

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

MONITORING YEAR 2 (2014)
Construction Completed February 2013
Planting Completed February 2014

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



Prepared for the
NC Department of Environment and Natural Resources
Ecosystem Enhancement Program

1652 Mail Service Center
Raleigh, NC 27699-1652



FINAL REPORT December 2014

Prepared by:



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

David G. Cooper

David G. Cooper, Project Scientist

Under Contract With:



*This assessment and report are consistent with NCDENR Ecosystem Enhancement Program
Template Version 1.4 (11/07/11) for EEP 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 Environment and Natural Resources (NCDENR) Ecosystem Enhancement Program (EEP) 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 EEP 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. EEP 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	Stream #1 Name	UT to Sandy Creek
USGS 14-digit HUC	03030002020010	Drainage Area	4.9 sq. mi.
NCDWQ Subbasin	03-06-09	NCDWQ Score	(Perennial)
Underlying Mapped Soil(s)	Chewacla loam	Rosgen Classification	C5
Drainage Class	Somewhat poorly drained		
Hydric Status	B		
Slope	0-2 %		
Available Water Capacity	Moderate to High		
FEMA Classification	Zone AE		
Invasive Vegetation Observed	Multiflora rose (<i>Rosa multiflora</i>) Chinese privet (<i>Ligustrum sinense</i>)		

1.3 Vegetation Condition and Comparison to Success Criteria

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 NCDENR's 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 NCDENR guidance requires survival of at least 320 native, planted, hardwood stems/acre (trees only) the end of the MY 5 to successfully earn riparian buffer credit.

Vegetation is currently being assessed using plot layouts consistent with the EEP/Carolina Vegetation Survey (CVS) Level II Vegetation Protocol. Stem count data is ascertained from 12 permanently placed 10-meter² vegetation plots (Figures 3a and 3b). Assessments include counts of both planted and natural stems. Due to the timing of MY1 vegetation surveys, planted hardwood species that were unknown due to age, lack of bark formation, wildlife browsing of buds, etc. were included in the MY1 stem counts. These species were identified during MY2 monitoring. Based on the current monitoring effort, two of eight vegetation plots met the minimum success criteria established for MY3 stream/wetland mitigation criteria and two of twelve plots met the criteria for riparian buffer credit. Supplemental planting is planned for the 2014-2015 planting season. Appendices B and C depict more detailed information regarding the vegetation condition, including annual

photograph comparisons and additional information regarding the proposed supplemental planting. Appendix F also contains additional information regarding vegetation monitoring and performance.

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 non-wetland areas; however, based on current site conditions, three plots (Vegetation Plots #3, #7, and #8) may likely be in wetland areas by MY4 assessments. The locations of the current plots will be reassessed during MY4 activities.

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.

A bankfull event was recorded during September 2014. Evidence of this event consisted of wrack material above the bankfull indicators along the channel and cork shavings within the crest gauge present at approximately 38 inches. 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 EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

Boundary marking along the conservation easement using signage consistent with EEP guidelines was performed by Ecological Engineering on December 8, 2014. A report detailing the boundary marking effort is in preparation to EEP. Boundary marking will be reviewed and amended as needed based on EEP comment, and additional information will be provided in the MY3 (2015) report.

During MY2 monitoring, a recently constructed beaver dam was observed within the channel. The location of this dam is shown in Figure 3a.

2.0 METHODOLOGY

This monitoring report follows methodology consistent with EEP's Procedural Guidance and Content Requirements for EEP Monitoring Reports (Version 1.4, dated 11/07/11), available at EEP's website (<http://www.nceep.net>).

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 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 EEP during the review of the draft MY2 monitoring report, future surveys of longitudinal profile data will incorporate more detailed data collection than has been shown to date. Please refer to Appendix F for additional information regarding survey methodology for future monitoring years.

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 the cross section.

Vegetation assessments were conducted using the CVS-EEP protocol (Version 4.2). As part of this protocol, vegetation is assessed using 100-meter² 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-EEP 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.

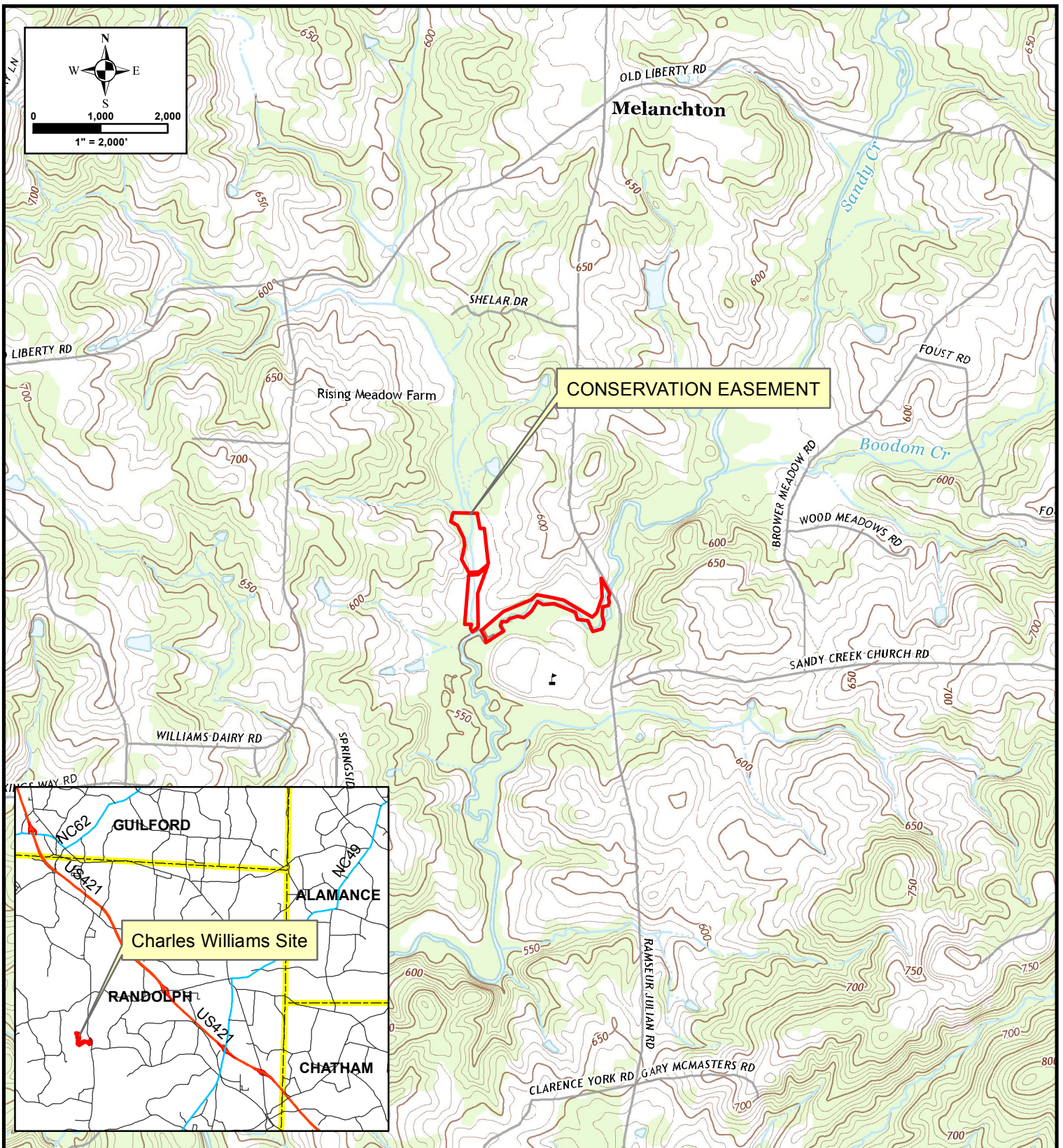
A crest gauge was installed near the downstream end of the Site along the UT to verify the on-site occurrences of bankfull events. In addition to the crest gauge, observations of recently deposited overbank wrack and/or sediment serve to validate gauge observations, as necessary. Documentation of the 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

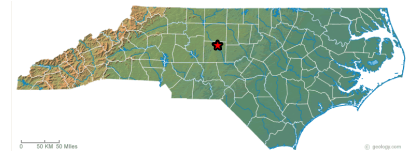
- Lee, Michael T., R.K. Peet, S.D. Roberts and T.R. Wentworth, 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (<http://cvs.bio.unc.edu/methods.htm>).
- NCDENR Division of Water Quality (NCDWQ) , 2005. Cape Fear River Basinwide Management Plan. Available at: <http://portal.ncdenr.org/web/wq/ps/bpu/basin/capefear>.
- 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.
- NC State Climate Office, 2014. 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 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.



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

Randolph Co., NC

November 2014

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' - 100')	Sandy Creek and UT to Sandy Creek		119,203 square feet		R	R	119,203	1 : 1	
Buffer Restoration (101' - 200')	Sandy Creek and UT to Sandy Creek		63,704 square feet		R	R	15,926	4 : 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): 1 year, 9 months

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

Number of Reporting Years: 2

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
Bare-rooted Planting Applied		February-14
Baseline Monitoring Document	June-13	July-13
Year 1 Monitoring	March-14	May-14
Year 2 Monitoring	September-14	November-14
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring (vegetation only)		

Table 3. Project Contact Table

Charles Williams Stream Wetland and Buffer Site / 80

Designer Ecological Engineering, LLP Jenny S. Fleming, PE	Firm Information/ Address 1151 SE Cary Parkway, Suite 101, Cary, NC 27518 (919) 557-0929
Construction Contractor Riverworks, Inc. Bill Wright	Firm Information/ Address 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Hauling Contractor Strader Fencing, Inc.	Firm Information/ Address 5434 Amick Road, Julian, NC 27283 (336) 697-7005
Planting Contractor(s) Carolina Silvics, Inc. (bare-rooted & containerized) Mary-Margaret S. McKinney, RF, PWS Riverworks, Inc. (livestakes only) George Morris	Firm Information/ Address 908 Indian Trail Road, Edenton, NC 27932 (252) 482.8491 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Seeding Contractor Strader Fencing, Inc. Kenneth L. Strader	Firm Information/ Address 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 Ecological Engineering, LLP David Cooper, Ed Hajnos, Reid Robol (stream, vegetation & wetland)	Firm Information/ Address 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

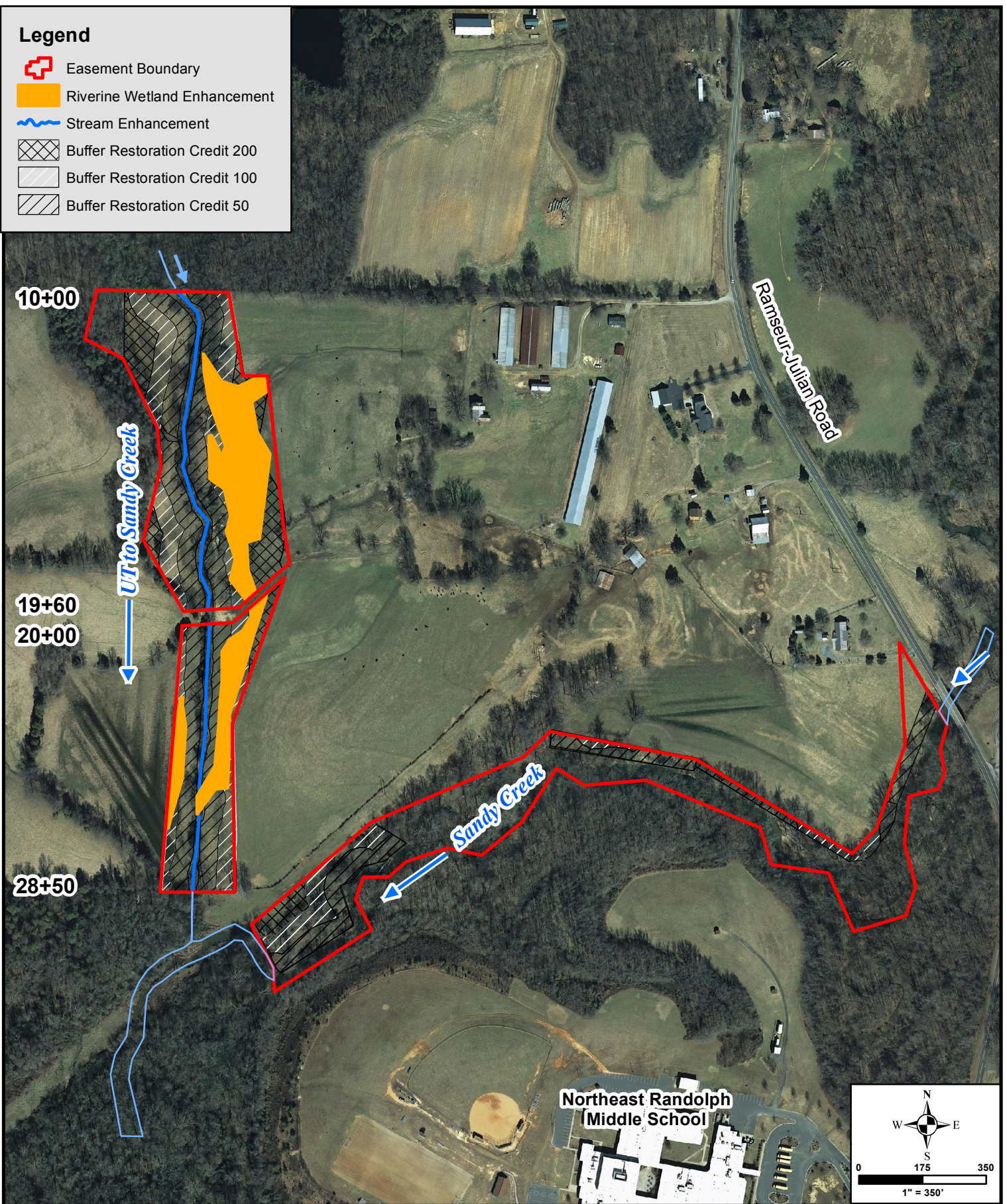
Project Information	
Project Name	Charles Williams Stream Wetland and Buffer Site
County	Randolph
Project Area	18 acres
Project Coordinates (latitude and longitude)	35°49'31.95" North/ 79°39'02.64" West
Project Watershed Summary Information	
Physiographic Province	Piedmont
River Basin	Cape Fear
USGS 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

Legend

-  Easement Boundary
-  Riverine Wetland Enhancement
-  Stream Enhancement
-  Buffer Restoration Credit 200
-  Buffer Restoration Credit 100
-  Buffer Restoration Credit 50



MITIGATION COMPONENTS
Charles Williams Site -
EEP Project No. 80

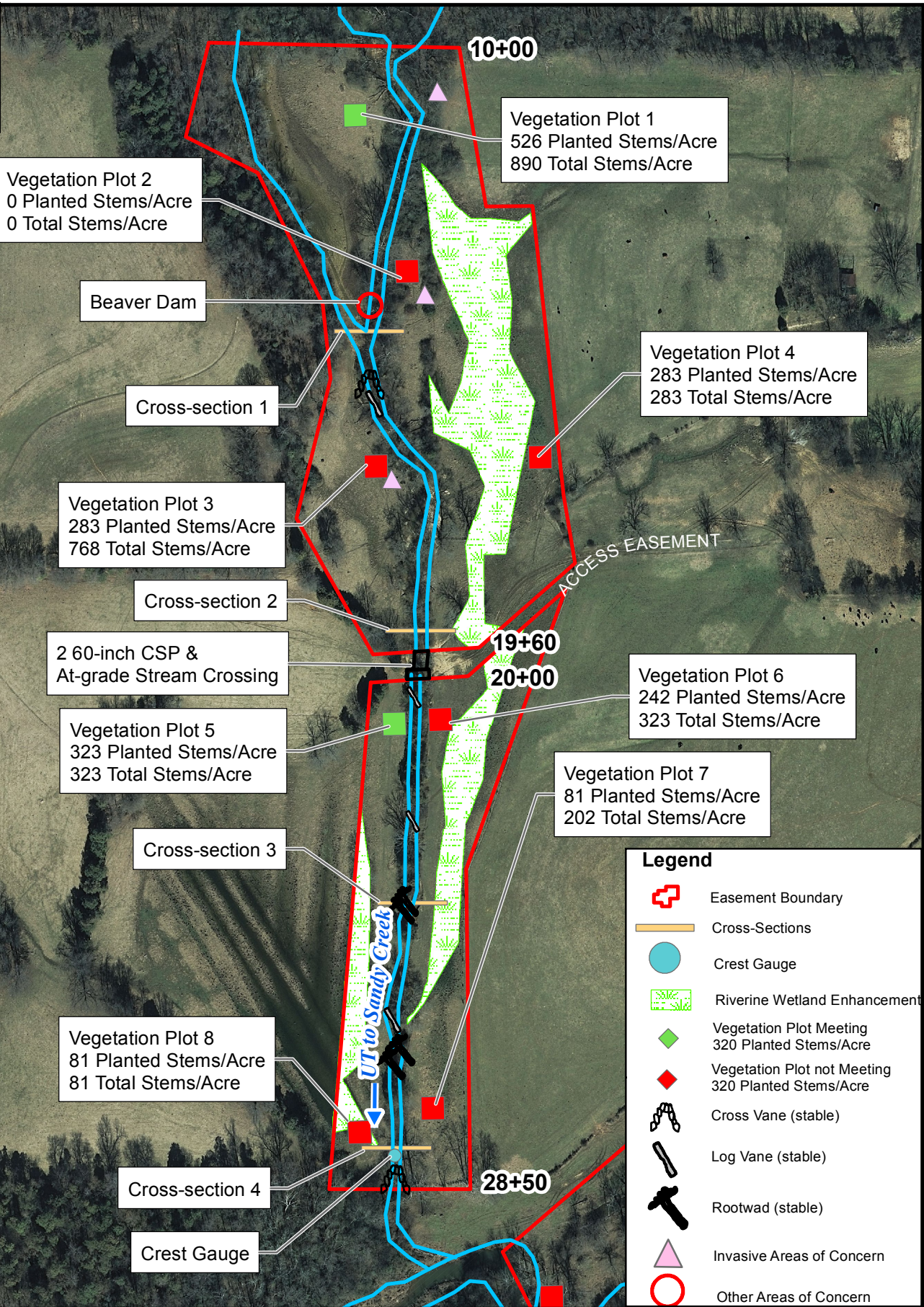
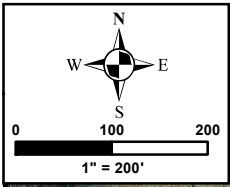
Randolph Co., NC

November 2014

Map Source:

2010 Aerial from
NCOneMap.com

FIGURE 2



Vegetation Plot 2
0 Planted Stems/Acre
0 Total Stems/Acre

Beaver Dam

Cross-section 1

Vegetation Plot 3
283 Planted Stems/Acre
768 Total Stems/Acre

Cross-section 2

2 60-inch CSP &
At-grade Stream Crossing

Vegetation Plot 5
323 Planted Stems/Acre
323 Total Stems/Acre

Cross-section 3

Vegetation Plot 8
81 Planted Stems/Acre
81 Total Stems/Acre

Cross-section 4

Crest Gauge

10+00

Vegetation Plot 1
526 Planted Stems/Acre
890 Total Stems/Acre

Vegetation Plot 4
283 Planted Stems/Acre
283 Total Stems/Acre

ACCESS EASEMENT

19+60

20+00

Vegetation Plot 6
242 Planted Stems/Acre
323 Total Stems/Acre

Vegetation Plot 7
81 Planted Stems/Acre
202 Total Stems/Acre

28+50

Legend

- Easement Boundary
- Cross-Sections
- Crest Gauge
- Riverine Wetland Enhancement
- Vegetation Plot Meeting
320 Planted Stems/Acre
- Vegetation Plot not Meeting
320 Planted Stems/Acre
- Cross Vane (stable)
- Log Vane (stable)
- Rootwad (stable)
- Invasive Areas of Concern
- Other Areas of Concern



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

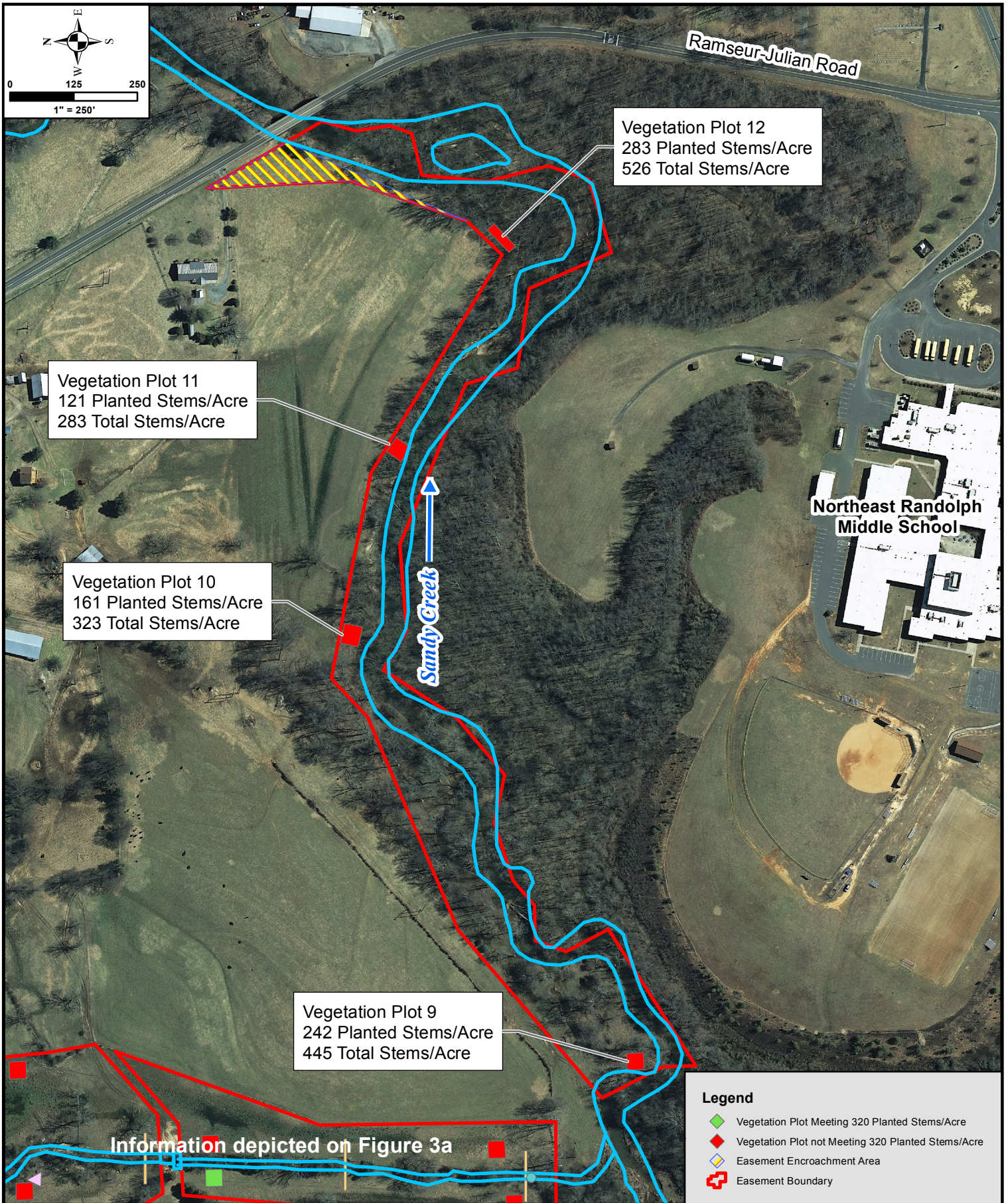
Randolph Co., NC

November 2014

Map Source:

2010 Aerial from
NCOneMap.com

FIGURE 3a



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

Randolph Co., NC

November 2014

Map Source:

2010 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	0	0	100				
		Degradation - Evidence of down-cutting.	0	0	0	0	100				
	Riffle Condition	Texture/Substrate - Riffle maintains coarser substrate.	0	0	0	0	100				
	Meander Pool Condition	Depth - Sufficient (Max. Pool Depth : Mean Bankfull Depth ratio \geq 1.6). Length - Appropriate ($>$ 30% of centerline distance between tail of upstream riffle and head of downstream riffle).	4	5	4	4	80				
Bank	Thalweg Position	Thalweg centering at upstream of meander bend (run).	8	8	8	8	100				
		Thalweg centering at downstream of meander bend (glide).	7	8	7	80					
Bank	Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.	0	0	0	0	100	none	none	n/a	
		Banks undercut/overhanging to the extent that mass wasting appears likely.	0	0	0	0	100	none	none	n/a	
		Does NOT include undercuts that are modest, appear sustainable and are providing habitat.	0	0	0	0	100	none	none	n/a	
Engineered Structures	Mass Wasting	Bank slumping, calving, or collapse.	0	0	0	0	100	none	none	n/a	
		Totals	0	0	0	0	95	n/a	n/a	n/a	
		Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8	8	8	8			
		Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3	3	3	3			
		Piping	Structures lacking any substantial flow underneath sills or arms.	8	8	8	8	8			
Habitat	Bank Protection	Bank erosion with the structures extent of influence does NOT exceed 15%.	8	8	8	8	8				
		Pool forming structures maintaining - Max. Pool Depth : Mean Bankfull Depth ratio $>$ 1.6. Rootwads/logs providing some cover at base-flow.	3	3	3	3	3				

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	n/a	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	See CCPV	10	+/- 0.1 ac.	<1%
			Total	n/a	n/a	n/a
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	n/a	n/a	n/a
			Cumulative Total	n/a	n/a	n/a
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	3	<.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)

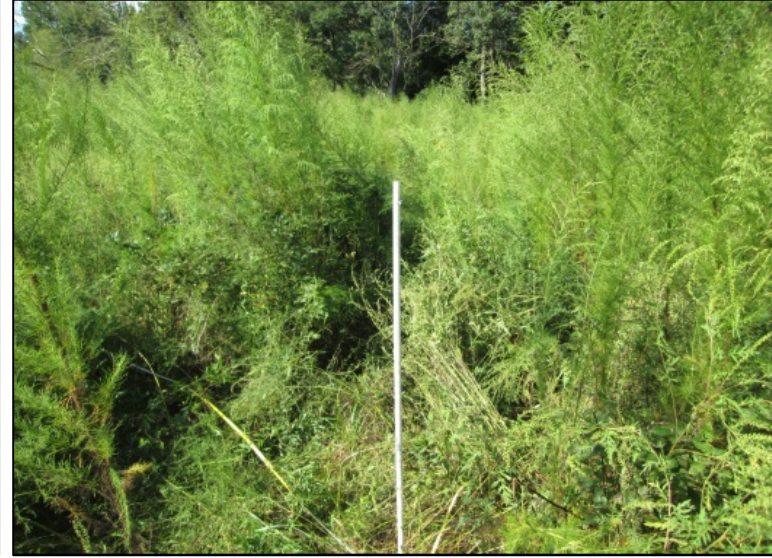
MY1 (March 2014)

MY2 (September 2014)

Vegetation Plot 1
Facing Southwest



Vegetation Plot 2
Facing Southwest



Vegetation Plot 3
Facing Southwest



Baseline MY0 (June 2013)



Vegetation Plot 4
Facing Southwest

MY1 (March 2014)



MY2 (September 2014)



Vegetation Plot 5
Facing Southwest



Vegetation Plot 6
Facing Southwest



Baseline MY0 (June 2013)

MY1 (March 2014)

MY2 (September 2014)

Vegetation Plot 7
Facing Southwest



Vegetation Plot 8
Facing Southwest



Vegetation Plot 9
Facing Southwest



Baseline MY0 (June 2013)



Vegetation Plot 10
Facing Southwest

MY1 (March 2014)



MY2 (September 2014)



Vegetation Plot 11
Facing Southwest



Vegetation Plot 12
Facing Southwest



Baseline MY0 (June 2013)



Cross Section 1
Facing West

MY1 (March 2014)



MY2 (September 2014)



Cross Section 1
Facing
Downstream



Baseline MY0 (June 2013)



Cross Section 2
Facing West

MY1 (March 2014)



MY2 (September 2014)



Cross Section 2
Facing
Downstream



Cross Section 3
Facing West



Baseline MY0 (June 2013)



Cross Section 3
Facing
Downstream

MY1 (March 2014)



MY2 (September 2014)



Cross Section 4
Facing West



Cross Section 4
Facing
Downstream



APPENDIX C

Vegetation Plot Data

Planted Vegetation Summary

During MY2 monitoring, competition from dense native herbaceous vegetation was observed, and contributed to low planted woody stem counts in 10 of the 12 Vegetation Plots. Supplemental planting and herbaceous control is proposed between December 2014 and March 2015 to augment planted woody stems. Please refer to the letter and tables below.

Proposed Supplemental Planting Letter



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 be 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

Office: 252-482-8491

Fax: 252-482-8491

Web: www.carolinasilvics.com



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 activities 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 EEP

Sandy Creek (Charles Williams)						
Species	Type	Riparian		Wetland		Nursery
		Qty	%	Qty	%	
<i>Betula nigra</i>	2-0 BR	300	10%	100	11%	NCFS
<i>Carya glabra</i>	2-0 BR	100	3%			NCFS
<i>Carya tomentosa</i>	2-0 BR	200	7%			NCFS
<i>Fraxinus pennsylvanica</i>	2-0 BR	275	9%	100	11%	NCFS
<i>Liriodendron tulipifera</i>	2-0 BR	400	13%			NCFS
<i>Platanus occidentalis</i>	2-0 BR	225	7%	200	23%	NCFS
<i>Quercus falcata var. pagodifolia</i>	2-0 BR	300	10%	100	11%	NCFS
<i>Quercus nigra</i>	2-0 BR			100	11%	NCFS
<i>Quercus phellos</i>	2-0 BR	600	20%	200	23%	NCFS
<i>Quercus rubra</i>	2-0 BR	300	10%			NCFS
<i>Amelanchier arborea</i>	1-gal	25	1%			Native Roots
<i>Carpinus caroliniana</i>	1-gal	85	3%			Native Roots
<i>Chionanthus virginicus</i>	1-gal	64	2%			Native Roots
<i>Diospyros virginiana</i>	2-0 BR	200	7%			NCFS
<i>Ilex verticillata</i>	1-gal			37	4%	Native Roots
<i>Magnolia virginiana</i>	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	Stream/Wetland Veg. = 67% Buffer Veg. = 100%
2	No	No	
3	No	No	
4	No	No	
5	Yes	Yes	
6	No	No	
7	No	No	
8	No	No	
9	n/a	No	
10	n/a	No	
11	n/a	No	
12	n/a	No	

Notes:

Previously unidentified planted woody stems were identified during MY2 vegetation counts.

Supplemental planting at approximately 300 stems per acre is proposed between December 2014 and March 2015.

Table 8. CVS Vegetation Plot Metadata
Charles Williams Stream, Wetland, and Buffer Site / 80

Report Prepared By	David Cooper
Date Prepared	9/17/2014 12:24
database name	SandyCreekCharlesWilliams_80_RandolphCounty_Year 2.mdb
database location	P:\10000 Consultants\10227 Sungate\10227-017_Charles Williams Monitoring\CVS Database
computer name	WKST6
file size	63438848

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

APPENDIX D

Stream Survey Data

Cross Section Plot Exhibits

River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 1, Rifle, STA. 14+41
Drainage Area (sq mi):	4.9
Date:	9/16/2014
Field Crew:	E. Hajnos, R. Robol

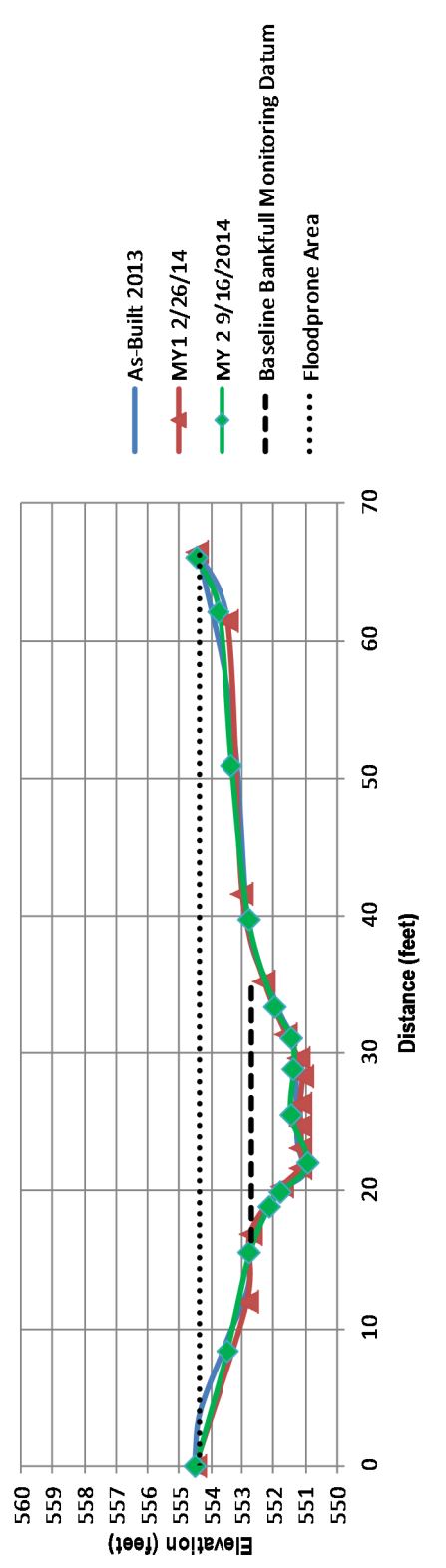
Station	Elevation
0.0	554.5
8.3	553.5
15.5	552.8
18.8	552.2
19.9	551.8
22.0	550.9
25.5	551.5
28.9	551.4
31.1	551.4
33.3	551.9
39.7	552.8
50.9	553.3
62.1	553.7
66.1	554.5



Stream Type: C5 Photograph facing downstream @ XS 1

SUMMARY DATA	
Bankfull Elevation:	552.8
Bankfull Cross Sectional Area:	22.7
Bankfull Width:	23.9
Flood Prone Area Elevation:	554.7
Flood Prone Width:	66.1
Max. Depth at Bankfull:	1.8
Mean Depth at Bankfull:	0.9
Width/Depth Ratio:	25.2
Entrenchment Ratio:	2.8
Bank Height Ratio:	1.0

UT to Sandy Creek, Cross Section 1, Rifle, Station: 14+41



River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 2, Glide, STA. 19+36
Drainage Area (sq mi):	4.9
Date:	9/16/2014
Field Crew:	E. Hajnos, R. Robol

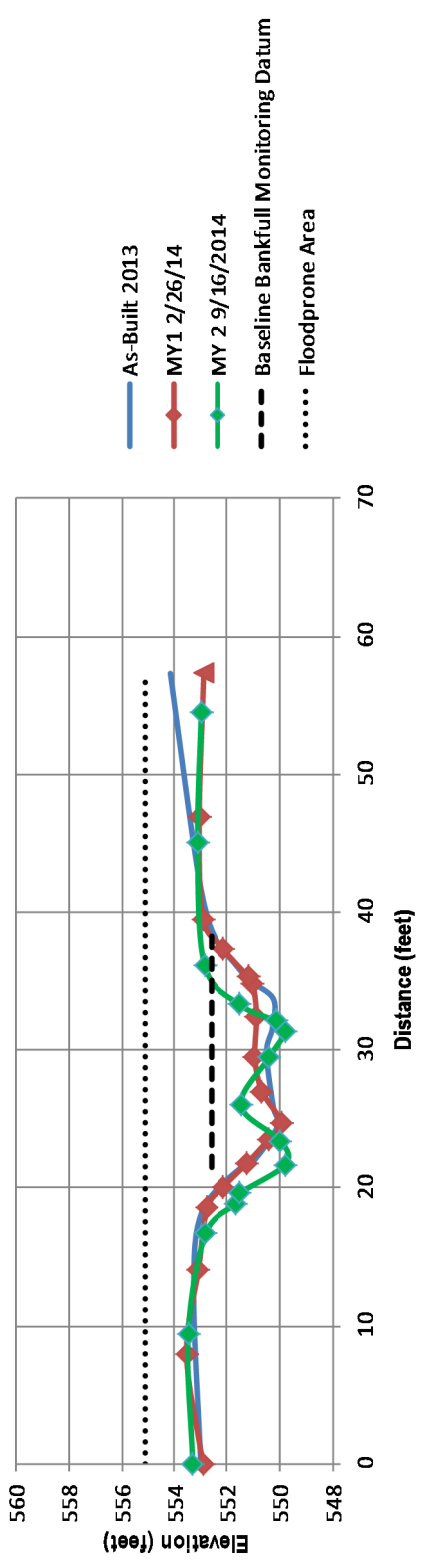
Station	Elevation
0.0	553.3
9.4	553.5
16.7	552.8
18.9	551.6
19.6	551.5
21.7	549.8
23.4	550.0
26.0	551.5
29.5	550.4
31.4	549.8
32.1	550.1
33.3	551.5
36.2	552.9
45.0	553.1
54.5	553.0



Stream Type: C5 Photograph facing downstream @ XS 2

SUMMARY DATA	
Bankfull Elevation:	552.83
Bankfull Cross Sectional Area:	35.3
Bankfull Width:	19.4
Flood Prone Area Elevation:	555.9
Flood Prone Width:	200+
Max. Depth at Bankfull:	3.1
Mean Depth at Bankfull:	1.8
Width/Depth Ratio:	10.7
Entrenchment Ratio:	>10
Bank Height Ratio:	1.0

UT to Sandy Creek, Cross Section 2, Run, Station: 19+36





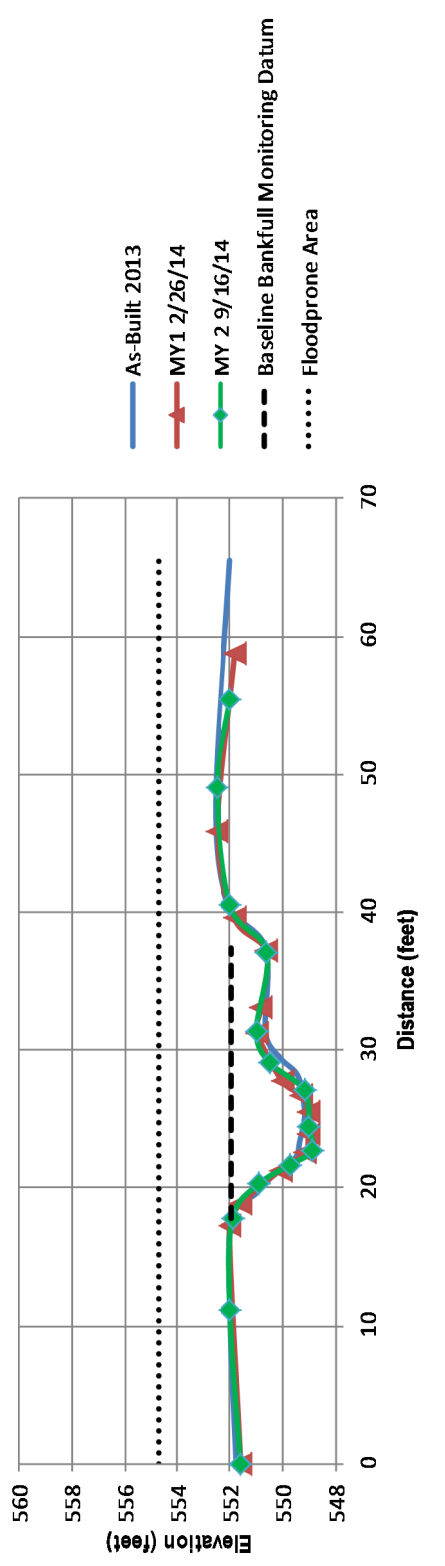
Stream Type: C5 Photograph facing downstream @ XS 3

Station	Elevation
0.0	551.6
11.2	552.0
17.8	551.9
20.3	550.9
21.7	549.7
22.7	548.9
24.4	549.0
27.1	549.2
29.1	550.5
31.3	551.0
37.1	550.6
40.5	552.0
49.0	552.5
55.4	552.0

River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 3, Run, STA. 23+49
Drainage Area (sq mi):	4.9
Date:	9/16/2014
Field Crew:	E. Hajnos, R. Robol

SUMMARY DATA	
Bankfull Elevation:	551.9
Bankfull Cross Sectional Area:	33.5
Bankfull Width:	20.1
Flood Prone Area Elevation:	554.9
Flood Prone Width:	200+
Max. Depth at Bankfull:	3.0
Mean Depth at Bankfull:	1.7
Width/Depth Ratio:	12.1
Entrenchment Ratio:	>8
Bank Height Ratio:	1.0

UT to Sandy Creek, Cross Section 3, Glide, Station: 23+49



River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 4, Riffle, STA. 27+14
Drainage Area (sq mi):	4.9
Date:	9/16/2014
Field Crew:	E. Hajnos, R. Robol

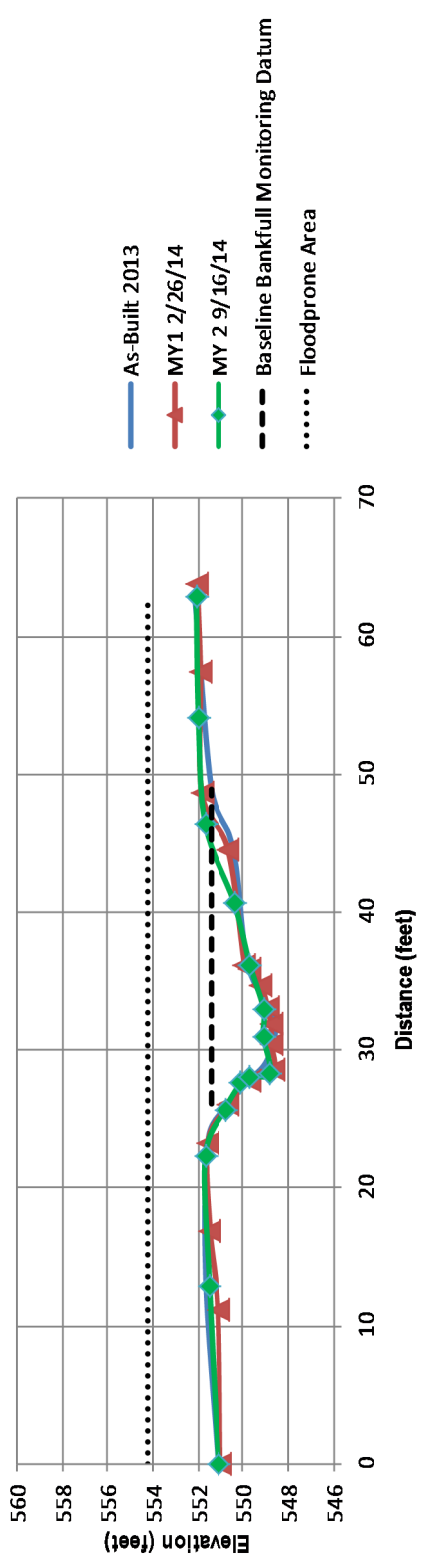
Station	Elevation
0.0	551.1
12.9	551.5
22.3	551.7
25.7	550.8
27.6	550.1
28.1	549.7
28.3	548.8
31.0	549.1
33.0	549.1
36.2	549.7
40.7	550.4
46.4	551.7
54.1	552.0
62.9	552.1



Stream Type: C5 Photograph facing downstream @ XS 4

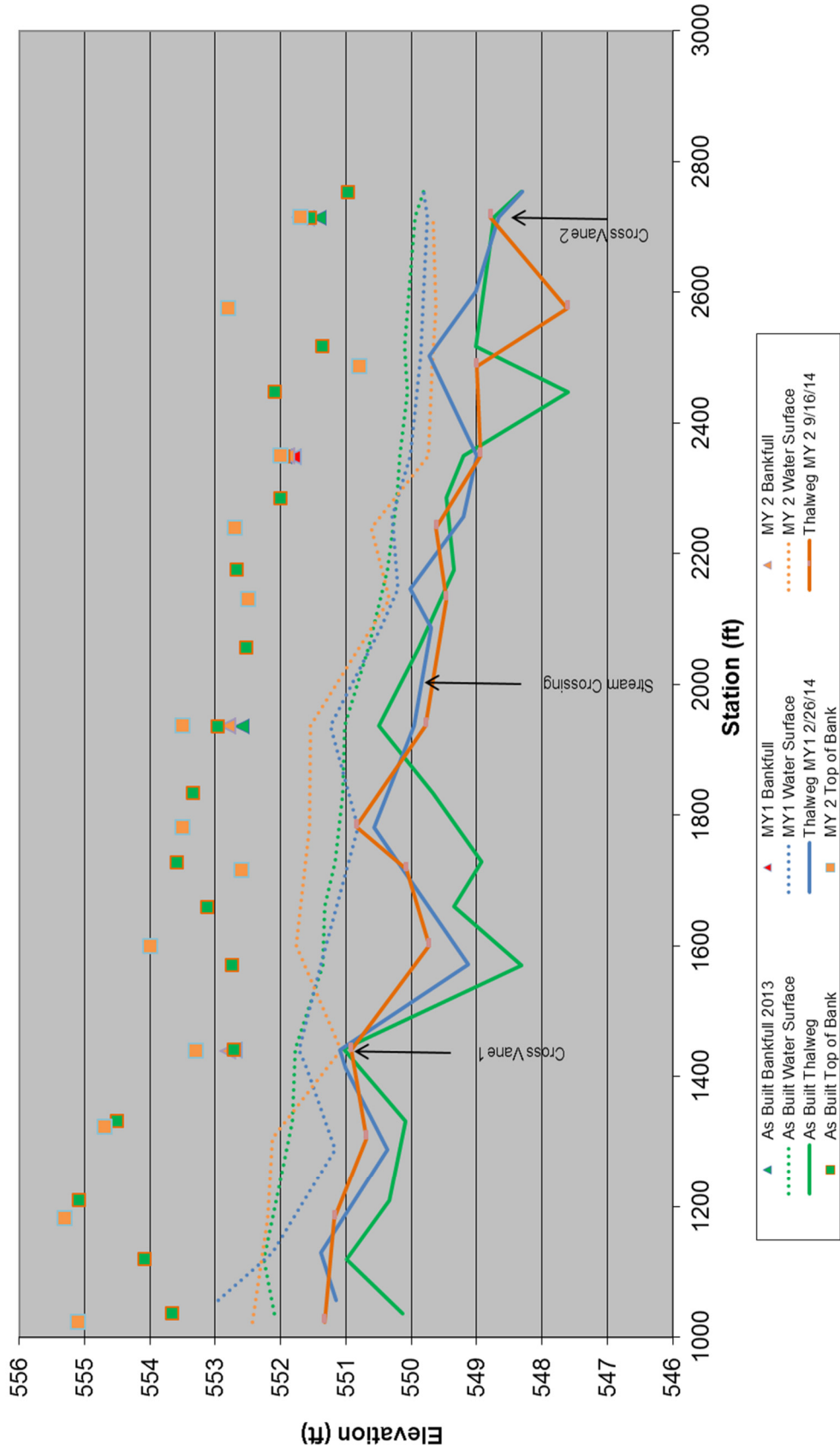
SUMMARY DATA	
Bankfull Elevation:	551.7
Bankfull Cross Sectional Area:	37.1
Bankfull Width:	24.1
Flood Prone Area Elevation:	554.6
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.9
Mean Depth at Bankfull:	1.5
Width/Depth Ratio:	15.6
Entrenchment Ratio:	>8.0
Bank Height Ratio:	1.0

UT to Sandy Creek, Cross Section 4, Riffle, Station: 27+14



Longitudinal Profile Plot Exhibit

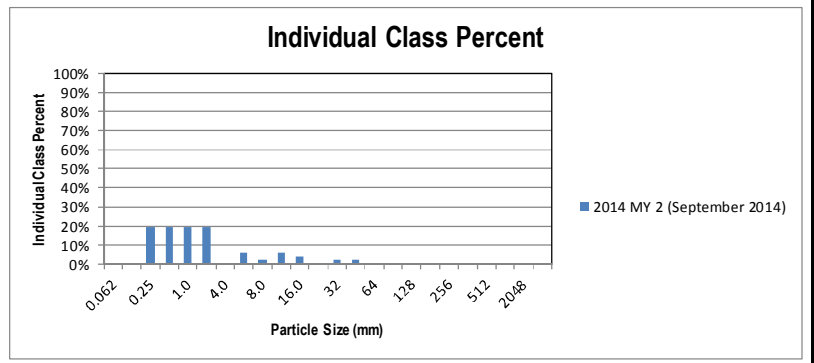
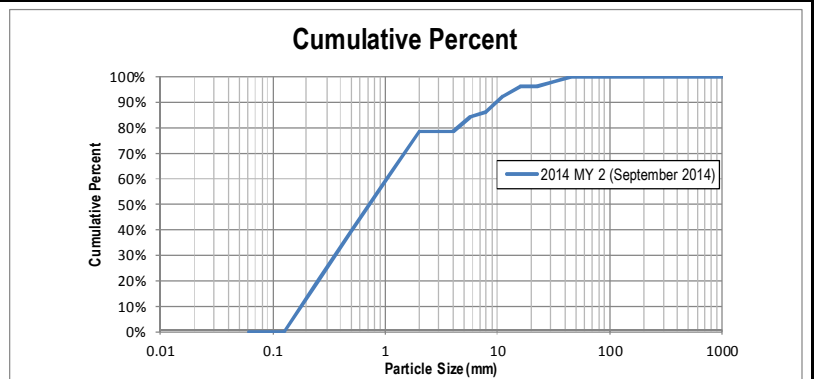
Profile Reach (UT Sandy Creek Sta. 10+00 to 17+53)



Cross Section Pebble Count Exhibits

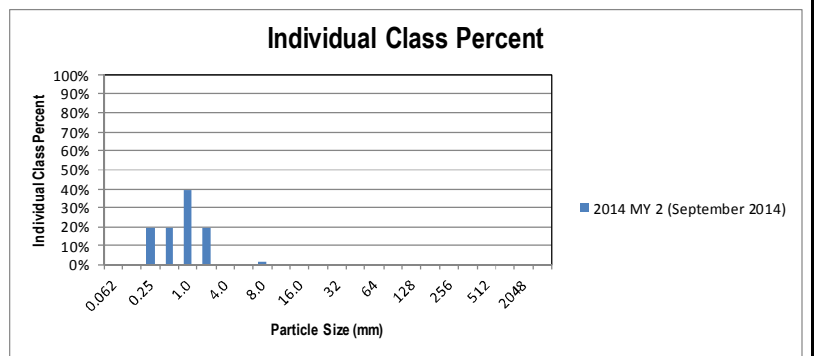
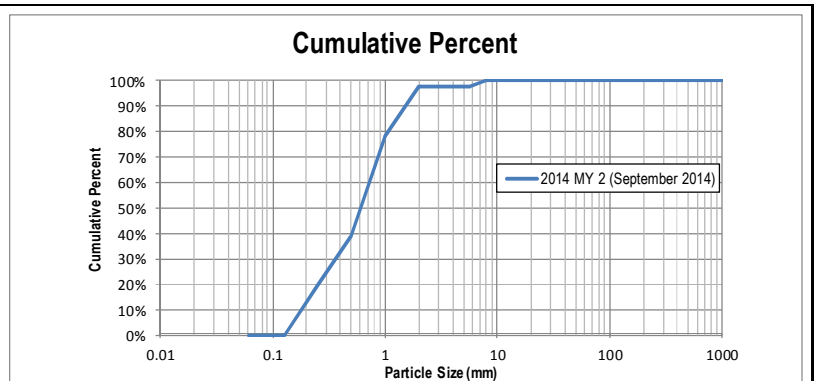
Charles Williams Stream, Wetland, and Buffer Site / 80					
Cross Section: 1					
Feature: Riffle					
2014 MY 2 (September 2014)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.25	10	20%	20%
	medium sand	0.5	10	20%	39%
	coarse sand	1.0	10	20%	59%
	very coarse sand	2.0	10	20%	78%
Gravel	very fine gravel	4.0	0	0%	78%
	fine gravel	5.7	3	6%	84%
	fine gravel	8.0	1	2%	86%
	medium gravel	11.3	3	6%	92%
	medium gravel	16.0	2	4%	96%
	coarse gravel	22.3	0	0%	96%
	coarse gravel	32	1	2%	98%
	very coarse gravel	45	1	2%	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			51	100%	

Summary Data	
D50	0.70 mm
D84	5.7 mm
D95	16 mm



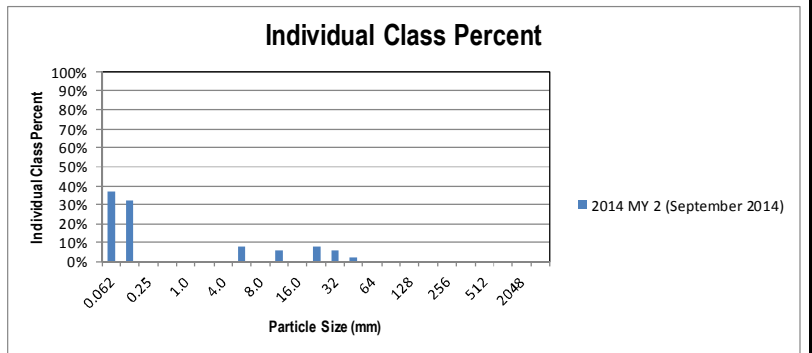
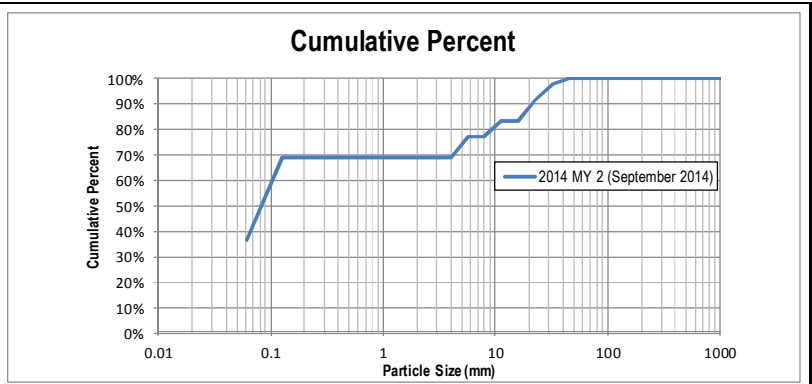
Charles Williams Stream, Wetland, and Buffer Site / 80					
Cross Section: 2					
Feature: Glide					
2014 MY 2 (September 2014)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.25	10	20%	20%
	medium sand	0.5	10	20%	39%
	coarse sand	1.0	20	39%	78%
	very coarse sand	2.0	10	20%	98%
Gravel	very fine gravel	4.0	0	0%	98%
	fine gravel	5.7	0	0%	98%
	fine gravel	8.0	1	2%	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			51	100%	

Summary Data	
D50	0.60 mm
D84	1.40 mm
D95	1.8 mm



Charles Williams Stream, Wetland, and Buffer Site / 80					
Cross Section: 3					
Feature: Run					
2014 MY 2 (September 2014)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	18	37%	37%
Sand	very fine sand	0.125	16	33%	69%
	fine sand	0.25	0	0%	69%
	medium sand	0.5	0	0%	69%
	coarse sand	1.0	0	0%	69%
	very coarse sand	2.0	0	0%	69%
Gravel	very fine gravel	4.0	0	0%	69%
	fine gravel	5.7	4	8%	78%
	fine gravel	8.0	0	0%	78%
	medium gravel	11.3	3	6%	84%
	medium gravel	16.0	0	0%	84%
	coarse gravel	22.3	4	8%	92%
	coarse gravel	32	3	6%	98%
	very coarse gravel	45	1	2%	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			49	100%	

Summary Data	
D50	0.07 mm
D84	11.3 mm
D95	30 mm



Charles Williams Stream, Wetland, and Buffer Site / 80					
Cross Section: 4					
Feature: Riffle					
2014 MY 2 (September 2014)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.25	0	0%	0%
	medium sand	0.5	0	0%	0%
	coarse sand	1.0	10	20%	20%
	very coarse sand	2.0	19	38%	58%
Gravel	very fine gravel	4.0	5	10%	68%
	fine gravel	5.7	0	0%	68%
	fine gravel	8.0	0	0%	68%
	medium gravel	11.3	0	0%	68%
	medium gravel	16.0	10	20%	88%
	coarse gravel	22.3	2	4%	92%
	coarse gravel	32	0	0%	92%
	very coarse gravel	45	4	8%	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	1.70 mm
D84	15.0 mm
D95	39.0 mm

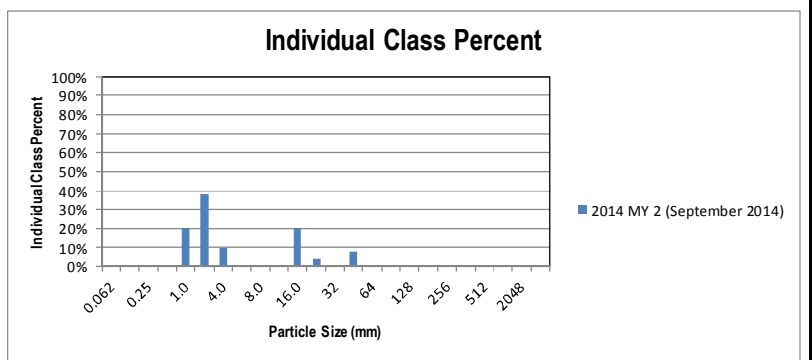
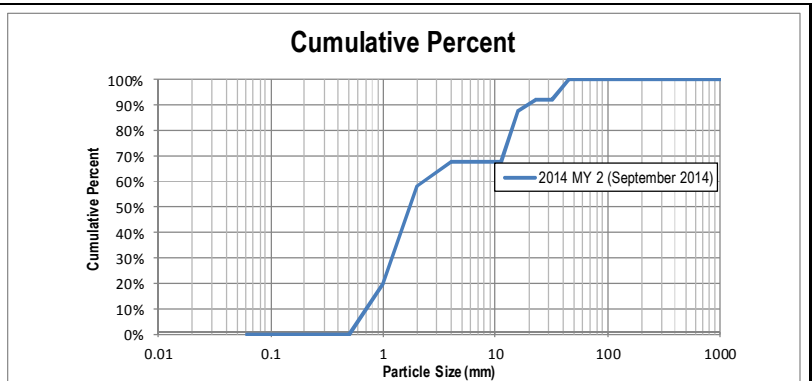


Table 10a. Baseline Stream Data Summary
Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Gauge ²	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline						
		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	
Dimension and Substrate - Riffle Only																										
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/ft 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)						
	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+
Based on fixed baseline bankfull elevation¹																												
Record elevation (datum) used																												
Bankfull Width (ft)	22.0	22.6	23.9					19.6	20.5	19.4				22.6	18.8	20.1				24.9	24.5	24.1						
Floodprone Width (ft)	63.0	65.4	66.1					200+	200+	200+				200+	200+	200+				200+	200+	200+						
Bankfull Mean Depth (ft)	1.0	1.0	0.9					1.7	1.6	1.8				1.6	1.5	1.7				1.5	1.5	1.5						
Bankfull Max Depth (ft)	1.7	1.6	1.8					2.5	2.8	3.1				2.8	2.8	3				2.8	2.9	2.9						
Bankfull Cross Sectional Area (ft ²)	21.7	22.5	22.7					33.4	32.8	35.3				36.4	29.0	33.5				36.1	37.8	37.1						
Bankfull Width/Depth Ratio	322.3	22.7	25.2					11.5	12.9	10.7				14.0	12.2	12.1				16.6	15.8	15.6						
Bankfull Entrenchment Ratio	2.9	2.9	2.8					>10.0	>10.0	>10				>8.0	>8.0	>8.0				>8.0	>8.0	>8.0						
Bankfull Bank Height Ratio	1.0	1.0	1.0					1.1	1.1	1.0				1.0	1.0	1.0				1.0	1.0	1.0						
Based on current/developing bankfull feature²																												
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: 1,748 linear feet

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5					
	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
Dimension and Substrate - Riffle only																																				
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																		
Floodprone Width (ft)	63	>131	200+	200+		2	65.4	>132.7	200+	200+		2	66.1	>133	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 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																		
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																		
Width/Depth Ratio	>15	>15	>15	>15		2	>15	>15	>15	>15		2	>15	>15	>15	>15		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																		
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																		
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																		
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																		
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																		
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																		
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																		
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																				
Channel Thalweg length (ft)				1748						1748						1748																				
Sinuosity (ft)				1.06						1.06						1.06																				
Water Surface Slope (Channel) (ft/ft)				0.0013						0.0013						0.0018																				
BF slope (ft/ft)				0.0013						0.0013						0.0010																				
³ Ri% / Ru% / P% / G% / S%	5%	80%	15%				5%	80%	15%				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																				
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

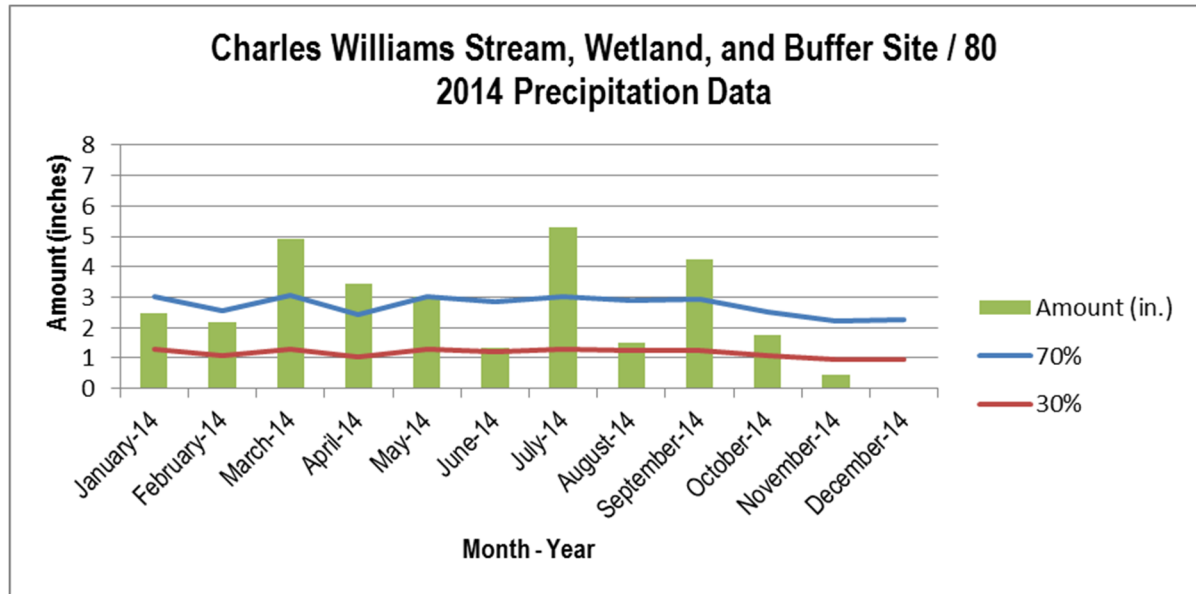
Hydrology Data

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

**Charles Williams Stream, Wetland, and Buffer Site / 80
2014 Precipitation Data**



APPENDIX F

Response to EEP Comments – Draft MY2 Report



1151 SE Cary Parkway, Suite 101
Cary, North Carolina 27518
(919) 557-0929
www.ecologicaleng.com

December 17, 2014

Ms. Kristie Corson
EEP Project Manager
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Subject: Response to Comments - DRAFT Annual Monitoring Report – Monitoring Year 2 (2014)
Sandy Creek (Charles Williams) Site Monitoring
Cape Fear River Basin – CU# 03030002
Randolph County, North Carolina
Contract No. 004682 – Task 5
EEP Project # 80

Dear Ms. Corson:

Thank you for your comment letter dated December 15, 2014 based on your review of the draft Monitoring Year 02 Report for Sandy Creek - Charles Williams Stream, Wetland and Buffer Site (EEP Project #80). Per our recent phone conversation, please find the comments addressed individually below, and do not hesitate to contact me with any additional questions. A revised monitoring report is in preparation.

We appreciate your assistance with this project to date.

ECOLOGICAL ENGINEERING, LLP

David Cooper,
Project Scientist

- ***Comment:*** Table 9 – The MYI data reports 0 planted stems and 0 total stems for Veg Plot #2. NCEEP staff visited the site on December 11, 2014, and counted 4 stems in Veg Plot #2. MYO report data included 5 total stems. The MYI data reports 2 planted stems for Veg Plot# 8. NCEEP staff counted 5 flagged stems (3 stems live stems, 1 dead stem, 1 re-sprout).
- ***Response:*** Table 9 only shows live, planted stems and does not account for flagged, planted stems which were either not located or which were located but found to be apparently dead. Data collection for MY1 (per CVS notation) was performed on September 16, 2014.

With regard to Veg. Plot #2 – during data collection, 4 planted stems were located. All located stems were considered dead. A fifth planted stem was not located and was labeled as missing. Table 9 shows 0 live, planted stems.

With regard to Veg. Plot #8 – during data collection, 6 planted stems were located. 4 of these stems were labeled as dead, 1 was a normal live stem, and 1 was a re-sprout. Two additional stems were not located and were labeled as missing. Table 9 shows 2 live, planted stems.

It is possible that some of the stems which were considered dead at the time of data collection may re-sprout in the coming season. If this is observed our data will be amended to show re-sprouts as needed.

- ***Comment: Please confirm if the data collected for MYI was accurately entered into CVS.***
 - ***Response:*** We have confirmed, by reviewing the hard copies of the field data sheets and comparing to the data entered into the CVS database, that the data were accurately entered. As noted above, report Table 9 only captures live, planted stems and does not account for dead or missing stems which were entered into the database.

- ***Comment: Please describe the reason for the reduced stem count between MYO and MYI.***
 - ***Response:*** We suspect there may be multiple reasons for the reduced stem count between MYO and MYI (per CVS notation). The primary cause appears to be the vigorous, dense, tall herbaceous growth across many areas of the site. Herbaceous cover was observed to overwhelm and weight down small, planted bare-root stems, and made accurate data collection (finding the planted stems) very difficult. The reduced stem count is likely attributable to the heavy herbaceous cover, which lowers vigor of planted stems and makes location of stems more difficult.

As previously noted, data collection for MY1 (per CVS notation) was performed on September 16, 2014. To improve likelihood of finding planted stems, data collection in subsequent monitoring years will be performed earlier in the growing season, prior to full annual growth of herbaceous cover.

- ***Comment: The Profile Reach data between Station 2300 and 2700 appears incorrect. Please confirm.***
 - ***Response:*** A comparison of As-built, MY1, and MY2 longitudinal profile charts does indeed show what appears to be incorrect data. Specifically, As-built data show a pool at station 2447, MY1 data show no pool in this area, and MY2 data show a pool at station 2575.

To determine the cause of this data representation, the raw point files were opened in Microstation and viewed in plan view. Longitudinal profile data shots were observed to be spaced widely apart and inconsistent in location between subsequent monitoring years. Due to the lack of detailed data collection, it is currently not possible to determine the actual longitudinal profile of the stream. There may be a single pool migrating downstream, or it is also possible that different pools were captured between As-built and MY2 data collection and the pools were completely missed during MY1. Because data points were not taken in the same spots, we cannot currently assess which of these possibilities is correct.

To improve the accuracy of subsequent longitudinal profile charts, greater detail will be collected in the field. An effort will be made to capture grade breaks (including individual pools and riffles) at more closely spaced intervals than have been captured in the past.

- **Comment: Please add the station numbers to the Plan Views.**
 - Response: We have added the station numbers to the Plan Views.
- **Comment: Figure 3b - Veg Plot #12 total stems/acre should read ~~536~~ 526.**
 - Response: We have corrected this typographic error on Figure 3b.
- **Comment: Please revise as necessary and provide 3 hardcopies and 1 pdf copy.**
 - Response: We will provide the requested revised MY2 report.