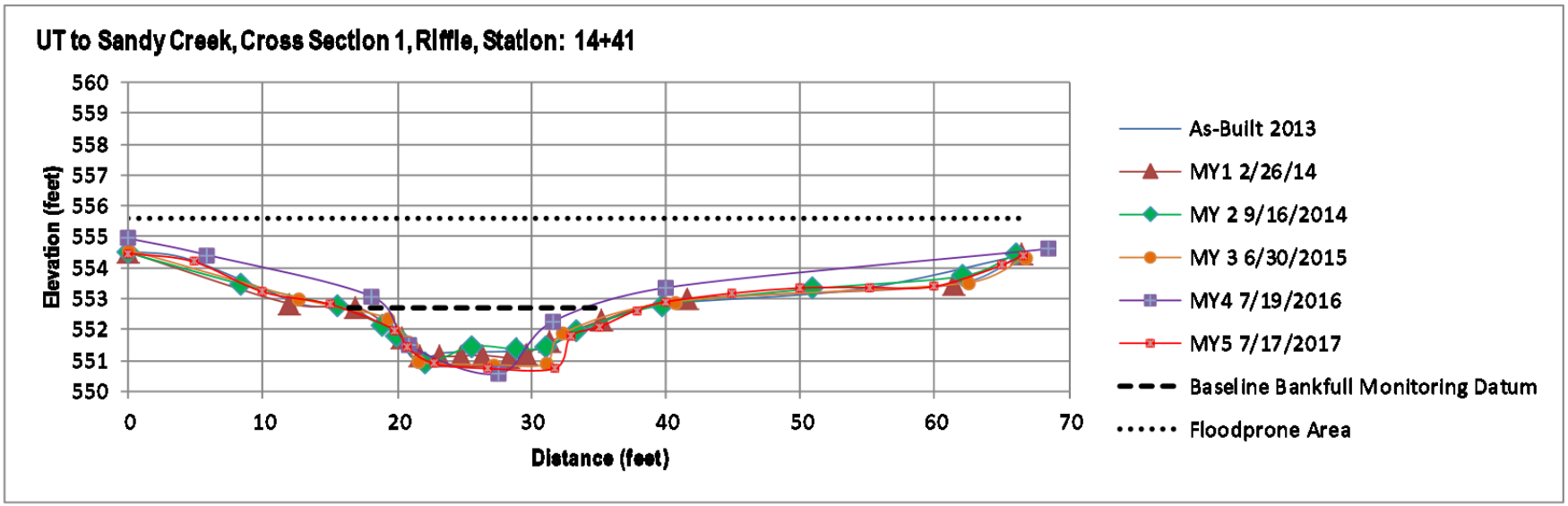
Stream Survey Data

River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-05
XS ID:	XS 1, Riffle, STA. 14+41
Drainage Area (sq mi):	4.9
Date:	7/17/2017
Field Crew:	D. Cooper, W. Turner

SUMMARY DATA	
Bankfull Elevation:	553.1
Bankfull Cross Sectional Area:	37.9
Bankfull Width:	32.2
Flood Prone Area Elevation:	555.6
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.3
Width/Depth Ratio:	24.8
Entrenchment Ratio:	>6
Bank Height Ratio:	1.0

Station	Elevation
0.00	554.4697
4.86	554.1971
10.00	553.2186
15.06	552.8074
19.86	551.975
20.71	551.4284
22.75	550.8952
26.66	550.7381
31.78	550.7477
32.95	551.7856
35.09	552.082
37.83	552.623
40.00	552.8933
44.94	553.1724
50.00	553.345
55.09	553.3635
59.93	553.386
65.02	554.0882
66.55	554.4152

Stream Type:	C5	Photograph facing downstream @ XS 1

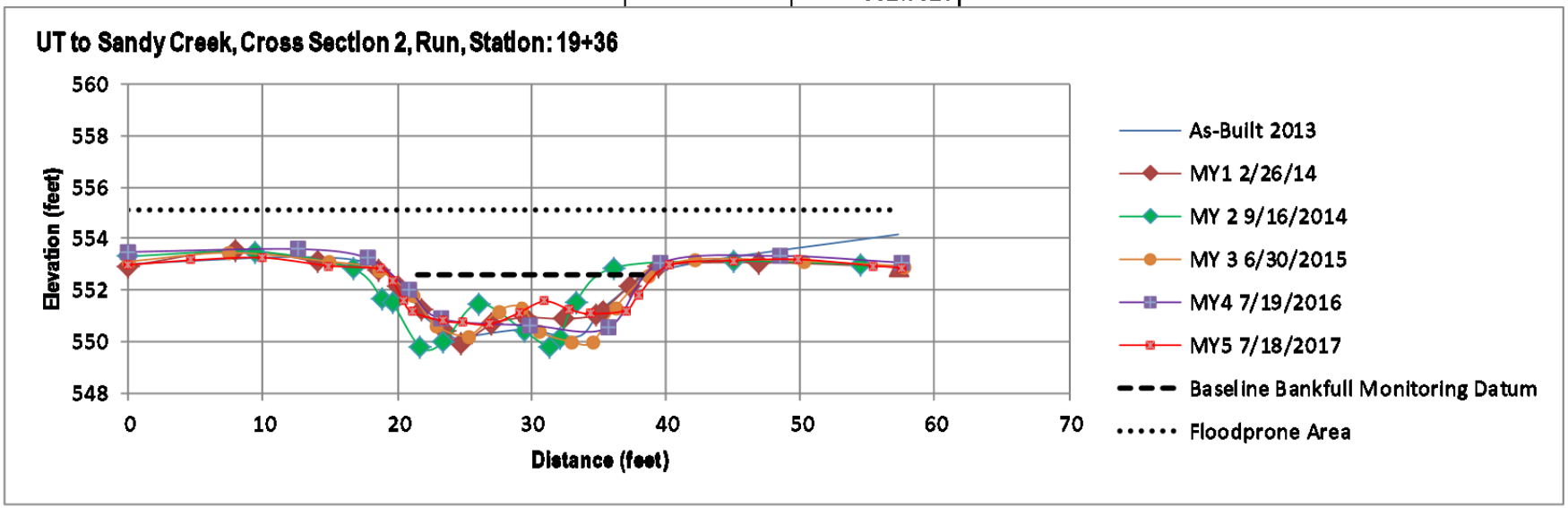


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-05
XS ID:	XS 2, Glide, STA. 19+36
Drainage Area (sq mi):	4.9
Date:	7/18/2017
Field Crew:	D. Cooper, W. Turner

SUMMARY DATA	
Bankfull Elevation:	552.9
Bankfull Cross Sectional Area:	33.9
Bankfull Width:	23.7
Flood Prone Area Elevation:	555.2
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.6
Width/Depth Ratio:	14.8
Entrenchment Ratio:	>8
Bank Height Ratio:	1.0

Station	Elevation
0.00	552.9845
4.69	553.1658
9.93	553.268
14.83	552.9523
18.78	552.826
19.66	552.3701
20.43	551.595
21.11	551.152
23.33	550.8106
24.83	550.737
26.84	550.6752
29.06	551.1232
31.01	551.5737
32.84	551.2513
34.41	551.085
37.01	551.2178
37.98	551.805
40.26	552.9664
45.06	553.1516
49.89	553.1988
55.37	552.9529

Stream Type:	C5	Photograph facing downstream @ XS 2

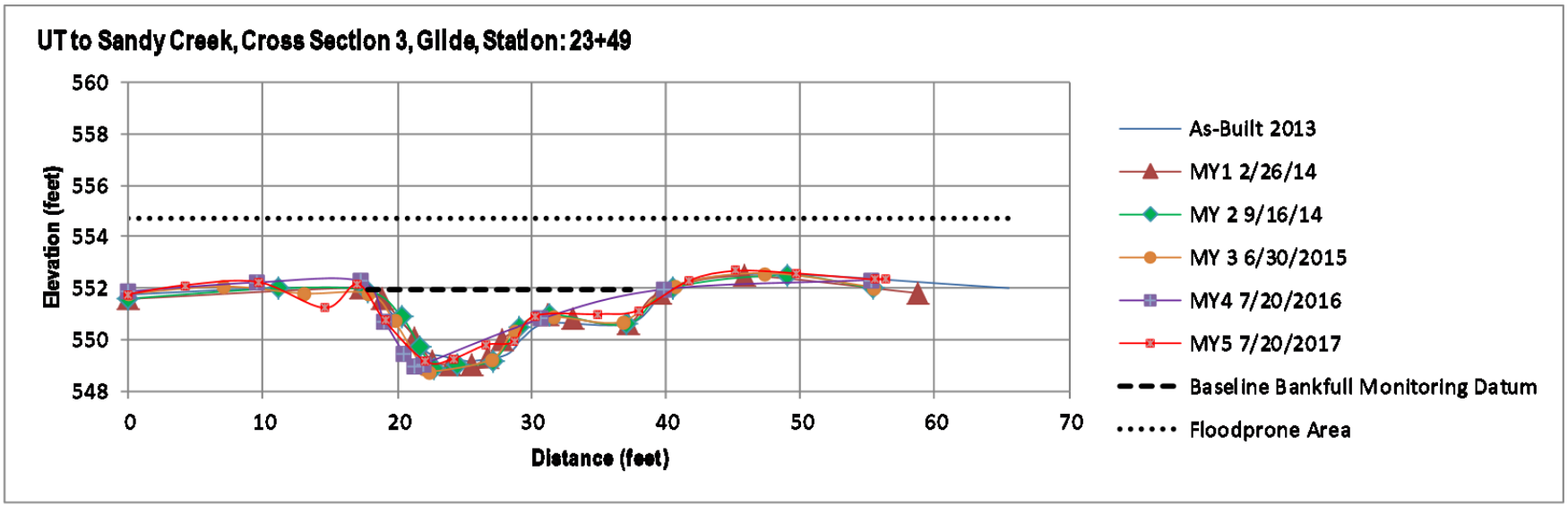


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-05
XS ID:	XS 3, Run, STA. 23+49
Drainage Area (sq mi):	4.9
Date:	7/19/2017
Field Crew:	D. Cooper, W. Turner

SUMMARY DATA	
Bankfull Elevation:	551.9
Bankfull Cross Sectional Area:	32.5
Bankfull Width:	23.0
Flood Prone Area Elevation:	554.9
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.7
Mean Depth at Bankfull:	1.5
Width/Depth Ratio:	15
Entrenchment Ratio:	>8
Bank Height Ratio:	1.1

Station	Elevation
0	551.7725
4.239720863	552.1223
9.645943505	552.2497
14.61741637	551.2408
17.05300209	552.1632
19.07109574	550.7354
22.0884401	549.1664
24.16159682	549.2658
26.59611879	549.8048
28.64100973	549.925
30.30366943	550.9368
35.01461868	550.9999
37.94015505	551.1396
41.7506089	552.3007
45.24282843	552.6832
49.69386169	552.5833
55.53082435	552.3413
58.34787958	552.3913

Stream Type:	C5	Photograph facing downstream @ XS 3

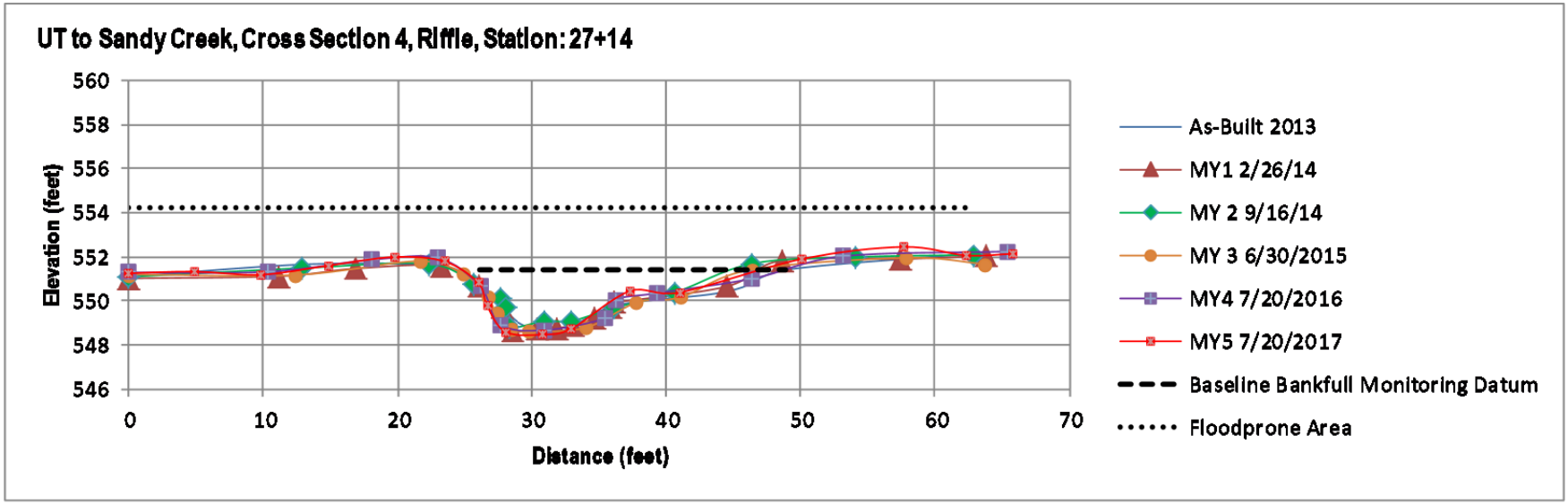


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-05
XS ID:	XS 4, Riffle, STA. 27+14
Drainage Area (sq mi):	4.9
Date:	7/20/2017
Field Crew:	D. Cooper, W. Turner

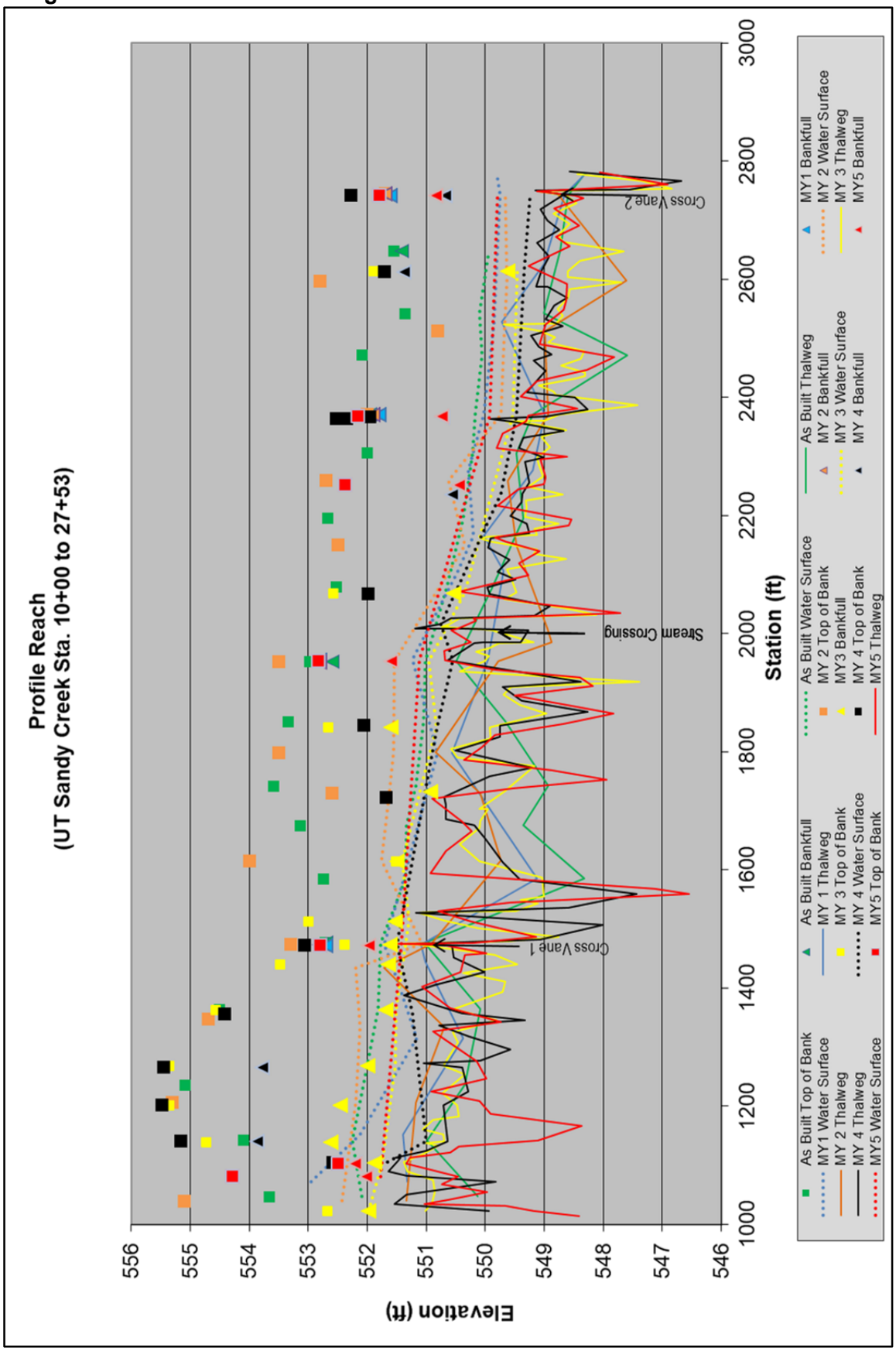
SUMMARY DATA	
Bankfull Elevation:	551.7
Bankfull Cross Sectional Area:	39.7
Bankfull Width:	25.1
Flood Prone Area Elevation:	554.8
Flood Prone Width:	200+
Max. Depth at Bankfull:	3.2
Mean Depth at Bankfull:	1.7
Width/Depth Ratio:	14.7
Entrenchment Ratio:	>8.0
Bank Height Ratio:	1.0

Station	Elevation
0	551.2606
4.853175575	551.3409
9.838043125	551.1986
14.83361596	551.6089
19.76775178	552.0037
23.4905335	551.8007
25.9935143	550.8302
26.6445454	549.7921
28.01703875	548.6039
30.85993943	548.4841
32.96710071	548.7443
37.34162311	550.4648
41.01200486	550.3933
50.16389719	551.9199
57.65749503	552.46
62.35559607	552.0746
65.82654674	552.1523

Stream Type:	C5	Photograph facing downstream @ XS 4



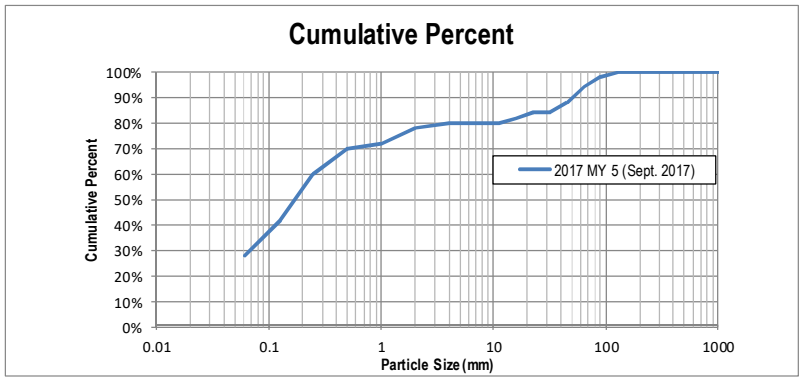
Longitudinal Profile Plot Exhibit

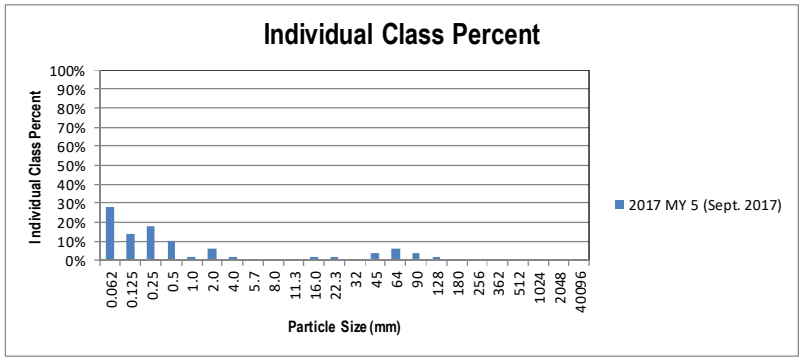


Cross Section Pebble Count Exhibits

Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 1 Feature: Riffle					
			2017 MY 5 (Sept. 2017)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	14	28%	28%
Sand	very fine sand	0.125	7	14%	42%
	fine sand	0.25	9	18%	60%
	medium sand	0.5	5	10%	70%
	coarse sand	1.0	1	2%	72%
	very coarse sand	2.0	3	6%	78%
Gravel	very fine gravel	4.0	1	2%	80%
	fine gravel	5.7	0	0%	80%
	fine gravel	8.0	0	0%	80%
	medium gravel	11.3	0	0%	80%
	medium gravel	16.0	1	2%	82%
	coarse gravel	22.3	1	2%	84%
	coarse gravel	32	0	0%	84%
	very coarse gravel	45	2	4%	88%
	very coarse gravel	64	3	6%	94%
Cobble	small cobble	90	2	4%	98%
	medium cobble	128	1	2%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

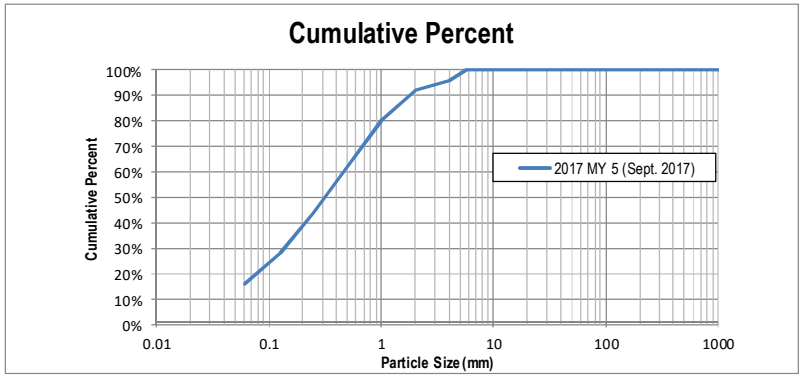
Summary Data	
D50	0.34 mm
D84	45.00 mm
D95	109.00 mm

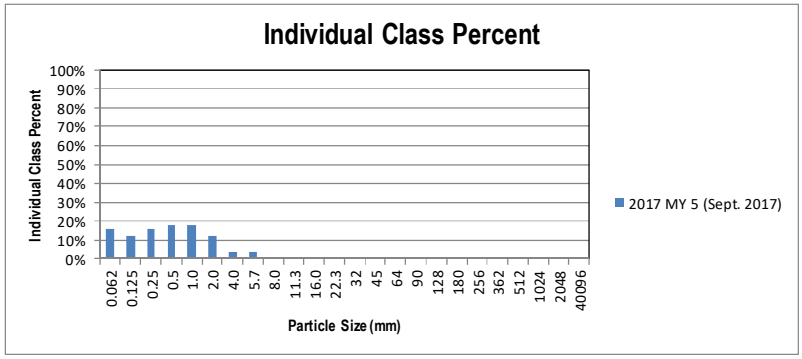




Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 2 Feature: Glide					
			2017 MY 5 (Sept. 2017)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	8	16%	16%
Sand	very fine sand	0.125	6	12%	28%
	fine sand	0.25	8	16%	44%
	medium sand	0.5	9	18%	62%
	coarse sand	1.0	9	18%	80%
	very coarse sand	2.0	6	12%	92%
Gravel	very fine gravel	4.0	2	4%	96%
	fine gravel	5.7	2	4%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

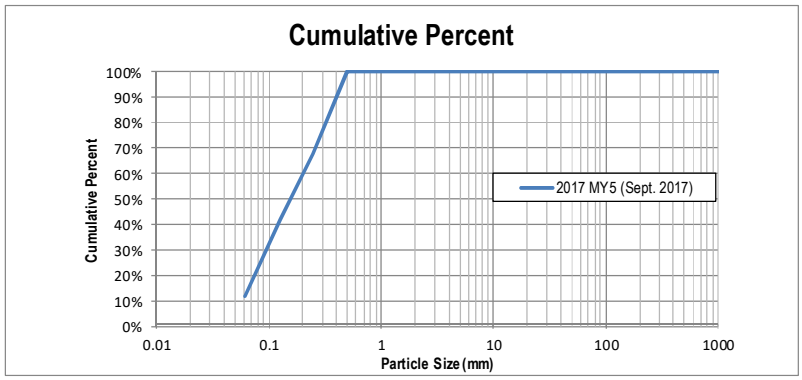
Summary Data	
D50	0.20 mm
D84	6.28 mm
D95	11.20 mm

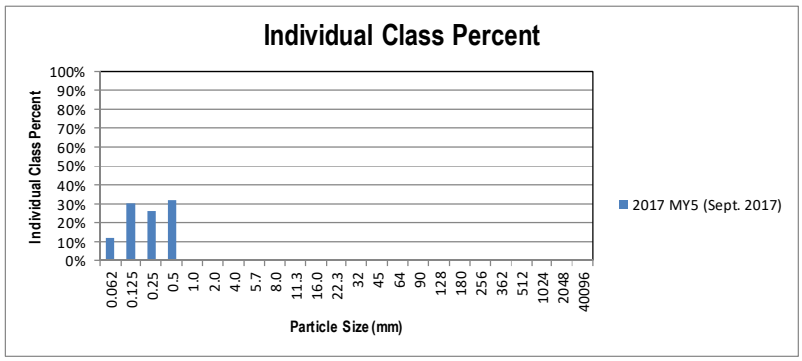




Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 3 Feature: Run					
			2017 MY5 (Sept. 2017)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	6	12%	12%
Sand	very fine sand	0.125	15	30%	42%
	fine sand	0.25	13	26%	68%
	medium sand	0.5	16	32%	100%
	coarse sand	1.0	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

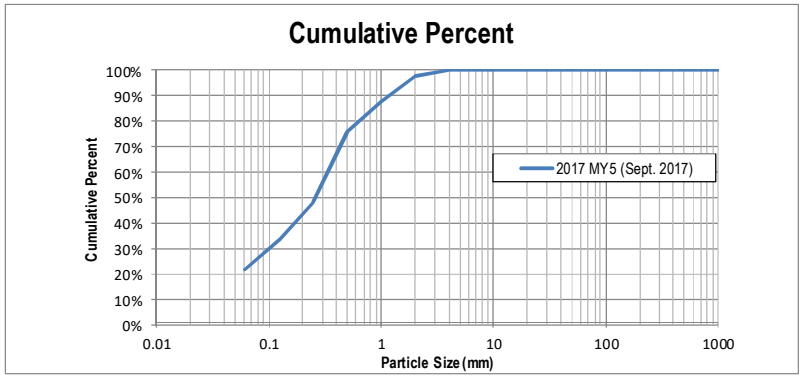
Summary Data	
D50	0.30 mm
D84	32.00 mm
D95	83.50 mm





Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 4 Feature: Riffle					
			2017 MY5 (Sept. 2017)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	11	22%	22%
Sand	very fine sand	0.125	6	12%	34%
	fine sand	0.25	7	14%	48%
	medium sand	0.5	14	28%	76%
	coarse sand	1.0	6	12%	88%
	very coarse sand	2.0	5	10%	98%
Gravel	very fine gravel	4.0	1	2%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

Summary Data	
D50	0.146 mm
D84	5.70 mm
D95	56.88 mm



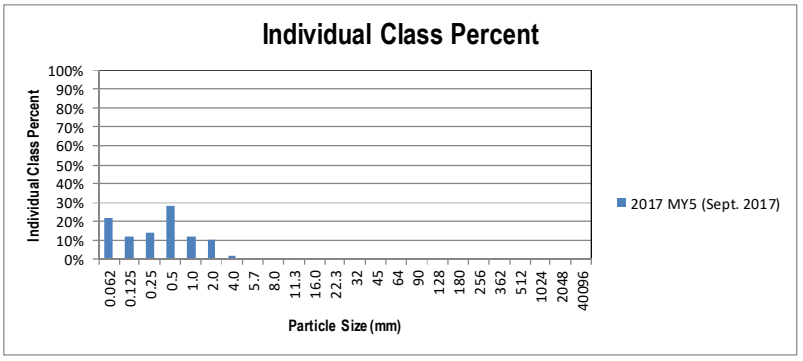


Table 10a. Baseline Stream Data Summary

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)						25.2				1								25.2		22	23.5	24.9	24.9		2
Floodprone Width (ft)						>300				1								>300		63	>131	200+	200+		2
Bankfull Mean Depth (ft)						1.58				1								1.59		1	1.3	1.5	1.5		2
[1]Bankfull Max Depth (ft)						2.6				1								2.6		1.7	2.3	2.8	2.8		2
Bankfull Cross Sectional Area (ft^2)						40.0				1								40		21.7	28.9	36.1	36.1		2
Width/Depth Ratio						15.8				1								15.8		>15	>15	>15	>15		2
Entrenchment Ratio						>15				1								>15		2.9	7.5	8.4	>8		2
[1]Bank Height Ratio						1.0				1								1.0		1.0	1.0	1.0	1.0		2
Profile																									
Riffle Length (ft)																				39	51.5	51.5	64		2
Riffle Slope (ft/ft)						0.013				1								0.013		0.26	0.28	0.28	0.3		2
Pool Length (ft)					8.3	30.5		63.7										30.5		168	198	196	232	27.5	4
Pool Max depth (ft)						3.4				1								3.4		3.1	3.5	3.4	4.25		4
Pool Spacing (ft)					56.0	116.0		94.0										116.4		158	372	239	719		3
Pattern																									
Channel Beltwidth (ft)					31.7	44.9		62.3									31.7	44.9	62.3	40	74.5	78.5	101	24.8	4
Radius of Curvature (ft)					15.0	37.8		95.0									15	37.8	95	19	60.5	58	107	31.5	4
Rc:Bankfull width (ft/ft)					0.6	1.5		3.8									0.6	1.5	3.8	0.9	2.7	2.6	4.8	1.4	4
Meander Wavelength (ft)					73.0	133.8		216.0									73	133.8	216	86	149.25	121.5	268	70.1	4
Meander Width Ratio					2.9	5.3		8.6									1.3	1.8	2.5	3.9	6.7	5.5	12	3.1	4
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					0.1425															0.07					
Max part size (mm) mobilized at bankfull					2.0															2.0					
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					C5												C5			C5					
Bankfull Velocity (fps)					3.9												3.75			3.05					
Bankfull Discharge (cfs)					150.0																				
Valley length (ft)					1961																				
Channel Thalweg length (ft)					1850												1850			1850					
Sinuosity (ft)					1.06												1.06			1.06					
Water Surface Slope (Channel) (ft/ft)					0.0014												0.0014			0.0013					
BF slope (ft/ft)																	0.0013			0.0013					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

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

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

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

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	1%	84%	4%	11%	0%																	11%	60%	14%	15%	0%		
[1]SC% / Sa% / G% / C% / B% / Be%	7%	83%	10%	0%	0%	0%																						
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.12	0.34	0.55	1.70	3.60	<2.0	<2.0																					
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	0	0	0	0	1850																	0	0	200	0	1650		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0	1850	0	0	0																		1850	0	0	0			

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

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

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

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

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

	Cross Section 1 (Riffle)							Cross Section 2 (Glide)							Cross Section 3 (Run)							Cross Section 4 (Riffle)						
Based on fixed baseline bankfull elevation [1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																												
Bankfull Width (ft)	22.0	22.6	23.9	24.0	19.9	32.2		19.6	20.5	19.4	21.8	20.8	23.7		22.6	18.8	20.1	22.4	22.1	23		24.9	24.5	24.1	24.2	22.8	25.1	
Floodprone Width (ft)	63.0	65.4	66.1	66.1	>100	>100		200+	200+	200+	200+	200+	200+		200+	200+	200+	200+	200+	200+		200+	200+	200+	200+	200+	200+	
Bankfull Mean Depth (ft)	1.0	1.0	0.9	1.1	1.3	1.3		1.7	1.6	1.8	1.7	1.8	1.6		1.6	1.5	1.7	1.6	1.4	1.5		1.5	1.5	1.5	1.8	1.7	1.7	
Bankfull Max Depth (ft)	1.7	1.6	1.8	1.9	2.5	2.3		2.5	2.8	3.1	2.8	2.4	2.2		2.8	2.8	3	3.16	3.0	2.7		2.8	2.9	2.9	3.1	3.0	3.2	
Bankfull Cross Sectional Area (ft ^{2})	21.7	22.5	22.7	25.6	25.6	37.9		33.4	32.8	35.3	36.7	36.4	33.9		36.4	29.0	33.5	36.5	30.4	32.5		36.1	37.8	37.1	42.7	39.6	39.7	
Bankfull Width/Depth Ratio	22.3	22.7	25.2	22.6	>12	24.8		11.5	12.9	10.7	12.9	11.9	14.8		14.0	12.2	12.1	13.7	>12.0	15		16.6	15.8	15.6	13.7	>12.0	14.7	
Bankfull Entrenchment Ratio	2.9	2.9	2.8	2.8	>2.2	>6.0		>10.0	>10.0	>10.0	>10.0	9.6	>8.0		>8.0	>8.0	>8.0	>8.0	>8.0	>8.0		>8.0	>8.0	>8.0	>8.0	>8.0	>8.0	
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0		1.1	1.1	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.1		1.0	1.0	1.0	1.0	1.1	1.0	
Based on current/developing bankfull feature [2]																												
Record elevation (datum) used																												
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)																												

These cells may or may not require population in any given year. See footnote 2 below

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

2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline bankfull datum then this should be tracked and quantified in these cells.

Table 11b. Monitoring Data - Stream Reach Data Summary

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	22	23.5	24.9	24.9		2	22.6	23.5	24.5	24.5		2	23.9	24.0	24.0	24.1		2	24.0	24.1	24.2	24.2		2	19.9	21.4	22.8	22.8		2	25.1	28.7	28.7	32.2		2
Floodprone Width (ft)	63	>131	200+	200+		2	65.4	>132.7	200+	200+		2	66.1	>133	200+	200+		2	66.1	>133	200+	200+		2	100+	>150	200+	200+		2	100+	>150	200+	200+		2
Bankfull Mean Depth (ft)	1	1.3	1.5	1.5		2	1.0	1.3	1.5	1.5		2	0.9	1.2	1.2	1.5		2	1.1	1.45	1.8	1.8		2	1.3	1.6	1.8	1.8		2	1.3	1.5	1.5	1.7		2
[1]Bankfull Max Depth (ft)	1.7	2.3	2.8	2.8		2	1.6	2.5	2.9	2.9		2	1.8	2.35	2.35	2.9		2	1.9	2.5	3.1	3.1		2	2.4	2.7	3.0	3.0		2	2.3	2.8	2.8	3.2		2
Bankfull Cross Sectional Area (ft^2)	21.7	28.9	36.1	36.1		2	22.5	30.5	37.8	37.8		2	22.7	29.9	29.9	37.1		2	25.6	34.15	42.7	42.7		2	25.6	32.6	39.6	39.6		2	37.9	38.8	38.8	39.7		2
Width/Depth Ratio	>15	>15	>15	>15		2	>15	>15	>15	>15		2	>15	>15	>15	>15		2	13.7	18.15	22.6	22.6		2	11.9	>12.0	>12.0	>12.0		2	14.7	19.8	19.8	24.8		2
Entrenchment Ratio	2.9	7.5	8.4	>8		2	2.9	>5.4	>8	>8		2	2.8	>5.4	>8	>8		2	2.8	>5.4	>8	>8		2	>2.2	>2.2	>2.2	>2.2		2	>6	>7	>7	>8		2
[1]Bank Height Ratio	1.0	1.0	1.0	1.0		2	1.0	1.0	1.0	1.0		2	1.0	1.0	1.0	1.0		2	1.0	1.0	1.0	1.0		2	1.0	1.1	1.1	1.1		2	1.0	1.0	1.0	1.0		2
Profile																																				
Riffle Length (ft)	39.0	51.5	51.5	64.0		2	53.13	75.34	78.7	91	14.5	6	88.9	127.7	123.7	160.1	26.9	5	88.9	127.7	123.7	160.0	26.88	5	40	80	50	150		3	50	92.5	92.5	135		2
Riffle Slope (ft/ft)	0.003	0.003	0.003	0.003		2	0.003	0.003	0.003	0.003	0.0	6	0.004	0.008	0.007	0.016	0.004	5	0.000	0.0012	0.001	0.003	0.001	5	0.004	0.007	0.007	0.01		3	0.004	0.005	0.005	0.007		2
Pool Length (ft)	168.0	198.0	196.0	232.0	27.5	4	283.6	283.6	283.6	283.6		2	115.8	127.7	127.7	139.6		2	115.8	127.7	127.7	139.6		2	45	49	50	50		3	32	78.7	96	108		3
Pool Max depth (ft)	3.1	3.5	3.4	4.3		4	0.8	1.5	1.5	2.3		2	2.0	2.0	2.0	2.0		2	1.4	1.65	1.88	1.88		2	3.1	4.6	5.1	5.5		3	3	3.7	3.3	4.8		3
Pool Spacing (ft)	158.0	372.0	239.0	719.0		3	283.6	283.6	283.6	283.6		1	975.2	975.2	975.2	975.2		1	975.2	975.2	975.2	975.2		1	460	835	1210	1210		2	192	436.67	393	725		3
Pattern																																				
Channel Beltwidth (ft)	40.0	74.5	78.5	101.0	24.8	4																														
Radius of Curvature (ft)	19.0	60.5	58.0	107.0	31.5	4																														
Rc:Bankfull width (ft/ft)	0.9	2.7	2.6	4.8	1.4	4																														
Meander Wavelength (ft)	86.0	149.3	121.5	268.0	70.1	4																														
Meander Width Ratio	3.9	6.7	5.5	12.0	3.1	4																														
Additional Reach Parameters																																				
Rosgen Classification	C5						C5						C5						C5						C5						C5					
Channel Thalweg length (ft)	1748						1748						1748						1748						1748						1748					
Sinuosity (ft)	1.06						1.06						1.06						1.06						1.06						1.06					
Water Surface Slope (Channel) (ft/ft)	0.0013						0.0013						0.0018						0.0017						0.0013						0.0013					
BF slope (ft/ft)	0.0013						0.0013						0.0010						0.0015						0.0014						0.0014					
[3]Ri% / Ru% / P% / G% / S%	5%	80%	15%				5%	80%	15%				5%	80%	15%				5%	80%	15%				7%	5%	8%				5%	80%	15%			
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0						0						0						0						0											
Channel Stability or Habitat Metric																																				
Biological or Other																																				

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

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

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

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

4. = Of value/needed only if the n exceeds 3

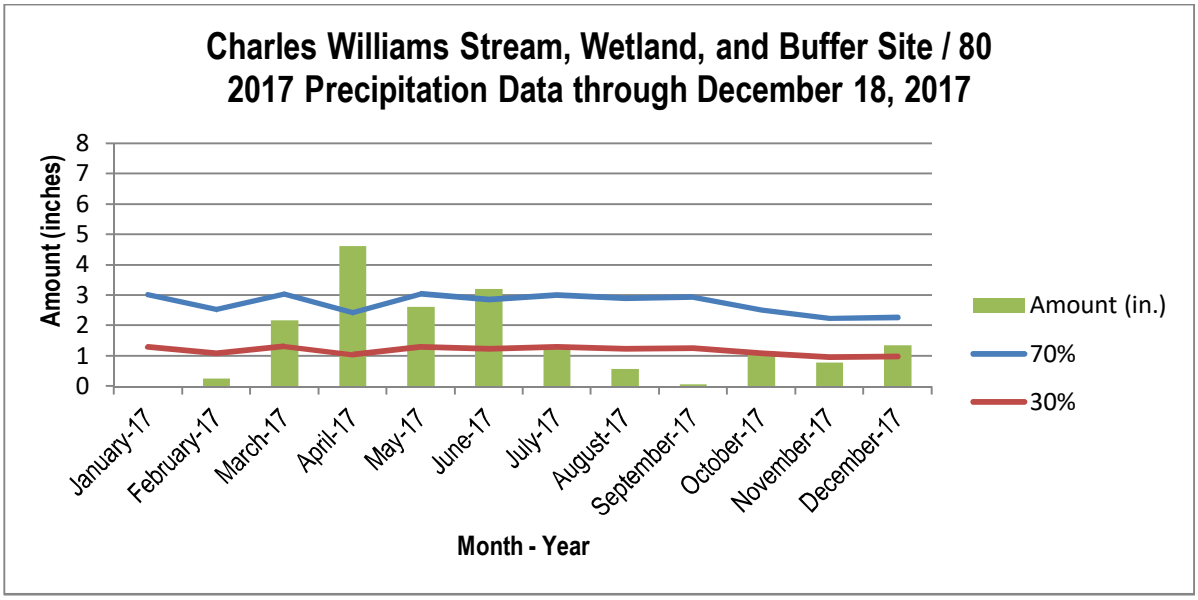
APPENDIX E

Hydrology Data

Table 12. Verification of Bankfull Events

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
11/6/2013	unknown	Crest Gauge	Not Available
3/6/2014	unknown	Visual On-site (wrack)	Not Available
9/16/2014	unknown	Crest Gauge	Not Available
4/17/2015	4/17/2015	Visual On-site (active overbank event)	Not Available
6/30/2015	unknown	Visual On-site (wrack, sediment staining, alluvial deposits)	Not Available
2/18/2016	unknown	Visual On-site (wrack, sediment staining, alluvial deposits, flattened vegetation)	Not Available
7/20/2016	unknown	Visual On-site (log jam from previous high flow event)	Not Available
2/10/2017	unknown	Crest Gauge 31.5”	Not Available
7/20/2017	between 2/10/2017 and 7/17/2017	Crest Gauge 28”, Visual On-site (wrack, sediment staining)	Overbank 1, 2, 3

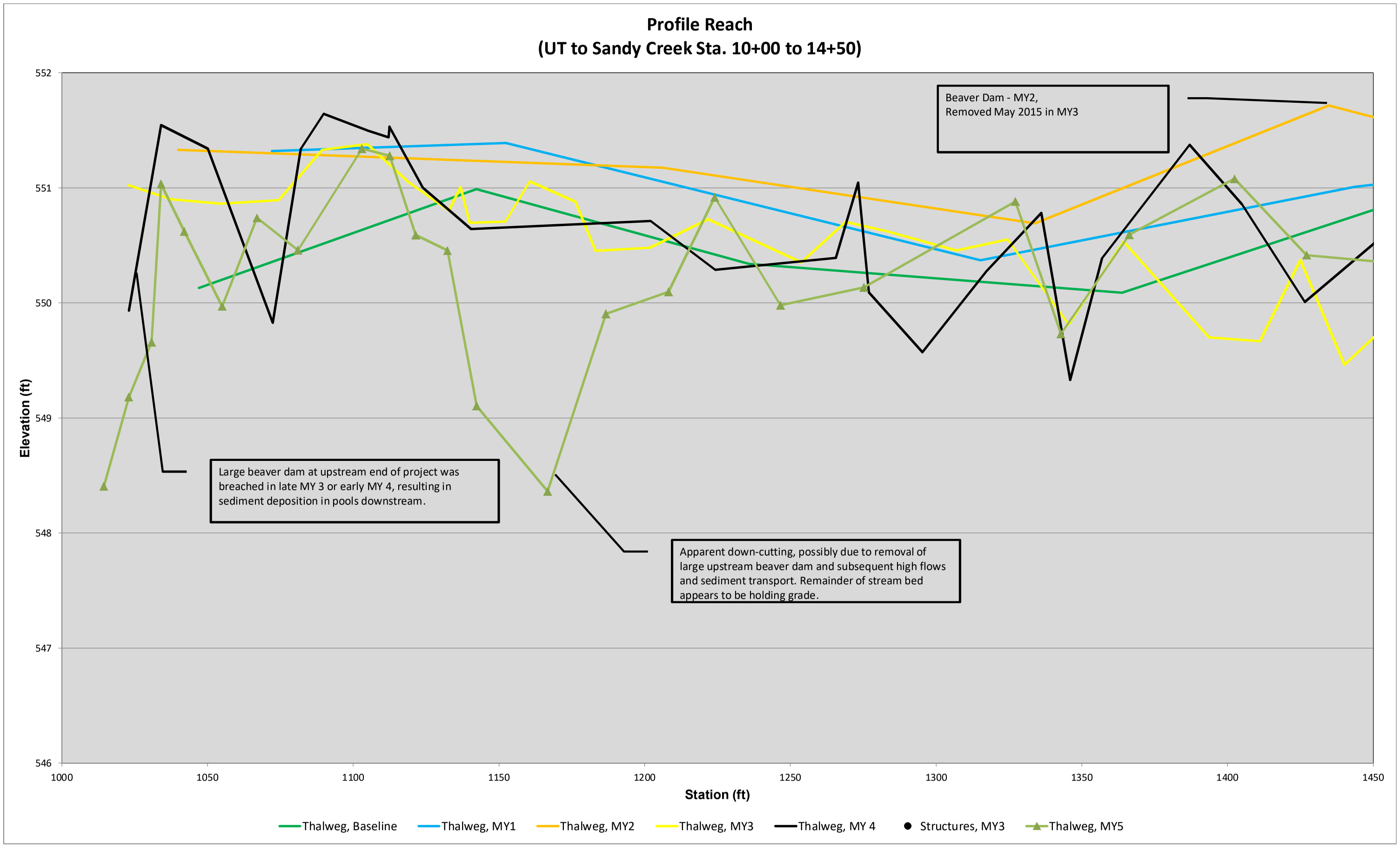


Note: precipitation data incomplete for Jan. and Feb. 2017.

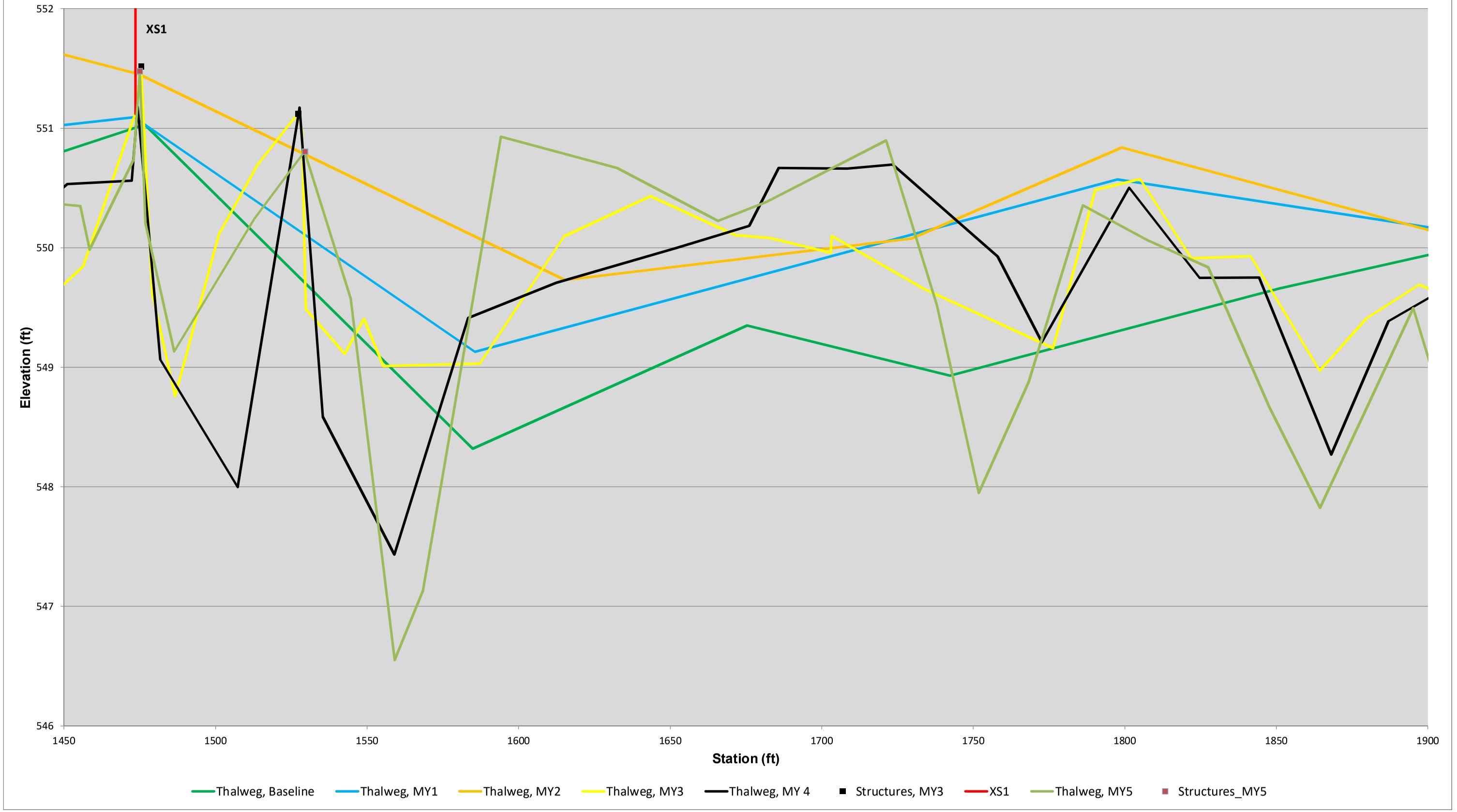
APPENDIX F

Detailed Thalweg Profile

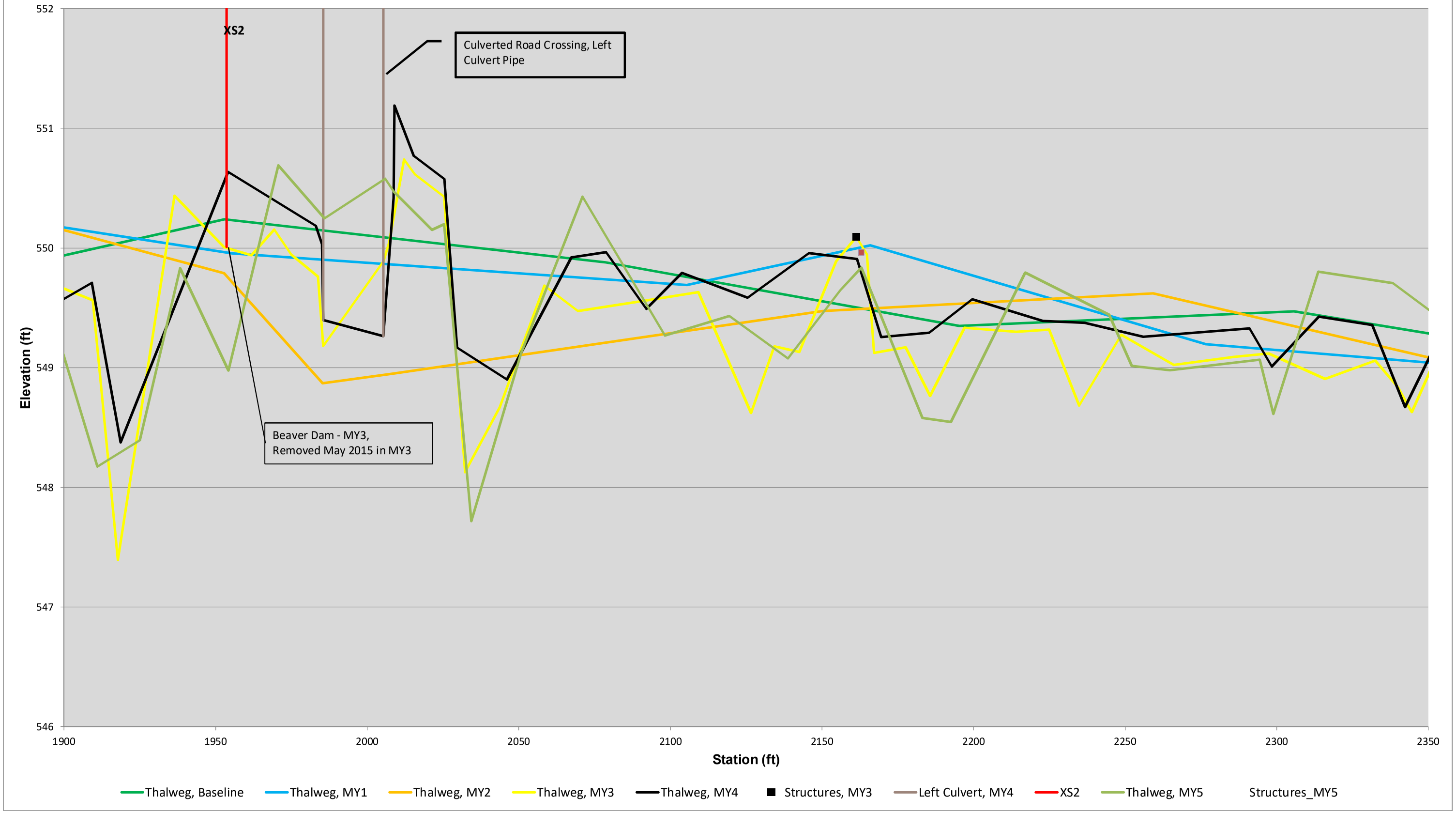
Profile Reach
(UT to Sandy Creek Sta. 10+00 to 14+50)



Profile Reach
(UT to Sandy Creek Sta. 14+50 to 19+00)



Profile Reach
(UT to Sandy Creek Sta. 19+00 to 23+50)



Profile Reach
(UT to Sandy Creek Sta. 23+50 to 28+00)