Mitigation Project Name	Roses Creek Stream Restoration Site	County	Burke	USACE Action ID	2014-00517
DMS ID	96309	Date Project Instituted	2/14/2014	NCDWR Permit No	2014-0194
River Basin	Catawba	Date Prepared	5/22/2018		
Cataloging Unit	03050101				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)				5,009.600										
Potential Credits (As-Built Survey)				5,009.600										
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%			1,502.880	2016	9/22/2016	N/A				N/A		N/A	N/A
3 (Year 1 Monitoring)	10%			500.960	2017	4/3/2017	N/A				N/A		N/A	N/A
4 (Year 2 Monitoring)	10%			500.960	2018	4/25/2018	N/A				N/A		N/A	N/A
5 (Year 3 Monitoring)	10%				2019		N/A				N/A		N/A	N/A
6 (Year 4 Monitoring)	5%				2020		N/A				N/A		N/A	N/A
7 (Year 5 Monitoring)	10%				2021		N/A				N/A		N/A	N/A
8 (Year 6 Monitoring)	5%				2022		N/A				N/A		N/A	N/A
9 (Year 7 Monitoring)	10%				2023		N/A				N/A		N/A	N/A
Stream Bankfull Standard	10%													
Total Credits Released to Date				2,504.800										

DEBITS (released credits only)

Ratios			1	2	2.5	5	1	3	2	5	1	3	2	5	1	3	2	5
			Stream Restoration	Stream Enhancement I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)			4,738.000		679.000													
As-Built Amounts (mitigation credits)			4,738.000		271.600													
Percentage Released			50%		50%													
Released Amounts (feet / acres)			2,369.000		339.500													
Released Amounts (credits)			2,369.000		135.800													
NCDWR Permit	USACE Action ID	Project Name																
	2013-00803	SR 1560 - Bridge 118 - Division 13	41.000															
	2013-00806	SR 1560 - Bridge 123 - Division 13	34.000															
	2013-01764	NCDOT TIP B-5138	151.000															
	2013-01675	SR 1438 - Bridge 291 - Division 13	21.000															
	2014-00641	SR 1150 - Bridge 10 - Division 11	68.000															
	2014-00119	SR 1365 Improvements - Division 11	255.000															
	2015-00240	SR 1515 Improvements - Division 11	130.000															
	2016-00373	SR 1560 - Bridge 580125 - Division 13	100.000															
	2015-02250	SR 1369 Improvements - Division 11	41.400		203.700													
2008-0915	2008-02753	Linville Dam ESSI Project	580.000															
	2015-02250	SR 1369 Improvements - Division 11	324.120															
	2017-00893	SR 1241 - Bridge 110320 - Division 13	82.000															
	2017-00910	SR 1410 - Bridge 580284 - Division 13	67.680		35.800													
	2017-00930	SR 1258 - Bridge 110131 - Division 13			32.100													
	2017-00930	SR 1258 - Bridge 110131 - Division 13	23.160															
	2017-00928	SR 1560 - Bridge 580126 - Division 13	38.000															
	2017-00901	NCDOT TIP B-4447	99.000															
	2017-00896	SR 1798 - Bridge 580011 - Division 13	38.000															

Roses Creek

	2015-02250	SR 1369 Improvements Additional - Division 11	30.000															
Remaining Amounts (feet / acres)			**245.640**		**67.900**													
Remaining Amounts (credits)			**245.640**		**27.160**													

Contingencies (if any): None

Signature of Wilmington District Official Approving Credit Release

9/6/18
Date

1 - For NCDMS, no credits are released during the first milestone

2 - For NCDMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCDMS Portal, provided the following criteria have been met:

1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Reciept of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required

3 - A 15% reserve of credits is to be held back until the bankfull event performance standard has been met

YEAR 3 MONITORING REPORT

ROSES CREEK STREAM MITIGATION SITE
Burke County, North Carolina
NC DMS Project # 96309

Prepared for:

NCDEQ Division of Mitigation Services (DMS)
217 West Jones St., Suite 3000A
Raleigh, North Carolina 27603

Construction Completed: May 2016
Morphology Data Collected: March 28, 2018
Vegetation Data Collected: August 6, 2018
Submitted: December 18, 2018

December 18, 2018

Harry Tsomides
Project Manager
NC Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, North Carolina 28801

RE: NCDEQ – Division of Mitigation Services
Roses Creek MY 3 Monitoring Report
DMS Project Number: 96309
Response to DMS Review Comments on Draft Year 3 Monitoring Report for Roses Creek

Mr. Tsomides:

As per your letter dated November 19, 2018, we have reviewed and addressed DMS review comments as follows:

1. Continue to monitor and report on low flow silted- in sections along tributaries. Some sections are juncus-dominant. Consider moving UT2 and UT3 flow gauges farther upstream to represent the entire reach.

   Response: These low flow and silted areas will continue to be monitored. During site visits in the spring, summer and fall flow has been observed in the entire reaches of UT2 and UT3. Due to consistent visual observation of flow we propose not to relocate flow gauges at this time.

2. Significant invasives continue to grow along UT1, some privet trees are now more 10-12 feet tall. There is also scattered privet and invasives along the lower main stem. Suggest addressing as soon as practicable.

   Response: We plan to address the areas of privet and invasives along UT1 and the lower main stem as soon as practicable, likely during the winter of 2019.

3. Please provide approximate locations of site issues / problem areas on the CCPVs; these were captured in 2017 but are not on the 2018 CCPVs. The mapped locations / areas presented in the narrative and tables should all be evident on the maps and mapped with as much detail as possible, including bare areas, silted reaches, erosion, invasive polygons, etc.

Response: The CCPV has been updated to show areas that are currently of concern. Many of the areas shown in 2017 were addressed during the repair work in October, 2018. A separate Adaptive Management Map has been included in the report in Appendix F. This figure shows areas that were repaired during 2018 and areas to be addressed in the near future.

4. HDR have done a nice job and been proactive about stream repairs (and planting); the repairs looked generally good following Hurricane Florence; recommend that the 2018 repair areas be shown on a separate Adaptive Management map, similar to the map you developed for the supplemental planting in 2017, showing clearly what was done and where.

   Response: Thank you. An Adaptive Management Map has been created and is included in Appendix F.

5. Table 2 – Structural repair date is indicated as February 2017, however stream repairs were conducted in October 2018. Please correct.

   Response: This error has been corrected.

6. Surface Water Level Meter Data – The water level graphs are hard to follow and should only present the current monitoring year time frame for clarity; the sensor level should be shown; rain data should be shown concurrently if possible; following is a good example.

   Response: The water level meter graphs have been edited to show the current monitoring year only.

7. Table 1 – Total SMU should be 5009.6; we are now breaking out SMU to the tenth.

   Response: The SMU amount has been corrected.

8. Update CCPV aerial, if available, to show restored stream alignment.

   Response: An updated aerial could not be located at this time.

9. Please confirm that the Standard BHR Calculation guidance has been followed; this was sent out to all providers the week of 9/17/2018.

555 Fayetteville Street, Suite 900, Raleigh, NC 27601-3034
T 919.232.6600

Response: The Standard BHR Calculation was used for the current monitoring year. A footnote has been included in the reporting tables.

If you have any questions or need additional information, please do not hesitate to give me a call (919.900.1650)

Sincerely,
HDR | ICA

Kenton Beal

555 Fayetteville Street, Suite 900, Raleigh, NC 27601-3034
T 919.232.6600

Prepared by:

HDR | ICA
555 Fayetteville Street, Suite 900
Raleigh, North Carolina 27601
919.232.6600
919.232.6642 (fax)

I HEREBY CERTIFY THAT THE DOCUMENT CONTAINED HEREIN, ROSES CREEK YEAR 3 MONITORING REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED SEALED, AND DATED THIS 18 TH DAY OF DECEMBER 2018.

Chris L. Smith, PE

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1.0 PROJECT SUMMARY

The following report summarizes the vegetation establishment and stream stability for Year 3 monitoring for the Roses Creek Site (hereafter referred to as the "Site") in Burke County, North Carolina.

1.1 Goals and Objectives

Primary goals for the Site, as detailed in the Roses Creek Stream Mitigation Site Mitigation Plan (ICA Engineering 2015) include:

1. Reducing water quality stressors and providing/enhancing flood attenuation.
2. Restoring and enhancing aquatic, semi-aquatic and riparian habitat.
3. Restoring and enhancing habitat connectivity with adjacent natural habitats.

The following objectives accomplish the goals listed above:

1. Reducing water quality stressors and providing/enhancing flood attenuation through:
    a. Restoring the existing degraded, straightened and incised/entrenched streams as primarily a Priority 1 restoration where bankfull and larger flows can access the floodplain allowing nutrients, sedimentation, trash and debris from upstream runoff to settle from floodwaters to the extent practical. Restoring a stable dimension, pattern, and profile will ensure the channel will transport and attenuate watershed flows and sediment loads without aggrading or degrading.
    b. Restore channel banks by relocating the channel, excavating bankfull benches, placing in-stream structures to reduce shearing forces on outside meander bends, and planting native vegetative species to provide soil stability, thus reducing stream bank stressors.
    c. Reducing point source (i.e. cattle and equipment crossings) and non-point source (i.e. stormwater runoff through pastures) pollution associated with on-site agricultural operations (hay production and cattle) by exclusionary fencing from the stream and riparian buffer and by eliminating all stream crossings from the easement.
    d. Plant a vegetative buffer on stream banks and adjacent floodplains to treat nutrient enriched surface runoff from adjacent pastureland associated with on-site agricultural operations.
    e. Restoring riparian buffers adjacent to the streams that are currently maintained for hay production that will attenuate floodwaters, in turn reducing stressors from upstream impacts.
2. Restoring and enhancing aquatic, semi-aquatic and riparian habitat through:
    a. Restoration of a sinuous gravel bed channel that promotes a stable bed form, and accommodates benthic macroinvertebrate and fish propagation. Additionally, woody materials such as log structures, overhanging planted vegetation and toe wood/brush toe in submerged water will provide a diversity of shading, bed form and foraging opportunities for aquatic organisms.
    b. Restoring native vegetation to the stream channel banks and the adjacent riparian corridor, that is currently grass dominated, will diversify flora and create a protected habitat corridor, which will provide an abundance of available foraging and cover habitat for a multitude of amphibians, reptiles, mammals and birds.
3. Restoring and enhancing habitat connectivity with adjacent natural habitats through:
    a. Planting the riparian buffer with native vegetation.

b. Protection of the restored community will ensure a protected wildlife corridor between the Site and the upstream and downstream mature riparian buffers and upland habitats.
c. Converting approximately 15 acres from existing agricultural land to riparian buffer protected by permanent conservation easement.

1.2 Success Criteria

Monitoring of restoration efforts will be performed until success criteria are fulfilled. Monitoring includes stream channel/hydraulics and vegetation. In general, the restoration success criteria, and required remediation actions, are based on the Stream Mitigation Guidelines (USACE et al. 2003) and the Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for stream and/or Wetland Mitigation (NCEEP 2011). Project success criteria are further detailed in the Baseline Monitoring Document & As-Built Baseline Report (HDR|ICA 2016).

1.3 Background Summary

The North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) contracted HDR|ICA to restore 4,746 linear feet of Roses Creek and three of its unnamed tributaries within the Site to assist in fulfilling stream mitigation needs in the watershed. The Site is located approximately 12 miles northwest of downtown Morganton in Burke County, NC. The Site contains Roses Creek and three unnamed headwater tributaries of Roses Creek (UT 1, UT 2 and UT 3). The Site is located within the 03050101060030 14-digit Hydrologic Unit, which is also a DMS Targeted Hydrologic Unit for Cataloging Unit 03050101 of the Catawba River Basin. Roses Creek is classified as a Water Supply Watershed (WS-III), as it is part of the headwaters that feed Lake Rhodhiss. The Site is comprised of one property owned by Robert B. Sisk and Martha M. Sisk (PIN # 1767479652) (known as the Sisk Farm). Additional information concerning project history is presented in Table 2.

1.4 Vegetation

Planted stem performance has improved over the past monitoring year. The entire site was replanted in February 2018 by River Works, Inc to mitigate the loss of planted stems from Year 2 supplemental planting. Although some recently planted stems were found dead during the Year 3 vegetation assessment, the supplemental planting helped a majority of the plots to meet Year 3 success criteria. When only taking planted stems into account, 12 of the 17 plots are meeting Year 3 criteria of 320 stems per acre. When taking into account natural recruits, 16 plots meet criteria with the exception of Plot 2. It is anticipated that natural recruits will continue to colonize on the Site. The site as a whole meets criteria with an average 355 planted stems per acre.

During Year 2, planted stems along UT 1 and UT 2 were heavily browsed upon by deer. Deer browse did not appear as evident during Year 3 although tracks are still present.

Bare areas and areas of thin grass noted during previous monitoring years are showing signs of improvement with the establishment of herbaceous cover and volunteer tree species. The total area of bare areas has decreased to 0.11 acres (0.7% of planted acreage) after Year 3. These areas will be closely monitored but are expected to fill in over time.

Chinese privet and Multiflora rose were discovered along UT 1 during Year 3. Invasive species management is scheduled to occur in early 2019, and may include mechanical and/or herbicide treatments.

1.5 Stream Stability

Roses Creek and its tributaries have remained in stable, functioning condition over the past monitoring year with the exception of bank/overbank erosion at stations: 10+91 -11+25, 12+69 - 12+91, 35+90 – 36+18, 37+18 – 37+30 and 39+26 - 39+44. These areas of erosion were repaired by Land Mechanic Design, Inc. between September 26, 2018 and October 2, 2018. Furthermore, the rock step structure originally installed at station 37+18 was relocated to station 37+30 due to severe erosion around the structure. A soil lift was installed immediately upstream of the relocated structure which extends 20 feet upstream. Repair work photos are included in Appendix B.

Cross Section geometry along Roses Creek has experienced minor fluctuations from previous monitoring years. Cross Sections 5 and 6 have increased in depth and bankfull area due to severe erosion along the left bank. Following the recent repair of the severe bank erosion, it is expected that the cross section will exhibit stability within acceptable parameters. Cross Sections 9 and 10 have increased in depth and bankfull area from last year. This is likely the result of sediment that was deposited in previous years moving downstream. As sediment continues to be transported through UT 2 it is expected that the trend towards baseline conditions will continue. UT 3 is exhibiting minor aggradation in the upstream half of the tributary. This can be seen in Cross Section 11 which has decreased in area and doubled in width to depth ratio. This is most likely the result of thick vegetation along the banks retarding flow and causing sediment deposition.

Near the confluence of UT 2 and Roses Creek, the small ditch dug in Year 2 continues to drain standing water from the floodplain as intended. The ditch remains stable and grass has established in the surrounding area that was disturbed during excavation. Thick vegetation continues to trap fine sediment at the top of UT 2, however coir logs installed last year have reduced sediment input from the road crossing above the tributary. This area will continue to be monitored closely over the next year.

Large amounts of detritus were deposited in the floodplain around station 17+00 indicating that the site has experienced heavy flows and at least one overbank event in the past year. The large stump noted at station 13+50 in the Year 2 Monitoring Report at station was transported out of the channel into the floodplain during one of these events. The crest gauge at the downstream end of the main channel indicated that during the second half of the monitoring year Roses Creek overtopped its banks by 1.93’. Crest gauge records are provided in Appendix E.

Based on water level data obtained using the Hobo U20 pressure transducers installed in the bottom of each tributary, all three have indicated constant flow throughout the past monitoring year. It is worth noting that each tributary has exhibited flow for a span of 30+ consecutive days at least once in the past year. Water level data is provided in Appendix E as well.

Bank pins were examined during morphological surveys and were not exposed.

A pebble count was conducted on site indicating that the average particle size has increased over the past year from a D50 of 48.80 mm to 61.45 mm.

2.0 METHODOLOGY

Year 3 monitoring surveys were completed using a Total Station. Each cross section was marked with a rebar monument at their beginning and ending points. The rebar has been located vertically and horizontally in NAD 83-State Plane. Surveying these monuments throughout the Site ensured proper orientation. The survey data was imported into MicroStation for verification. RIVERMorph was used to analyze cross section data. Tables and figures were created using Microsoft Excel. A pebble count was conducted and analyzed in RIVERMorph.

Vegetation monitoring was completed using CVS level II methods, for 17, 100 square meter vegetation plots (Lee et al. 2006). The taxonomic standard for vegetation used for this document was Flora of the Southern and Mid-Atlantic States (Weakley 2011).

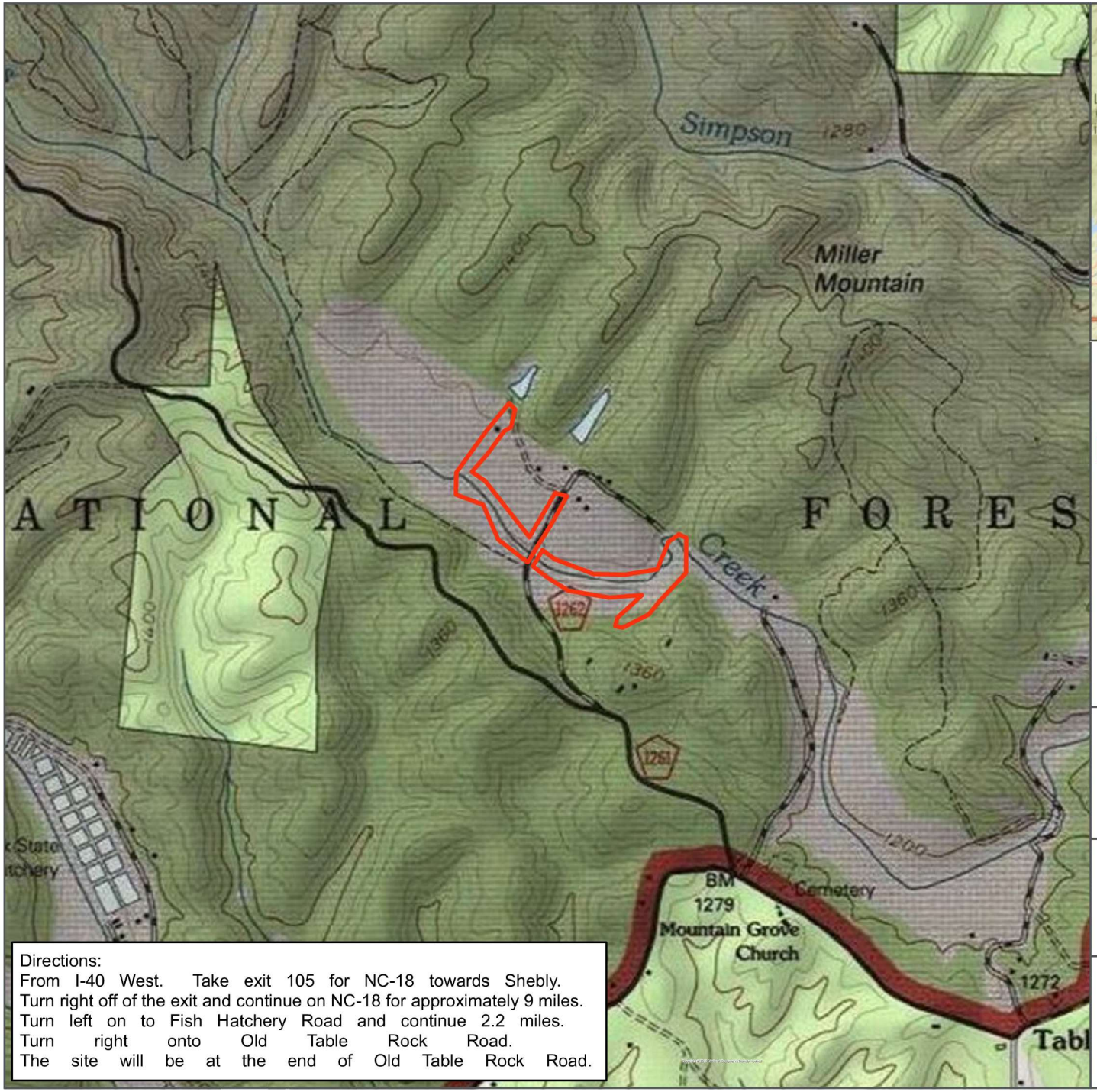
3.0 REFERENCES

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).

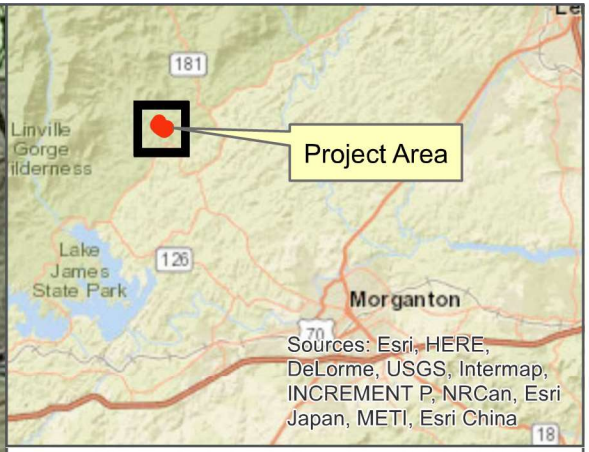
Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States (online). Available: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf [May 15, 2011]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

APPENDICES

Appendix A. Project Vicinity Map and Background Tables



Directions:
From I-40 West. Take exit 105 for NC-18 towards Shebly.
Turn right off of the exit and continue on NC-18 for approximately 9 miles.
Turn left on to Fish Hatchery Road and continue 2.2 miles.
Turn right onto Old Table Rock Road.
The site will be at the end of Old Table Rock Road.



Legend

Project Easement

The subject project site is an environmental restoration site of the NCDEQ Divison of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, monitoring, and stewardship of the restoration site is permitted within the terms and timeframes of their defined, pre-approved roles. Any intended site visitation or activity by any person outside of these previously sanctioned activities/roles requires prior coordination with DMS.

ROSES CREEK STREAM MITIGATION SITE

VICINITY MAP
BURKE COUNTY, NC

N

0 1,000 2,000 4,000 Feet

FIGURE 1

PATH: Z:\ROSES_CREEK\5.0_PROJECT_DEVELOPMENT\5.2_WORK_IN_PROGRESS\DOCS\MONITORING\YEAR 1\APPENDIX A_VICINITY MAP AND BACKGROUND TABLES\VICINITY MAP.MXD - USER: ADIGERON - DATE: 11/13/2017

Map Produced 12/2/2016

Table 1. Project Components and Mitigation Credits

Roses Creek, Burke County DMS Project No. 96309									
Credit Summary									
	Stream SMU		Riparian Wetland WMU		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,009.6								
Project Components									
Project Component or Reach ID	Stationing/ Location		Existing Footage/ Acreage		Approach (PI, PII, etc.)		Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio	SMU
Roses Creek	10+00-41+81		3,643		PI		Restoration	3,181	1:1	3,121*
Roses Creek	41+81-42+19		38		-		EII	38	2.5:1	15
UT 1	10+00-12+54; 16+11-16+46		267		PI		Restoration	289	1:1	289
UT 1	12+54-16+11; 16+46-19+30		641		-		EII	641	2.5:1	256
UT 2	10+00-17+07		610		PI		Restoration	707	1:1	707
UT 3	10+00-16+21		558		PI		Restoration	621	1:1	621
Total	NA		5,757		PI		Restoration/ EII	5,477	1-2.5:1	5,009.6

* Stream Mitigation Units decreased by 60 to account for break in easement at the stream crossing on Sisk Farm Road

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	4,798					
Enhancement II	679					

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	September 2015	September 2015
Final Design – Construction Plans	September 2015	March 2016
Construction	February 25, 2016	May 18, 2016
Temporary S&E Mix Applied to Entire Project Area	---	May 18, 2016
Permanent Seed Mix Applied to Entire Project Area	---	May 18, 2016
Bare Root, Containerized, and B&B plantings for Entire Project Area	---	May 27, 2016
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	May 2016	July 2016
Year 1 Monitoring	November 2016	January 2017
Stream Morphology	November 2016	--
Vegetation	August 2016	--
Supplemental Planting	---	February 2017
Year 2 Monitoring	August 2017	November 2017
Stream Morphology	June 2017	--
Vegetation	August 2017	--
Supplemental Planting	---	February 2018
Year 3 Monitoring	August 2018	November 2018
Stream Morphology	March 2018	--
Vegetation	August 2018	--
Structural Repairs	---	October 2018
Year 4 Monitoring		
Stream Morphology		
Vegetation		
Year 5 Monitoring		
Stream Morphology		
Vegetation		
Year 6 Monitoring		
Stream Morphology		
Vegetation		
Year 7 Monitoring		
Stream Morphology		
Vegetation		

Table 3. Project Contacts Table

Designer Primary project design POC	ICA Engineering 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Chris Smith (919) 851-6066
Construction Contractor Construction Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Structural Repair Contractor Structural Repair Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Planting Contractor Planting Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Supplemental Planting Contractor Supplemental Planting Contractor POC	River Works, Inc. 114 W Main Street, Suite 106 Clayton, NC 27520 Bill Wright (919) 590-5193
Seeding Contractor Seeding Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27607 Lloyd Glover (919) 639-6132
Seed Mix Sources	Green Resources – Triangle Office
Nursery Stock Suppliers	1) Dykes and Son Nursery, McMinnville, TN 2) Foggy Mountain Nursery (live stakes)
Monitoring Performers	HDR|ICA Engineering Inc. 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Ben Furr (919) 232-6600
Stream Monitoring POC	HDR|ICA Engineering Inc. 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Ben Furr (919) 232-6600
Vegetation Monitoring POC	HDR|ICA Engineering Inc. 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Ben Furr (919) 232-6600

Table 4. Project Information

Project Information				
Project Name		Roses Creek Stream Mitigation Site		
County		Burke		
Project Area (acres)		17.3		
Project Coordinates (latitude and longitude)		35.850953,-81.819541		
Project Watershed Summary Information				
Physiographic Province		Piedmont / Mountain		
River Basin		Catawba		
USGS Hydrologic Unit 8-digit	03050101	USGS Hydrologic Unit 14-digit	03050101060030	
NCDWQ Sub-basin		03-08-31		
Project Drainage Area (acres)		Roses: 3,309, UT 1: 35, UT 2: 47, UT 3: 10		
Project Drainage Area Percentage of Impervious Area		<1%		
CGIA Land Use Classification		Agricultural/Pasture		
Ecoregion		Northern Inner Piedmont		
Geological Unit		Zabg: Alligator Back Formation; Gneiss		
Reach Summary Information				
Parameters	**Roses Creek**	**UT 1**	**UT 2**	**UT 3**
Length of reach (linear feet)	3,681 existing	900 existing	610 existing	558 existing
Valley Classification	VIII	VIII	VIII	VIII
Drainage Area (acres)	3,309	35	47	13
NCDWQ Stream Identification Score	56	30	33.5	34
NCDWQ Water Quality Classification	WS-III; Tr	WS-III; Tr	WS-III; Tr	WS-III; Tr
Morphological Description (stream type)	E4, B4, and F4	B5, F5	B5	B5, G5
Evolutionary Trend	Simon's Stages: Premodified » Constructed » Degradation and Widening	Could maintain a B type channel in majority of reach Or F » B	G » B/E	G » B

Regulatory Considerations (cont.)			
Coastal Zone Management (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	CLOMR/LOMR
Essential Fisheries Habitat	No	N/A	N/A

Appendix B. Visual Assessment Data

Figure 2.0 – 2.8. Current Condition Plan View

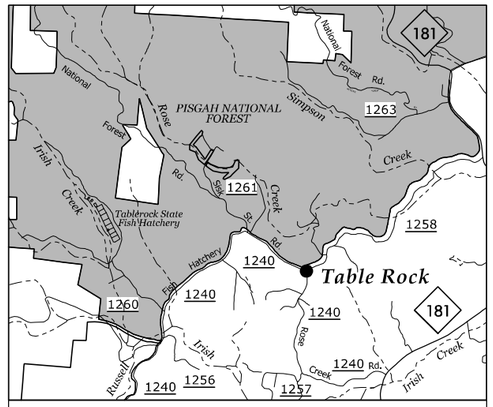
STATE		SHEET NO.
N.C.	ROSES CREEK	1

CURRENT CONDITIONS PLAN VIEW (CCPV)
ROSES CREEK

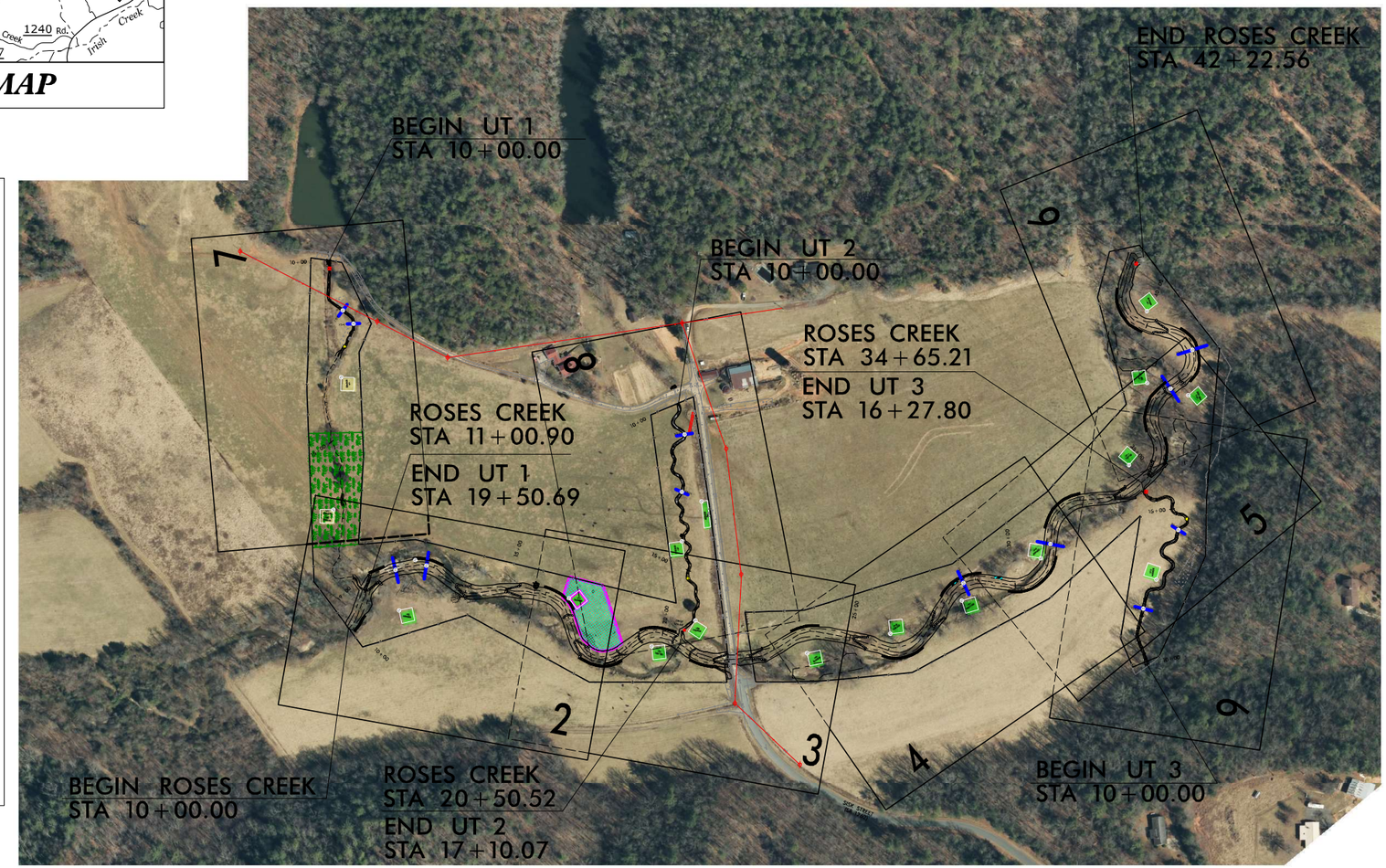
LOCATION: BURKE COUNTY, NORTH CAROLINA

LAT: 35°51'01" N **LONG: –81°49'11" W**

TYPE OF WORK: CCPV PLANS – YEAR 3



VICINITY MAP



YEAR 3 CONDITIONS

- FALLEN TREE
- CONSTRUCTED BERM

BANK/BED CONDITION

- MINOR EROSION
- DEPOSITION (SILT)

VEGETATION PROBLEM AREAS

- INVASIVE POPULATION
- THIN GRASS

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT
- POWERLINE
- FENCE
- XS-1 — CROSS–SECTION LOCATION
- FM — FLOW METER
- CREST GAUGE
- PHOTO POINT & DIRECTION
- WLB — EXISTING WETLANDS
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- ROCK L–VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- ROCK /LOG CROSS VANE
- FLOODPLAIN INTERCEPTOR

GRAPHIC SCALES

50 25 0 50 100
PLANS

10 5 0 10 20
PROFILE (HORIZONTAL)

20 10 0 20 40
PROFILE (VERTICAL)

DESIGN DATA

ROSES CREEK			UT 1			UT 2			UT 3		
DESIGN STREAM TYPE	=	C4	DESIGN STREAM TYPE	=	C5	DESIGN STREAM TYPE	=	C5	DESIGN STREAM TYPE	=	C5
BANKFULL AREA (FT^2) CROSS–SECTIONED	=	66.4	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.1	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.1	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.6
BANKFULL WIDTH (FT)	=	30.5	BANKFULL WIDTH (FT)	=	5.0	BANKFULL WIDTH (FT)	=	5.0	BANKFULL WIDTH (FT)	=	5.5
MAX DEPTH (FT)	=	2.72	MAX DEPTH (FT)	=	0.58	MAX DEPTH (FT)	=	0.58	MAX DEPTH (FT)	=	0.63
WIDTH /DEPTH RATIO	=	14.0	WIDTH /DEPTH RATIO	=	13.0	WIDTH /DEPTH RATIO	=	13.0	WIDTH /DEPTH RATIO	=	13.1
DRAINAGE AREA (MI^2)	=	5.17	DRAINAGE AREA (MI^2)	=	0.06	DRAINAGE AREA (MI^2)	=	0.07	DRAINAGE AREA (MI^2)	=	0.02
BANKFULL SLOPE(FT/FT)	=	0.0062	BANKFULL SLOPE(FT/FT)	=	0.0021	BANKFULL SLOPE(FT/FT)	=	0.0021	BANKFULL SLOPE(FT/FT)	=	0.0021

PROJECT LENGTH

		PROPOSED DESIGN STREAM LENGTH		ASBUILT STREAM LENGTH	
ROSES CREEK	=	3,219.20	FT	3,222.56	FT
UT 1	=	930.38	FT	950.69	FT
UT 2	=	707.59	FT	710.07	FT
UT 3	=	621.03	FT	627.80	FT

CHRISTOPHER L. SMITH
PROJECT MANAGER

Prepared in the Office of:

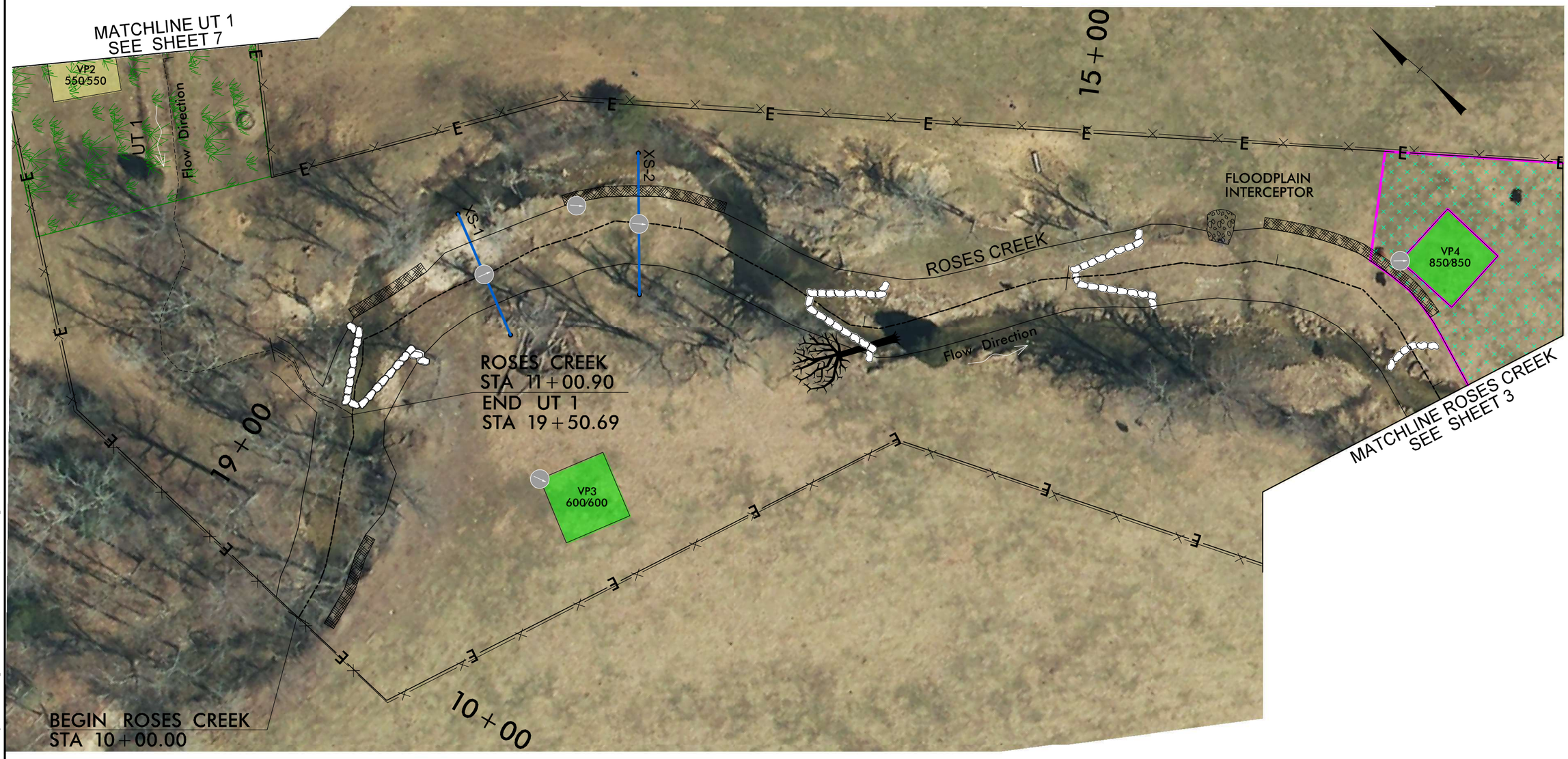
HDR ICA
ICA Engineering, Inc.
555 Fayetteville Street, Suite 900
Raleigh, NC 27601
NC License No: F–0258

DMS PROJECT #: 96309

CONTRACT: ROSES CREEK

11/20/2018
Z:\Roses_Creek\6.0_CAD_BIM\6.2_Work_In_Progress\stream\Proj\Monitoring Plans\Year 3\RosesCrk_psh_01.dgn
ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3



LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- FENCE
- PHOTO POINT & DIRECTION
- XS-1 — CROSS–SECTION LOCATION
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- CREST GAUGE
- ROCK L–VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

YEAR 3 CONDITIONS

- FALLEN TREE
- VEGETATION PROBLEM AREAS
  - INVASIVE POPULATION
  - THIN GRASS
- VEGETATION PLOT CONDITIONS
  - CRITERIA MET
  - CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

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555 Fayetteville Street,
Suite 900
Raleigh, NC 27601
NC License No: F–0258

ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08–23–18

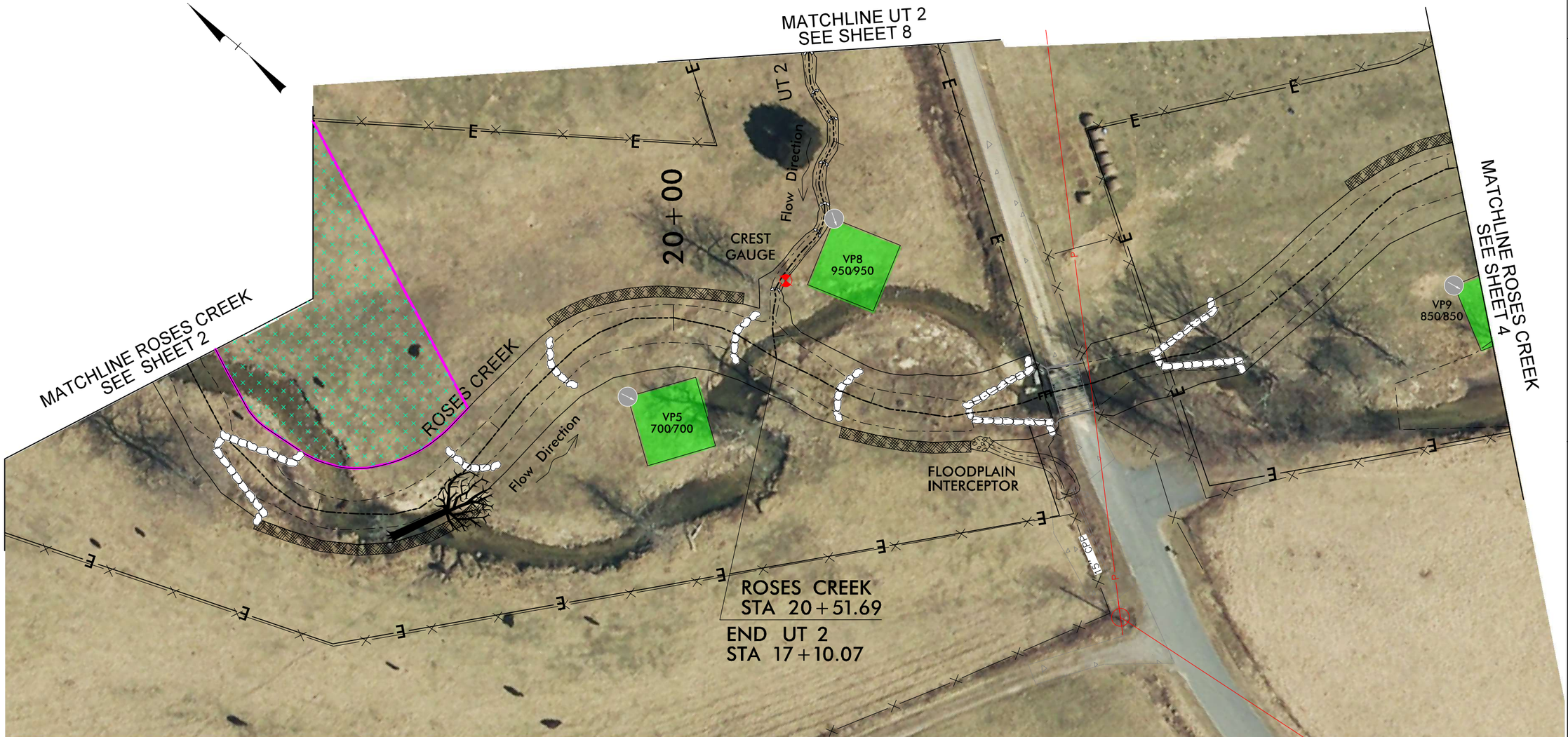
CCPV
YEAR 3

SHEET
2

EEP# 96309

W:\20\2018 Roses_Creek\6.0_CAD_BIM\6.2_Work_In_Progress\stream\Proj\Monitoring Plans\Year 3\RosesCrk_psh_02.dgn

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3



LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- FENCE
- PHOTO POINT & DIRECTION
- XS-1 — CROSS-SECTION LOCATION
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- POWER LINE
- CREST GAUGE
- ROCK L-VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

YEAR 3 CONDITIONS

- FALLEN TREE

VEGETATION PROBLEM AREAS

- THIN GRASS

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

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Suite 900
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ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

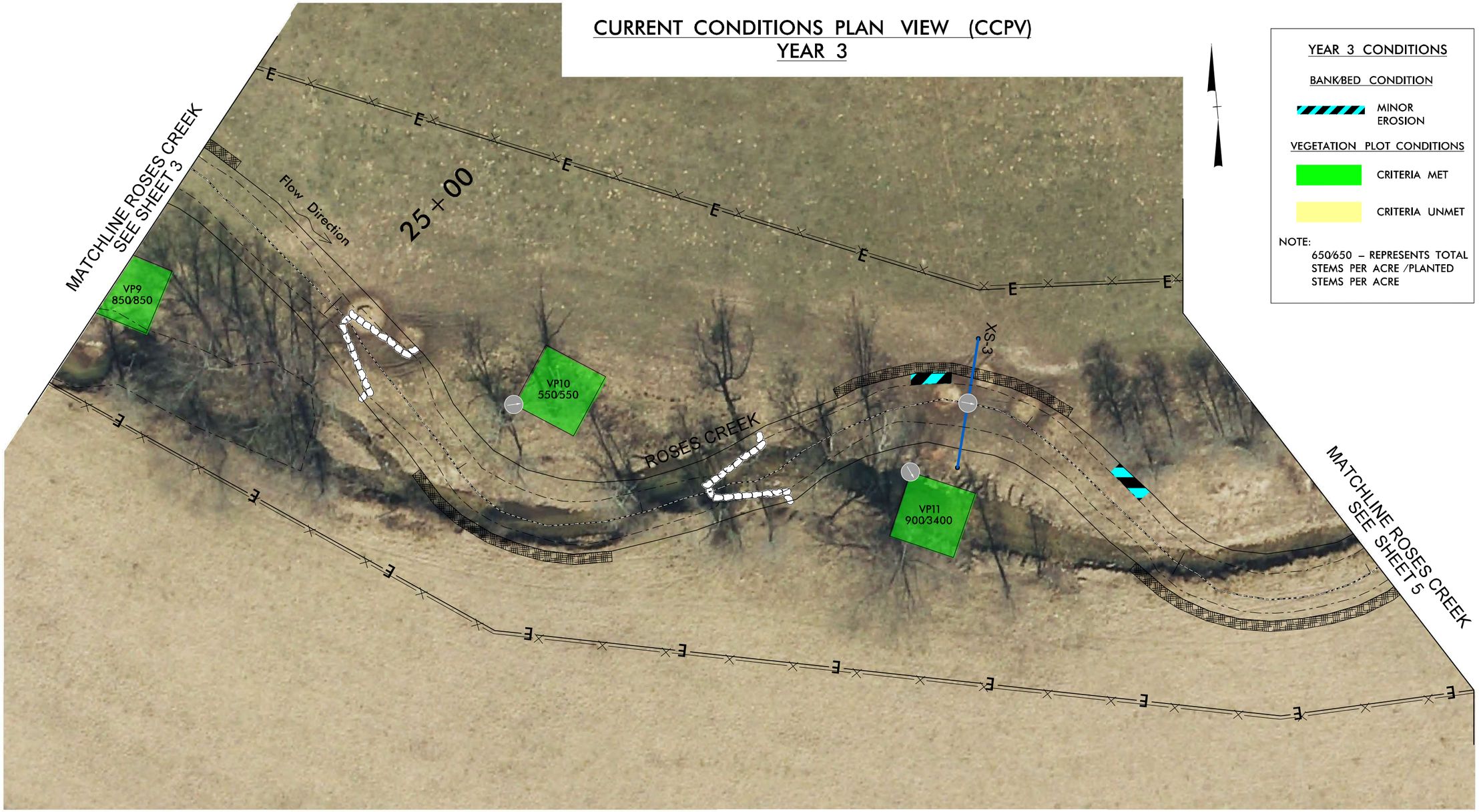
DATE: 08-23-18

CCPV
YEAR 3

SHEET
3

EEP# 96309

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3



YEAR 3 CONDITIONS

BANK/BED CONDITION

- MINOR EROSION

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- FENCE
- PHOTO POINT & DIRECTION
- XS-1 — CROSS–SECTION LOCATION
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- CREST GAUGE
- ROCK L–VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

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Raleigh, NC 27601
NC License No: F-0258

ROSES CREEK PROJECT
STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-23-18

CCPV
YEAR 3

SHEET
4

EEP# 96309

11/20/2018
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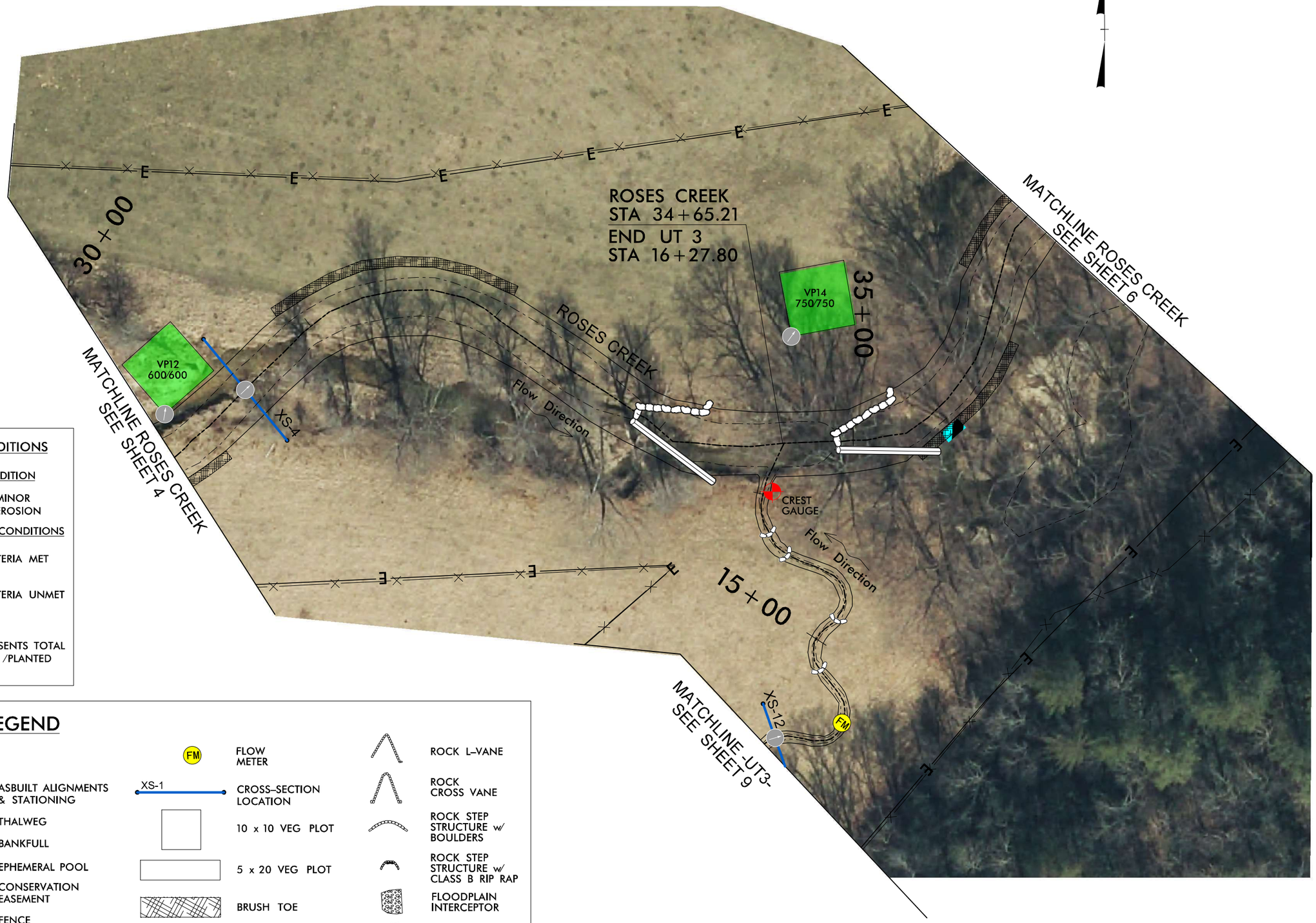
ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3



YEAR 3 CONDITIONS

BANK/BED CONDITION

MINOR EROSION

VEGETATION PLOT CONDITIONS

CRITERIA MET

CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- FENCE
- CREST GAUGE
- FM — FLOW METER
- XS-1 — CROSS-SECTION LOCATION
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- PHOTO POINT & DIRECTION
- ROCK L-VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR
- ROCK /LOG CROSS VANE

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555 Fayetteville Street,
Suite 900
Raleigh, NC 27601
NC License No: F-0258

ROSES CREEK PROJECT
STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

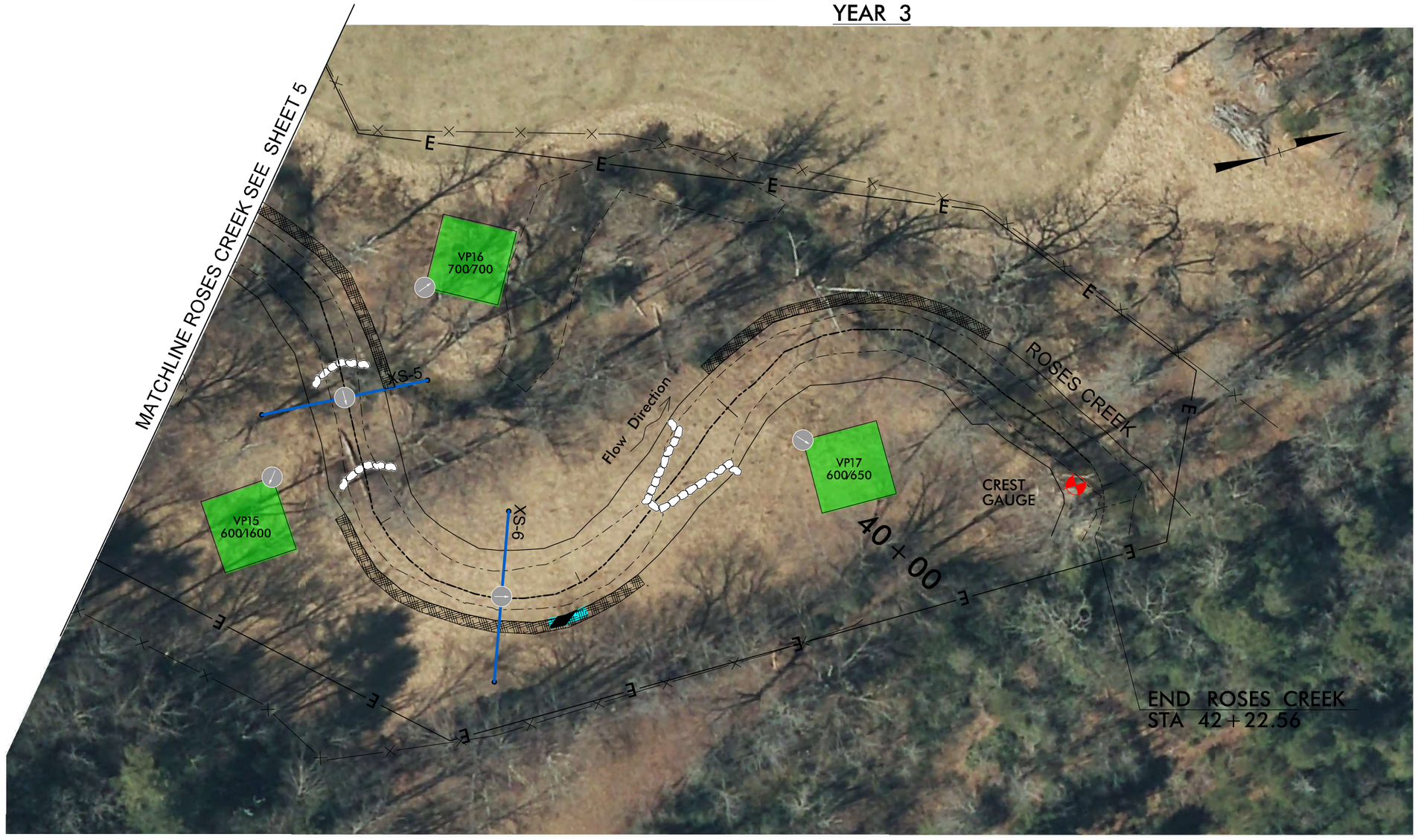
DATE: 08-23-18

CCPV
YEAR 3

SHEET
5

EEP# 96309

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3



LEGEND

15+00

- ASBUILT ALIGNMENTS & STATIONING
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT
- FENCE
- XS-1 CROSS–SECTION LOCATION
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- BRUSH TOE
- PHOTO POINT & DIRECTION
- CREST GAUGE
- ROCK L–VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

YEAR 3 CONDITIONS

BANK/BED CONDITION

- MINOR EROSION

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

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555 Fayetteville Street,
Suite 900
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ROSES CREEK
STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-23-18

CCPV
YEAR 3

SHEET
6

EEP# 96309

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3

YEAR 3 CONDITIONS

VEGETATION PROBLEM AREAS

INVASIVE POPULATION

VEGETATION PLOT CONDITIONS

CRITERIA MET

CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

- ASBUILT ALIGNMENTS & STATIONING (15+00)
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT (E)
- FENCE
- CROSS–SECTION LOCATION (XS-1)
- 10 x 10 VEG PLOT
- FLOW METER (FM)
- POWER LINE
- PHOTO POINT & DIRECTION
- CREST GAUGE
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR

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ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE 50 25 0 25
PLANS

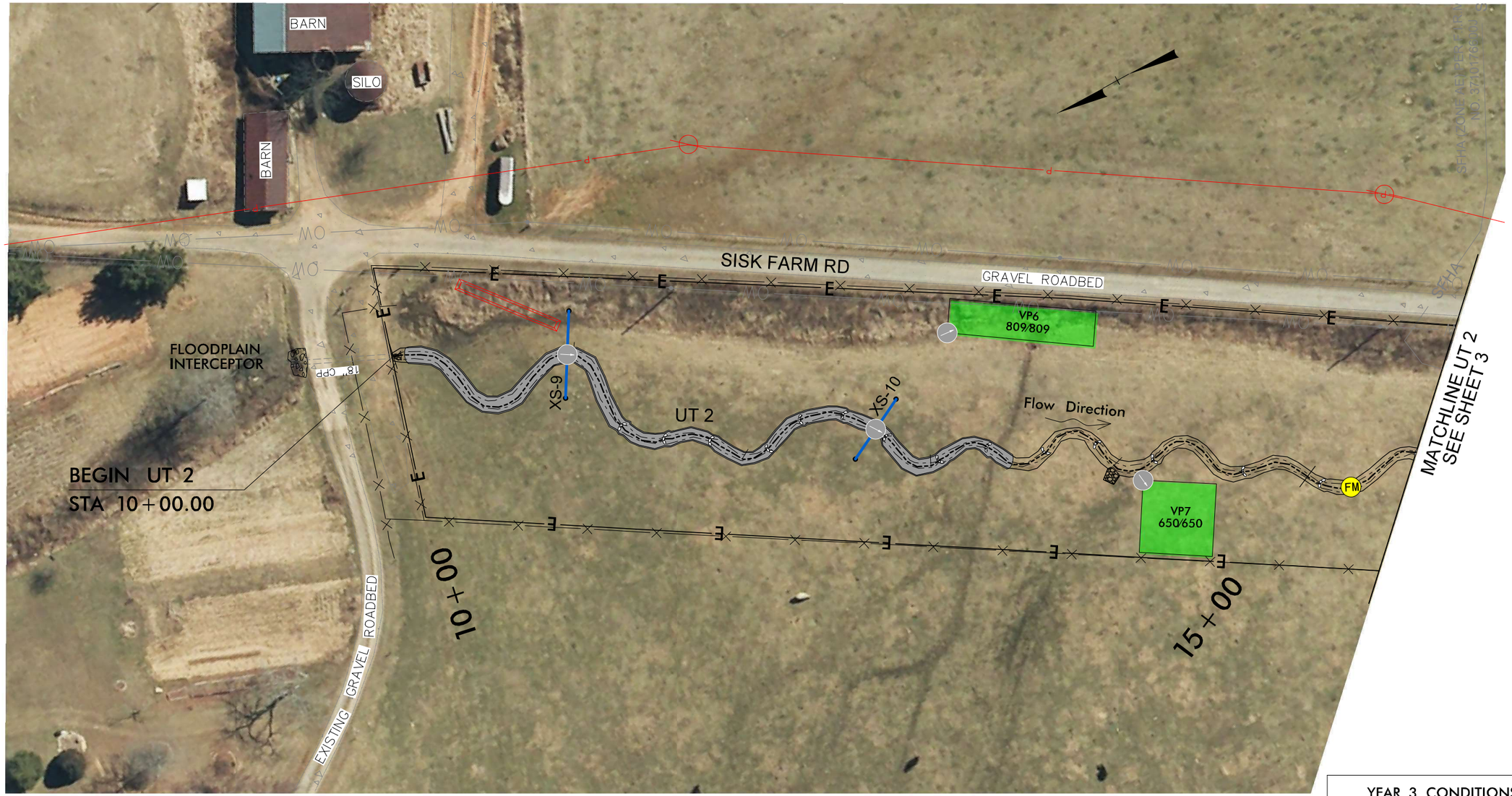
DATE: 08-23-18

CCPV YEAR 3

SHEET 7

EEP# 96309

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3



LEGEND

- ASBUILT ALIGNMENTS & STATIONING (15+00)
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT (E)
- FENCE
- CROSS-SECTION LOCATION (XS-1)
- 10 x 10 VEG PLOT
- 5 x 20 VEG PLOT
- FLOW METER (FM)
- PHOTO POINT & DIRECTION
- CREST GAUGE
- BRUSH TOE
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- FLOODPLAIN INTERCEPTOR
- POWER LINE

YEAR 3 CONDITIONS

- CONSTRUCTED BERM

BANK/BED CONDITION

- DEPOSITION (SILT)

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

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ROSES CREEK
STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-23-18

CCPV
YEAR 3

SHEET
8

EEP# 96309

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 3

YEAR 3 CONDITIONS

BANK/BED CONDITION

DEPOSITION (SILT)

VEGETATION PLOT CONDITIONS

CRITERIA MET

CRITERIA UNMET

NOTE:
650/650 – REPRESENTS TOTAL STEMS PER ACRE /PLANTED STEMS PER ACRE

LEGEND

15+00 — ASBUILT ALIGNMENTS & STATIONING

THALWEG

BANKFULL

EPHEMERAL POOL

E — CONSERVATION EASEMENT

FENCE

PHOTO POINT & DIRECTION

XS-1 — CROSS-SECTION LOCATION

10 x 10 VEG PLOT

WLB — EXISTING WETLANDS

ROCK STEP STRUCTURE w/ CLASS B RIP RAP

FLOODPLAIN INTERCEPTOR

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ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE 50 25 0 25
PLANS

DATE: 08-23-18

CCPV YEAR 3

SHEET 9

EEP# 96309

Table 5: Visual Stream Morphology Stability Assessment
Reach ID: Roses Creek
Assessed Length: 3,121 FT

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
1. Bed	**1. Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			2	57	98%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	17	17			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	18	18			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	18	18			100%
	4.Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	17	17			100%
		2. Thalweg centering at downstream of meander (Glide)	17	17			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	30	99.9%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	19			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	19	19			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	19	19			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	19	19			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	19	19			100%

Table 5a: Visual Stream Morphology Stability Assessment
Reach ID: UT1
Assessed Length: 234 LF

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
1. Bed	**1. Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	20	91%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	2	2			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	2	2			100%
	4.Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%
		2. Thalweg centering at downstream of meander (Glide)	3	3			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	12	12			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	12	12			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	12	12			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	12	12			100%

Table 5b: Visual Stream Morphology Stability Assessment
Reach ID: UT2
Assessed Length: 707 LF

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
1. Bed	**1. Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	112	84%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	22	22			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	21	21			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	21	21			100%
	4.Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	22	22			100%
		2. Thalweg centering at downstream of meander (Glide)	22	22			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	21	21			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	21	21			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	21	21			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	21	21			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	21	21			100%

Table 5c: Visual Stream Morphology Stability Assessment
Reach ID: UT3
Assessed Length: 620 LF

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
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	75	88%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	13	13			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth≥ 1.6)	12	12			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	13	13			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	13	13			100%
		2. Thalweg centering at downstream of meander (Glide)	13	13			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	14	14			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	14	14			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	14	14			100%
	3. Bank Protection	Bank erosion within the structures extent of influence doesnot exceed 15%. (See guidance for this table in EEP monitoring guidance document)	14	14			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	14	14			100%

Table 6. Vegetation Condition Assessment

Planted Acreage **15.81**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.44 Acres	Pink polygons filled with green x's	4	0.42	2.7%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 Acres	Blue cross hatch pattern	1	0.9	5.7%
			Total			
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	The entire site is experiencing low stem vigor.	The entire site is experiencing low stem vigor.	1	1.2	8%
			Cumulative Total			

Easement Acreage **17.33**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	None	0	1	0.1	<1%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	None	N/A	0	0	0

Figures 3.1 - 3.27. Vegetation Plot and Problem Area Photos

3.1 Vegetation Plot 1

3.2 Vegetation Plot 2

3.3 Vegetation Plot 3

3.4 Vegetation Plot 4

3.5 Vegetation Plot 5

3.6 Vegetation Plot 6

3.7 Vegetation Plot 7

3.8 Vegetation Plot 8

3.9 Vegetation Plot 9

3.10 Vegetation Plot 10

3.11 Vegetation Plot 11

3.12 Vegetation Plot 12

3.13 Vegetation Plot 13

3.14 Vegetation Plot 14

3.15 Vegetation Plot 15

3.16 Vegetation Plot 16

3.17 Vegetation Plot 17

3.18 Erosion at station 10+91-11+25

3.19 Repair at station 10+91-11+25

3.20 Erosion at station 12+69-12+91

3.21 Repair at station 12+69-12+91

3.22 Erosion at station 35+90-36+18

3.23 Repair at station 35+90-36+18

3.24 Severe Erosion and rock step at station 37+10-37+30

3.25 Repair of erosion at station 37+10-37+30 and relocation of rock step

3.26 Erosion at station 39+26-39+44

3.27 Repair at station 39+26-39+44

Appendix C. Vegetation Plot Data

EEP Project Code 96309. Project Name: Roses Creek

			Current Plot Data (MY3 2017)																														
			96309-WFW-0001			96309-WFW-0002			96309-WFW-0003			96309-WFW-0004			96309-WFW-0005			96309-WFW-0006			96309-WFW-0007			96309-WFW-0008			96309-WFW-0009			96309-WFW-0010			96309-WFW-0011		
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
Alnus incana	gray alder																			1															
Alnus serrulata	hazel alder	Shrub																						2	2	6			15						
Betula nigra	river birch	Tree	1	1	1	4	4	4	1	1	1				1	1	1							1	1	2	1	1	20			20	1	1	20
Carya glabra	pignut hickory	Tree																											2				1	1	1
Cephalanthus occidentalis	common buttonbush	Shrub																																	
Cornus alternifolia	alternateleaf dogwood	Tree																																	
Cornus amomum	silky dogwood	Shrub			2	1	1	1	1	1	1	1	1	2	1	1	1	6	6	11	2	2	2	4	4	4			2	1	1	1	2	2	2
Cornus florida	flowering dogwood	Tree																																	
Diospyros virginiana	common persimmon	Tree			20																														
Fraxinus nigra	black ash	Tree																																	
Fraxinus pennsylvanica	green ash	Tree				1	1	1	1	1	1	3	3	3	3	3	3	2	2	5	4	4	6	1	1	6	3	3	3	3	3	3	2	2	2
Lindera benzoin	northern spicebush	Shrub																																	
Liquidambar styraciflua	sweetgum	Tree																																	
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	1	3	3	3	1	1	1							1	1	2				2	2	2	1	1	2	1	1	1
Platanus occidentalis	American sycamore	Tree							1	1	1	6	6	7	5	5	12				3	3	6	4	4	9	3	3	4	3	3	3	3	3	3
Populus heterophylla	swamp cottonwood	Tree																																	
Prunus serotina	black cherry	Tree																																	
Quercus michauxii	swamp chestnut oak	Tree																																	
Quercus nigra	water oak	Tree	1	1	1																														
Quercus pagoda	cherrybark oak	Tree																			1	1	1												
Quercus phellos	willow oak	Tree																																	
Quercus rubra	northern red oak	Tree							1	1	1			1																1	1	1			
Rhus copallinum	flameleaf sumac	shrub			1																														
Salix nigra	black willow	Tree																														1			
Ulmus americana	American elm	Tree																																	
		Stem count	3	3	26	7	7	7	8	8	8	11	11	14	10	10	17	8	8	17	11	11	17	12	12	27	9	9	48	9	9	31	10	10	29
		size (ares)	1			1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	3	3	6	4	4	4	6	6	6	4	4	5	4	4	4	2	2	3	5	5	5	5	5	5	4	4	7	5	5	7	6	6	6
		Stems per ACRE	121.4	121.4	1052	283.3	283.3	283.3	323.7	323.7	323.7	445.2	445.2	566.6	404.7	404.7	688	323.7	323.7	688	445.2	445.2	688	485.6	485.6	1093	364.2	364.2	1942	364.2	364.2	1255	404.7	404.7	1174

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%

EEP Project Code 96309. Project Name: Roses Creek

			Current Plot Data (MY3 2017)																		Annual Means								
			96309-WFW-0012			96309-WFW-0013			96309-WFW-0014			96309-WFW-0015			96309-WFW-0016			96309-WFW-0017			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
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
Alnus incana	gray alder																						1								
Alnus serrulata	hazel alder	Shrub																			2	2	21	2	2	12					
Betula nigra	river birch	Tree	1	1	20	1	1	1			20			20			20	1	1	20	13	13	170	8	8	151	19	19	19	26	26	26
Carya glabra	pignut hickory	Tree																			1	1	3	2	2	2					
Cephalanthus occidentalis	common buttonbush	Shrub																									4	4	4	5	5	5
Cornus alternifolia	alternateleaf dogwood	Tree																									1	1	1	2	2	2
Cornus amomum	silky dogwood	Shrub	2	2	2	2	2	2				1	1	1	2	2	2	2	2	2	28	28	38	26	26	26	35	35	35	54	54	54
Cornus florida	flowering dogwood	Tree													1	1	1				1	1	1	1	1	1						
Diospyros virginiana	common persimmon	Tree																					20			22						
Fraxinus nigra	black ash	Tree																						2	2	2	9	9	9	9	9	9
Fraxinus pennsylvanica	green ash	Tree	3	3	3	6	6	8	1	1	1	4	4	4	1	1	1	2	2	2	40	40	52	35	35	38	56	56	56	74	74	74
Lindera benzoin	northern spicebush	Shrub																						1	1	2						
Liquidambar styraciflua	sweetgum	Tree												2									2			3						
Liriodendron tulipifera	tuliptree	Tree							1	1	1	1	1	1	1	1	1	1	1	1	15	15	17	6	6	11	11	11	11	12	12	12
Platanus occidentalis	American sycamore	Tree	1	1	20	4	4	6	5	5	5							2	2	4	40	40	80	31	31	42	49	49	49	59	59	59
Populus heterophylla	swamp cottonwood	Tree													3	3	3				3	3	3	3	3	3						
Prunus serotina	black cherry	Tree										1	1	1							1	1	1	1	1	1						
Quercus michauxii	swamp chestnut oak	Tree																									2	2	2	2	2	2
Quercus nigra	water oak	Tree																			1	1	1				1	1	1	1	1	1
Quercus pagoda	cherrybark oak	Tree																			1	1	1									
Quercus phellos	willow oak	Tree																									47	47	47	68	68	68
Quercus rubra	northern red oak	Tree																			2	2	3									
Rhus copallinum	flameleaf sumac	shrub																					1									
Salix nigra	black willow	Tree			9						6			2	1	1	1				1	1	19	1	1	4	4	4	4	7	7	7
Ulmus americana	American elm	Tree																									4	4	4	7	7	7
		Stem count	7	7	54	13	13	17	7	7	33	7	7	31	9	9	29	8	8	29	149	149	434	119	119	320	242	242	242	326	326	326
		size (ares)	1			1			1			1			1			1			17			17			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.42			0.42			0.42			0.42		
		Species count	4	4	5	4	4	4	3	3	5	4	4	7	6	6	7	5	5	5	14	14	18	13	13	15	13	13	13	13	13	13
		Stems per ACRE	283.3	283.3	2185	526.1	526.1	688	283.3	283.3	1335	283.3	283.3	1255	364.2	364.2	1174	323.7	323.7	1174	354.7	354.7	1033	283.3	283.3	761.8	576.1	576.1	576.1	776	776	776

Color for Density

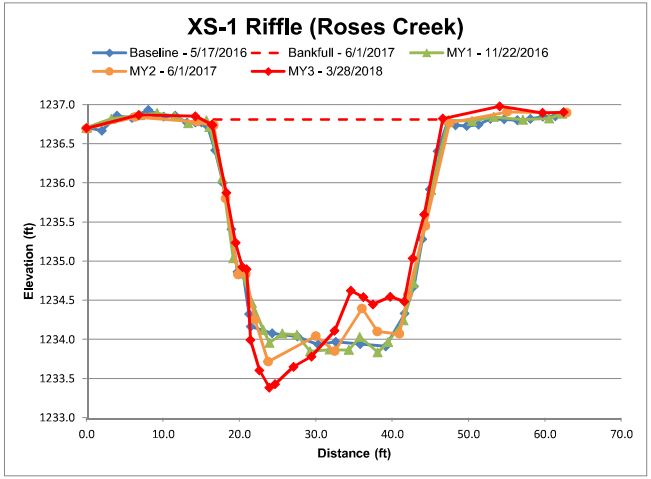
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Appendix D. Stream Survey Data

Figures 4.1 – 4.12. Cross Section Plots

Figure 4.1

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 1 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo

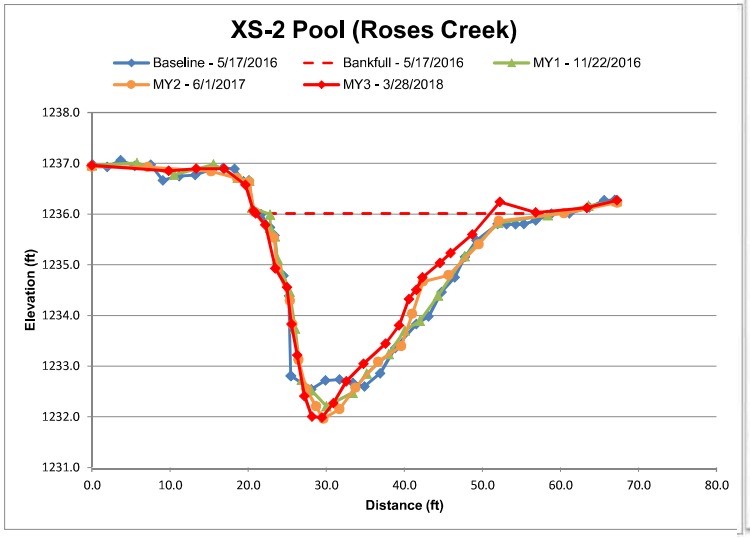


	Cross Section 1 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	33.80	31.10	30.73	29.98				
Floodprone Width (ft)	508.32	508.32	508.32	508.32				
Bankfull Mean Depth (ft)	2.00	2.20	2.19	2.18				
Bankfull Max Depth (ft)	2.81	2.89	3.01	3.35				
Bankfull Cross Sectional Area (ft^2)	67.70	68.28	67.22	65.27				
Bankfull Width/Depth Ratio	16.90	14.14	14.03	13.75				
Bankfull Entrenchment Ratio	15.04	16.35	16.54	16.96				
Low Bank Height (ft)	---	---	---	3.44				
Bank Height Ratio*	1.00	1.00	1.00	1.02				

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Figure 4.2

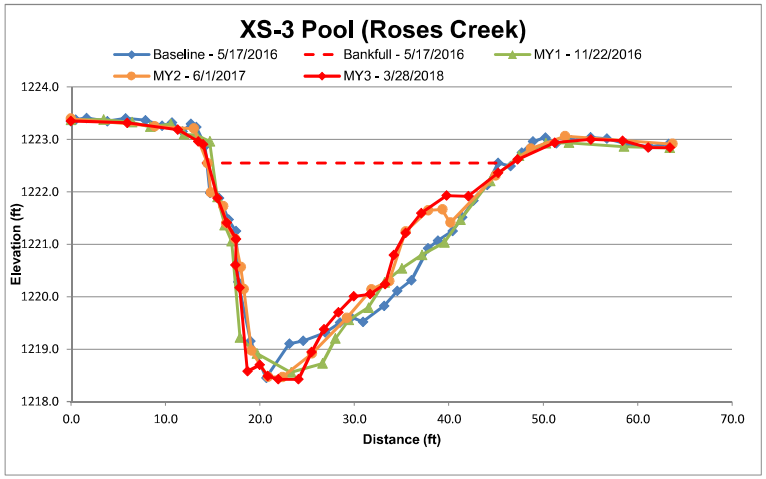
River Basin	Catawba
Watershed	03050101060030
XS ID	XS 2 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo



	Cross Section 2 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	38.53	37.04	39.49	30.03				
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	1.73	1.75	1.65	1.96				
Bankfull Max Depth (ft)	3.47	3.80	4.05	4.02				
Bankfull Cross Sectional Area (ft^2)	66.48	64.97	65.02	58.79				
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Low Bank Height (ft)								
Bank Height Ratio								

Figure 4.3

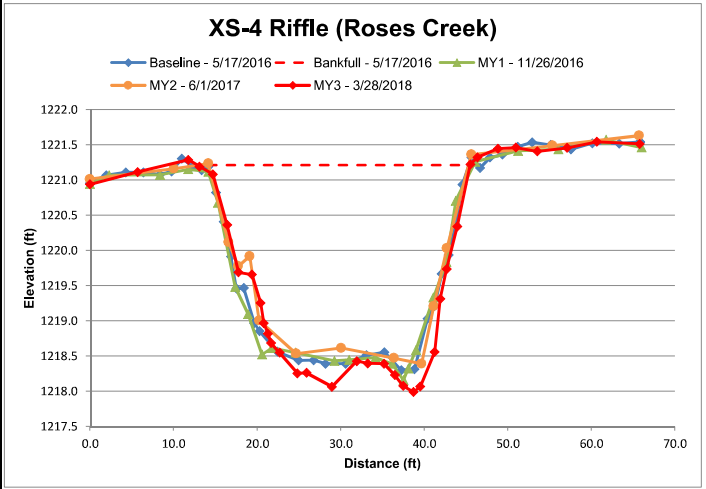
River Basin	Catawba
Watershed	03050101060030
XS ID	XS 3 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo



	Cross Section 3 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	32.44	31.58	32.26	32.20				
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	2.19	2.32	2.07	2.03				
Bankfull Max Depth (ft)	4.10	3.99	4.09	4.13				
Bankfull Cross Sectional Area (ft^2)	71.10	73.39	66.76	65.48				
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Low Bank Height (ft)								
Bank Height Ratio								

Figure 4.4

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 4 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo

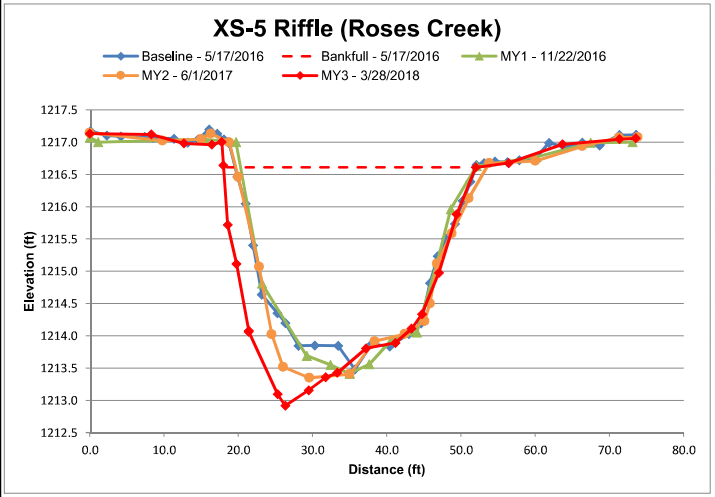


	Cross Section 4 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	31.11	31.66	31.03	32.35				
Floodprone Width (ft)	696.00	696.00	696.00	696.00				
Bankfull Mean Depth (ft)	2.19	2.16	2.08	2.12				
Bankfull Max Depth (ft)	2.89	3.03	2.80	3.20				
Bankfull Cross Sectional Area (ft^2)	68.21	68.41	64.61	71.47				
Bankfull Width/Depth Ratio	14.21	14.66	14.92	14.64				
Bankfull Entrenchment Ratio	22.37	21.98	22.43	21.51				
Low Bank Height (ft)	---	---	---	3.38				
Bank Height Ratio*	1.00	1.00	1.00	1.06				

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Figure 4.5

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 5 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo

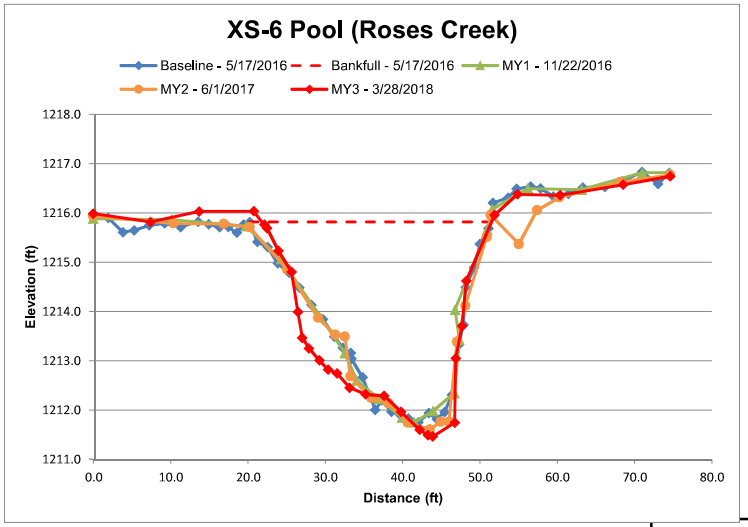


	Cross Section 5 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	32.56	32.99	34.06	36.04				
Floodprone Width (ft)	563.60	563.60	563.60	563.60				
Bankfull Mean Depth (ft)	2.13	2.25	2.22	2.37				
Bankfull Max Depth (ft)	3.16	3.23	3.29	3.73				
Bankfull Cross Sectional Area (ft^2)	69.41	74.12	75.52	85.30				
Bankfull Width/Depth Ratio	15.29	14.66	15.34	15.21				
Bankfull Entrenchment Ratio	17.31	17.08	16.55	15.638				
Low Bank Height (ft)	---	---	---	3.69				
Bank Height Ratio*	1.00	1.00	1.00	<1				

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Figure 4.6

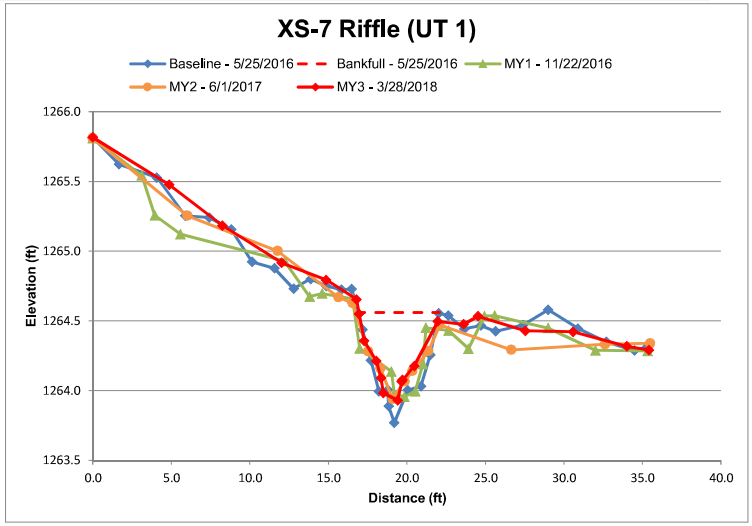
River Basin	Catawba
Watershed	03050101060030
XS ID	XS 6 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo



	Cross Section 6 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	31.02	31.30	30.99	29.70				
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	2.37	2.23	2.32	2.69				
Bankfull Max Depth (ft)	4.07	3.98	4.11	4.36				
Bankfull Cross Sectional Area (ft^2)	73.63	69.77	71.83	80.01				
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Low Bank Height (ft)								
Bank Height Ratio								

Figure 4.7

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 7 (UT 1)
Drainage Area (Acres)	38.40
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo

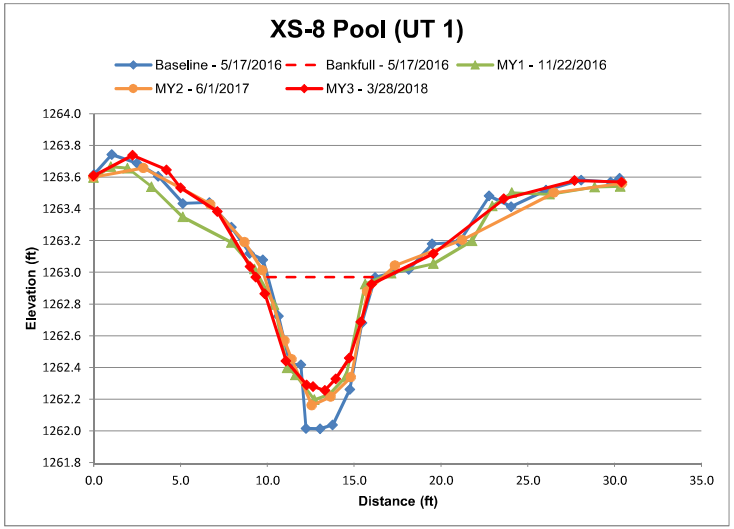


	Cross Section 7 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	5.12	4.46	5.31	5.01				
Floodprone Width (ft)	91.80	91.80	91.80	91.80				
Bankfull Mean Depth (ft)	0.45	0.41	0.35	0.36				
Bankfull Max Depth (ft)	0.78	0.59	0.61	0.62				
Bankfull Cross Sectional Area (ft^2)	2.30	1.82	1.86	1.78				
Bankfull Width/Depth Ratio	11.38	10.88	15.17	13.92				
Bankfull Entrenchment Ratio	17.93	20.58	17.29	18.32				
Low Bank Height (ft)	---	---	---	0.57				
Bank Height Ratio*	1.00	1.00	1.00	<1				

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Figure 4.8

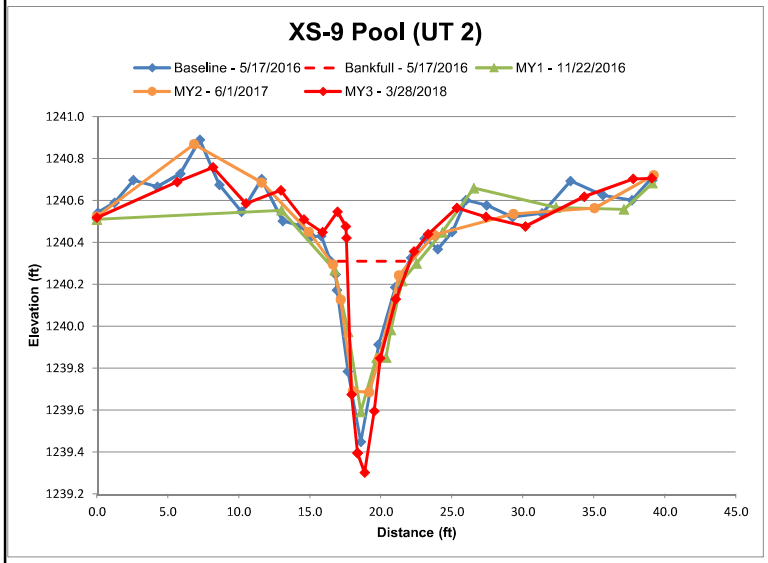
River Basin	Catawba
Watershed	03050101060030
XS ID	XS 8 (UT 1)
Drainage Area (Acres)	38.40
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo



	Cross Section 8 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	6.24	7.07	6.80	7.49				
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	0.58	0.44	0.47	0.42				
Bankfull Max Depth (ft)	0.96	0.77	0.81	0.71				
Bankfull Cross Sectional Area (ft^2)	3.64	3.10	3.23	3.12				
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Low Bank Height (ft)								
Bank Height Ratio								

Figure 4.9

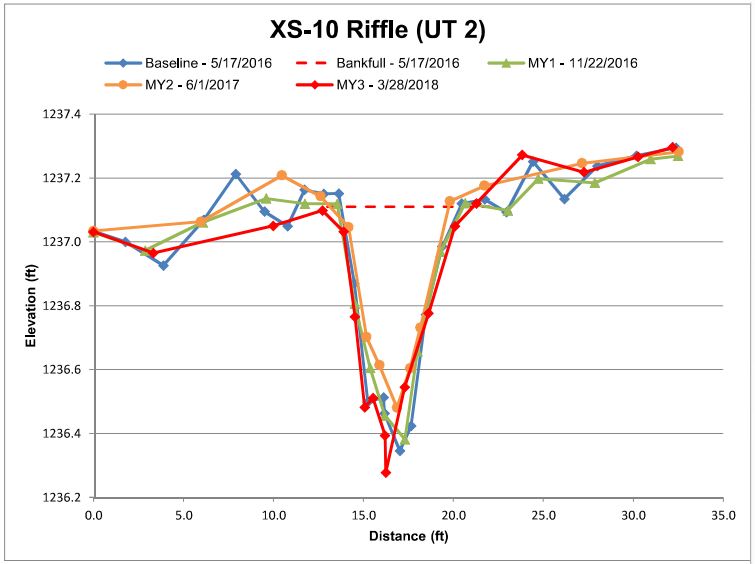
River Basin	Catawba
Watershed	03050101060030
XS ID	XS 9 (UT 2)
Drainage Area (Acres)	44.80
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo



	Cross Section 9 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	5.56	6.43	5.69	5.53				
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	0.37	0.31	0.33	0.49				
Bankfull Max Depth (ft)	0.86	0.72	0.63	1.12				
Bankfull Cross Sectional Area (ft^2)	2.07	1.97	1.90	2.73				
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Low Bank Height (ft)								
Bank Height Ratio								

Figure 4.10

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 10 (UT 2)
Drainage Area (Acres)	44.80
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo

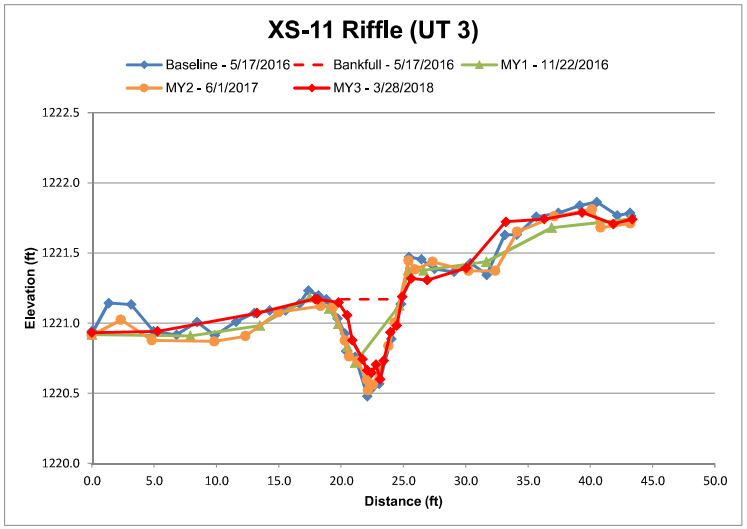


	Cross Section 10 (Riffle)							
Dimension and substrate*	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	6.70	7.10	6.79	7.38				
Floodprone Width (ft)	93.36	93.36	93.36	93.36				
Bankfull Mean Depth (ft)	0.42	0.38	0.32	0.39				
Bankfull Max Depth (ft)	0.77	0.74	0.64	0.84				
Bankfull Cross Sectional Area (ft^2)	2.79	2.69	2.17	2.88				
Bankfull Width/Depth Ratio	16.75	18.68	21.22	18.92				
Bankfull Entrenchment Ratio	13.93	13.14	13.75	12.65				
Low Bank Height (ft)	---	---	---	0.83				
Bank Height Ratio*	1.00	1.00	1.01	1.00				

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Figure 4.11

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 11 (UT 3)
Drainage Area (Acres)	12.80
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo

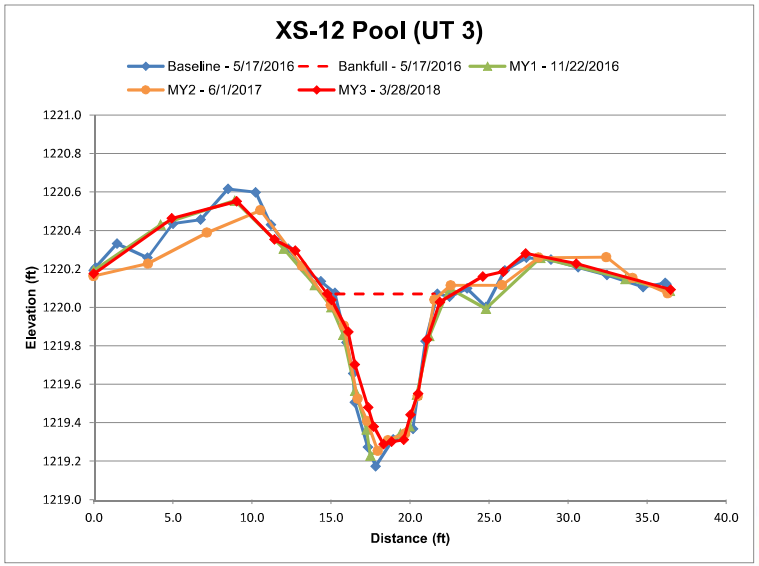


	Cross Section 11 (Riffle)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	6.00	7.28	5.38	6.73				
Floodprone Width (ft)	175.41	175.41	175.41	175.4				
Bankfull Mean Depth (ft)	0.36	0.21	0.37	0.24				
Bankfull Max Depth (ft)	0.69	0.46	0.65	0.57				
Bankfull Cross Sectional Area (ft^2)	2.19	1.51	2.01	1.62				
Bankfull Width/Depth Ratio	16.67	34.67	14.54	28.04				
Bankfull Entrenchment Ratio	29.24	24.09	32.60	26.06				
Low Bank Height (ft)	---	---	---	0.50				
Bank Height Ratio*	1.00	1.00	1.00	<1				

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Figure 4.12

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 12 (UT 3)
Drainage Area (Acres)	12.80
Date	3/28/2018
Field Crew	Kenton Beal, Alex DiGeronimo



	Cross Section 12 (Pool)							
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	6.39	7.93	7.52	7.99				
Floodprone Width (ft)								
Bankfull Mean Depth (ft)	0.56	0.46	0.45	0.40				
Bankfull Max Depth (ft)	0.90	0.84	0.82	0.78				
Bankfull Cross Sectional Area (ft^2)	3.55	3.61	3.40	3.23				
Bankfull Width/Depth Ratio								
Bankfull Entrenchment Ratio								
Low Bank Height (ft)								
Bank Height Ratio								

Table 8. Baseline Stream Data Summary
Roses Creek Mitigation Site
Roses Creek: 3,200 Lf.

Parameter	Regional Curve		Pre-Existing Condition	Reference - Roses Creek Upstream	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq. Mountains	Eq. Piedmont	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	35.00	26.20	41.10	30.50	30.50	31.02	31.98	31.11	33.80	1.58	3.00
Floodprone Width (ft)			78.90	250.00	480.00	394.24	524.76	508.32	671.72	139.47	3.00
Bankfull Mean Depth (ft)	1.80	2.60	1.67	1.88	2.18	2.00	2.19	2.19	2.37	0.19	3.00
Bankfull Max Depth (ft)			2.92	2.71	2.72	2.81	3.26	2.89	4.07	0.71	3.00
Bankfull Cross Sectional Area (ft^2)	66.00	66.10	68.83	57.40	66.40	67.70	69.85	68.21	73.63	3.29	3.00
Width/Depth Ratio			24.60	16.20	14.00	13.09	14.73	14.21	16.90	1.96	3.00
Entrenchment Ratio			1.92	8.20	15.70	12.67	16.45	15.04	21.65	4.65	3.00
Bank Height Ratio			1.80	1.00	1.00	1.00	1.00	1.00	1.00	0.00	3.00
d50 (mm)			61.30	61.30	61.30						
Profile											
Riffle Length (ft)						37.17	64.41	58.40	106.19	18.18	23.00
Riffle Slope (ft/ft)			0.01	0.02	0.03	0.01	0.02	0.02	0.05	0.01	23.00
Pool Length (ft)						17.36	53.01	54.24	93.29	20.18	26.00
Pool Max depth (ft)			4.13	4.70	4.36	3.31	4.50	4.43	6.20	0.80	26.00
Pool Spacing (ft)			37.00 - 171.00	76.9 - 227.9	2.0 - 7.5	86.78	130.47	130.18	210.45	35.20	25.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			73.00 - 152.00	30.0 - 195.0	61.0 - 195.2						
Radius of Curvature (ft)			28 - 168	30.0 - 178.0	61.0 - 91.5						
Rc: Bankfull Width (ft/ft)			0.7 - 4.1	1.0 - 5.8	2.0 - 3.0						
Meander Wavelength (ft)			200 - 375	60 - 344	61.0 - 344.0						
Meander Width Ratio			1.78 - 3.70	1.0 - 6.4	2.0 - 6.4						
Substrate, bed and transport parameters											
Ri% / P%						35% / 65%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^2 / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			3.83		3.83	3.83					
Additional Reach Parameters											
Drainage Area (SM)			5.17	4.66	5.17						
Impervious cover estimate (%)											
Rosgen Classification			B4	C4	C4	C4					
Bankfull Velocity (fps)				5.10	4.80						
Bankfull Discharge (cfs)			300.00	295.00	300.00						
Valley length (ft)			2894.00		2894.00	2894.00					
Channel Thalweg length (ft)			3425.00		3219.00	3219.00					
Sinuosity (ft)			1.18	1.11	1.11	1.11					
Water Surface Slope (Channel) (ft/ft)			0.0099	0.0192	0.0062	0.0059					
BF slope (ft/ft)					0.0062	0.0059					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 8a. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 1 to Roses Creek: 234 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq. Mountains	Eq. Piedmont	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	6.70	5.30	6.00	4.40	5.00	5.12	5.12	5.12	5.12	0.00	1.00
Floodprone Width (ft)			8.40	27.50	60.00	91.80	91.80	91.80	91.80	0.00	1.00
Bankfull Mean Depth (ft)	0.50	0.70	0.23	0.51	0.38	0.45	0.45	0.45	0.45	0.00	1.00
Bankfull Max Depth (ft)			0.36	1.00	0.58	0.78	0.78	0.78	0.78	0.00	1.00
Bankfull Cross Sectional Area (ft^2)	3.20	3.30	1.39	2.30	2.10	2.30	2.30	2.30	2.30	0.00	1.00
Width/Depth Ratio			26.20	12.80	13.00	11.38	11.38	11.38	11.38	0.00	1.00
Entrenchment Ratio			1.40	6.28	12.00	17.93	17.93	17.93	17.93	0.00	1.00
Bank Height Ratio			6.11	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
d50 (mm)											
Profile											
Riffle Length (ft)						7.20	10.60	9.60	17.00	2.91	12.00
Riffle Slope (ft/ft)			0.0260	0.0033 - 0.0284	0.0021 - 0.0029	0.0201	0.0265	0.0213	0.0799	0.0210	12.00
Pool Length (ft)						3.60	11.89	9.80	37.39	9.23	11.00
Pool Max depth (ft)			Channelized	1.98	0.77	0.49	0.73	0.77	0.96	0.19	11.00
Pool Spacing (ft)			Channelized	10.10 - 41.0	10.0 - 30.0	18.40	24.04	20.90	45.59	8.03	10.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	10.00 - 30.00						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.00 - 15.00						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.40 - 3.00						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	20.0 - 55.0						
Meander Width Ratio			Channelized	2.74 - 4.11	2.00 - 6.00						
Substrate, bed and transport parameters											
Ri% / P%						49% / 51%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^{gp} / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			0.07		0.07	0.07					
Additional Reach Parameters											
Drainage Area (SM)			0.06	0.07	0.06						
Impervious cover estimate (%)											
Rosgen Classification			F5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.10						
Bankfull Discharge (cfs)			2.4	3.00	2.40						
Valley length (ft)			199.00		199.00	199.00					
Channel Thalweg length (ft)			199.00		234.00	234.00					
Sinuosity (ft)			1.00	1.16	1.18	1.18					
Water Surface Slope (Channel) (ft/ft)			0.0260	0.0033 - 0.0284	0.0021	0.0027					
BF slope (ft/ft)					0.0021	0.0027					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 8b. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 2 to Roses Creek: 707 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Mountains Eq.	Piedmont Eq.	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	7.10	5.60	4.40	4.40	5.00	6.70	6.70	6.70	6.70	0.00	1.00
Floodprone Width (ft)			8.10	27.50	60.00	32.45	32.45	32.45	32.45	0.00	1.00
Bankfull Mean Depth (ft)	0.50	0.80	0.95	0.51	0.38	0.42	0.42	0.42	0.42	0.00	1.00
Bankfull Max Depth (ft)			1.39	1.00	0.58	0.77	0.77	0.77	0.77	0.00	1.00
Bankfull Cross Sectional Area (ft^2)	3.50	3.70	4.16	2.30	2.10	2.79	2.79	2.79	2.79	0.00	1.00
Width/Depth Ratio			4.60	12.80	13.00	15.95	15.95	15.95	15.95	0.00	1.00
Entrenchment Ratio			1.84	6.28	12.00	4.84	4.84	4.84	4.84	0.00	1.00
Bank Height Ratio			1.70	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
d50 (mm)											
Profile											
Riffle Length (ft)						4.27	13.94	13.33	31.46	6.12	23.00
Riffle Slope (ft/ft)			0.0260	0.0033 - 0.0284	0.0021 - 0.0030	0.0020	0.0025	0.0025	0.0038	0.0006	23.00
Pool Length (ft)						3.73	10.18	8.00	27.19	5.71	24.00
Pool Max depth (ft)			Channelized	1.98	0.77	0.53	0.96	0.92	1.59	0.24	24.00
Pool Spacing (ft)			Channelized	10.10 - 41.00	10.0 - 30.00	7.46	25.57	22.39	57.59	11.77	23.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	13.70 - 30.00						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.00 - 16.00						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.40 - 3.20						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	20.00 - 75.50						
Meander Width Ratio			Channelized	2.74 - 4.11	2.70 - 6.00						
Substrate, bed and transport parameters											
Ri% / P%						58% / 42%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^{p} / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			0.89		0.06	0.06					
Additional Reach Parameters											
Drainage Area (SM)			0.07	0.07	0.07						
Impervious cover estimate (%)											
Rosgen Classification			G5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.10						
Bankfull Discharge (cfs)			2.40	3.00	2.40						
Valley length (ft)			575.00		575.00	575.00					
Channel Thalweg length (ft)			575.00		707.00	707.00					
Sinuosity (ft)			1.00	1.16	1.99	1.23					
Water Surface Slope (Channel) (ft/ft)			0.0260	0.0033 - 0.0284	0.0021	0.0023					
BF slope (ft/ft)					0.0021	0.0023					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 8c. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 3 to Roses Creek: 620 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Mountains Eq.	Piedmont Eq.	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	4.50	3.50	5.00	4.40	5.50	6.00	6.00	6.00	6.00	0.00	1
Floodprone Width (ft)			44.13	27.50	70.00	175.41	175.41	175.41	175.41	0.00	1
Bankfull Mean Depth (ft)	0.30	0.30	0.26	0.51	0.42	0.36	0.36	0.36	0.36	0.00	1
Bankfull Max Depth (ft)			1.70	1.00	0.63	0.69	0.69	0.69	0.69	0.00	1
Bankfull Cross Sectional Area (ft^2)	1.50	1.60	2.40	2.30	2.60	2.19	2.19	2.19	2.19	0.00	1
Width/Depth Ratio			12.23	12.80	13.10	16.67	16.67	16.67	16.67	0.00	1
Entrenchment Ratio			9.52	6.28	12.70	29.24	29.24	29.24	29.24	0.00	1
Bank Height Ratio			3.33	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1
d50 (mm)											
Profile											
Riffle Length (ft)						4.0	13.7	11.1	46.1	9.2	20
Riffle Slope (ft/ft)			0.0295	0.0033 - 0.0284	0.0029 - 0.0045	0.0025	0.0030	0.0030	0.0035	0.0004	20
Pool Length (ft)						3.2	12.1	8.1	34.6	9.0	20
Pool Max depth (ft)			Channelized	1.98	0.84	0.76	1.49	1.29	2.61	0.61	20
Pool Spacing (ft)			Channelized	10.10 - 41.00	12.7 - 51.70	10.3	25.0	25.8	45.3	9.4	19
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	15.10 - 49.50						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.70 - 17.60						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.30 - 3.20						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	15.10 - 83.10						
Meander Width Ratio			Channelized	2.74 - 4.11	2.70 - 9.00						
Substrate, bed and transport parameters											
Ri% / P%						53% / 47%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^{p} / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			0.09		0.08	0.08					
Additional Reach Parameters											
Drainage Area (SM)			0.02	0.07	0.02						
Impervious cover estimate (%)											
Rosgen Classification			B5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.00						
Bankfull Discharge (cfs)			2.6	3.0	2.6						
Valley length (ft)			422		422	422					
Channel Thalweg length (ft)			422		620	620					
Sinuosity (ft)			1.00	1.16	1.47	1.47					
Water Surface Slope (Channel) (ft/ft)			0.0268	0.0033 - 0.0284	0.0025	0.0037					
BF slope (ft/ft)					0.0025	0.0037					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 9. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
Roses Creek: 3,200 LF

	Cross Section 1 (Riffle)								Cross Section 2 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	33.80	31.10	30.73	29.98					38.53	37.04	39.49	30.03				
Floodprone Width (ft)	508.32	508.32	508.32	508.32												
Bankfull Mean Depth (ft)	2.00	2.20	2.19	2.18					1.73	1.75	1.65	1.96				
Bankfull Max Depth (ft)	2.81	2.89	3.01	3.35					3.47	3.80	4.05	4.02				
Bankfull Cross Sectional Area (ft^2)	67.70	68.28	67.22	65.27					66.48	64.97	65.02	58.79				
Bankfull Width/Depth Ratio	16.90	14.14	14.03	13.75												
Bankfull Entrenchment Ratio	15.04	16.35	16.54	16.96												
Low Bank Height (ft)				3.44												
Bank Height Ratio*	1.00	1.00	1.00	1.02												
	Cross Section 3 (Pool)								Cross Section 4 (Riffle)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	32.44	31.58	32.26	32.20					31.11	31.66	31.03	32.35				
Floodprone Width (ft)									696.00	696.00	696.00	696.00				
Bankfull Mean Depth (ft)	2.19	2.32	2.07	2.03					2.19	2.16	2.08	2.12				
Bankfull Max Depth (ft)	4.10	3.99	4.09	4.13					2.89	3.03	2.80	3.20				
Bankfull Cross Sectional Area (ft^2)	71.10	73.39	66.76	65.48					68.21	68.41	64.61	71.47				
Bankfull Width/Depth Ratio									14.21	14.66	14.92	14.64				
Bankfull Entrenchment Ratio									22.37	21.98	22.43	21.51				
Low Bank Height (ft)												3.38				
Bank Height Ratio*									1.00	1.00	1.00	1.06				
	Cross Section 5 (Riffle)								Cross Section 6 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	32.56	32.99	34.06	36.04					31.02	31.30	30.99	29.70				
Floodprone Width (ft)	563.60	563.60	563.60	563.60												
Bankfull Mean Depth (ft)	2.13	2.25	2.22	2.37					2.37	2.23	2.32	2.69				
Bankfull Max Depth (ft)	3.16	3.23	3.29	3.73					4.07	3.98	4.11	4.36				
Bankfull Cross Sectional Area (ft^2)	69.41	74.12	75.52	85.30					73.63	69.77	71.83	80.01				
Bankfull Width/Depth Ratio	15.29	14.66	15.34	15.21												
Bankfull Entrenchment Ratio	17.31	17.08	16.55	15.64												
Low Bank Height (ft)				3.69												
Bank Height Ratio*	1.00	1.00	1.00	<1												

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Table 9a. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
UT 1 Roses Creek: 234 LF

	Cross Section 7 (Riffle)								Cross Section 8 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	5.12	4.46	5.31	5.01					6.24	7.07	6.80	7.49				
Floodprone Width (ft)	91.80	91.80	91.80	91.80												
Bankfull Mean Depth (ft)	0.45	0.41	0.35	0.36					0.58	0.44	0.47	0.42				
Bankfull Max Depth (ft)	0.78	0.59	0.61	0.62					0.96	0.77	0.81	0.71				
Bankfull Cross Sectional Area (ft^2)	2.30	1.82	1.86	1.78					3.64	3.10	3.23	3.12				
Bankfull Width/Depth Ratio	11.38	10.88	15.17	13.92												
Bankfull Entrenchment Ratio	17.93	20.58	17.29	18.32												
Low Bank Height (ft)				0.57												
Bank Height Ratio*	1.00	1.00	1.00	<1												

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Table 9b. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
UT2 Roses Creek: 707 LF

	Cross Section 9 (Pool)								Cross Section 10 (Riffle)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	5.56	6.43	5.69	5.53					6.70	7.10	6.79	7.38				
Floodprone Width (ft)									93.36	93.36	93.36	93.36				
Bankfull Mean Depth (ft)	0.37	0.31	0.33	0.49					0.42	0.38	0.32	0.39				
Bankfull Max Depth (ft)	0.86	0.72	0.63	1.12					0.77	0.74	0.64	0.84				
Bankfull Cross Sectional Area (ft^2)	2.07	1.97	1.90	2.73					2.79	2.69	2.17	2.88				
Bankfull Width/Depth Ratio									16.75	18.68	21.22	18.92				
Bankfull Entrenchment Ratio									13.93	13.14	13.75	12.65				
Low Bank Height (ft)												0.83				
Bank Height Ratio*									1.00	1.00	1.01	1.00				

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Table 9c. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
UT3 Roses Creek: 620 LF

	Cross Section 11 (Riffle)								Cross Section 12 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	6.00	7.28	5.38	6.73					6.39	7.93	7.52	7.99				
Floodprone Width (ft)	175.41	175.41	175.41	175.41												
Bankfull Mean Depth (ft)	0.36	0.21	0.37	0.24					0.56	0.46	0.45	0.40				
Bankfull Max Depth (ft)	0.69	0.46	0.65	0.57					0.90	0.84	0.82	0.78				
Bankfull Cross Sectional Area (ft^2)	2.19	1.51	2.01	1.62					3.55	3.61	3.40	3.23				
Bankfull Width/Depth Ratio	16.67	34.67	14.54	28.04												
Bankfull Entrenchment Ratio	29.24	24.09	32.60	26.06												
Low Bank Height (ft)				0.5												
Bank Height Ratio*	1.00	1.00	1.00	<1												

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

Appendix E. Hydrologic Data

Figures 5.1 - 5.24 Crest Gauge Photos

5.1 Crest Gauge Roses Creek Lower (10/5/2016)

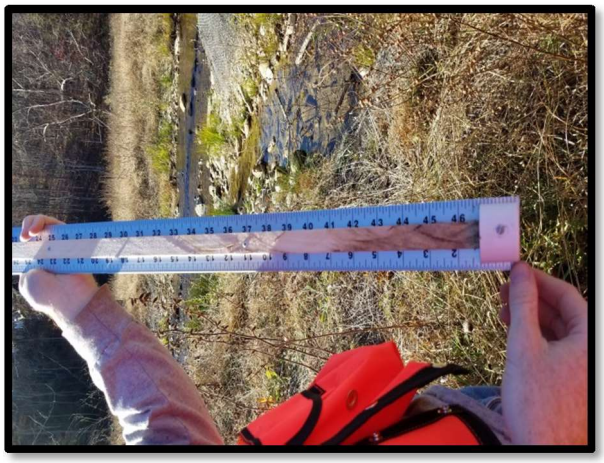
5.2 Crest Gauge UT 1 (10/5/2016)

5.3 Crest Gauge UT 2 (10/5/2016)

5.4 Crest Gauge UT 3 (10/5/2016)

5.5 Crest Gauge Roses Creek (11/22/2016)

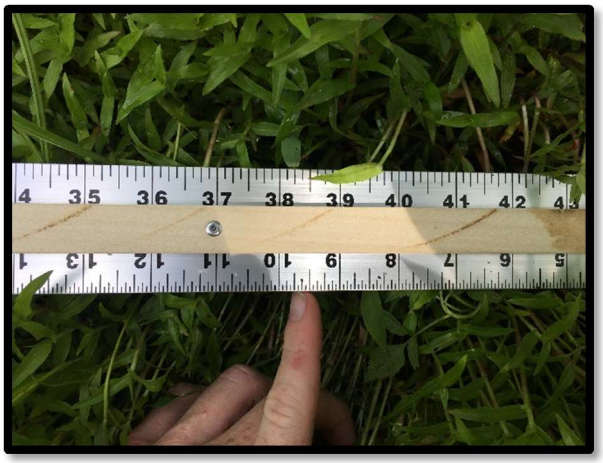
5.6 Crest Gauge UT 1 (11/22/2016)



5.7 Crest Gauge UT 2 (11/22/2016)

5.8 Crest Gauge UT 3 (11/22/2016)

5.9 Crest Gauge Roses Creek (6/2/2017)



5.10 Crest Gauge UT 1 (6/2/2017)

5.11 Crest Gauge UT 2 (6/2/2017)

5.12 Crest Gauge UT 3 (6/2/2017)

5.13 Crest Gauge Roses Creek (8/15/2017)

5.14 Crest Gauge UT 1 (8/15/2017)

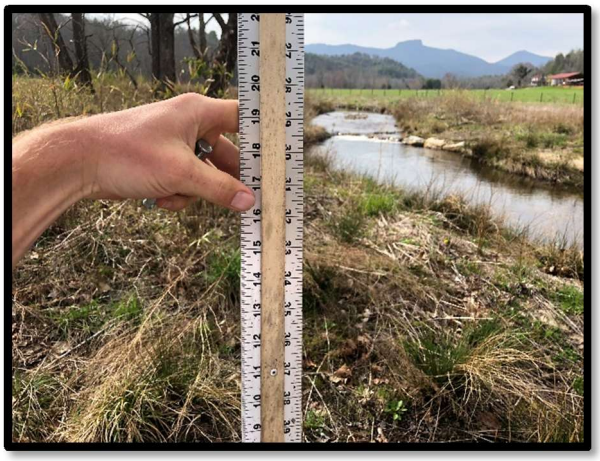
5.15 Crest Gauge UT 2 (8/15/2017)

5.16 Crest Gauge UT 3 (8/15/2017)

5.17 Crest Gauge Roses Creek (3/28/2018)

5.18 Crest Gauge UT 1 (3/28/2018)

5.19 Crest Gauge UT 2 (3/28/2018)



5.20 Crest Gauge UT 3 (3/28/2018)

5.21 Crest Gauge Roses Creek (8/6/2018)

5.22 Crest Gauge UT 1 (8/6/2018)

5.23 Crest Gauge UT 2 (8/6/2018)

5.24 Crest Gauge UT 3 (8/6/2018)

Table 10. Verification of Bankfull Events

Date	Crest Gauge Info		Gauge Reading (ft)	Gauge Elevation (ft)	Crest Elevation (ft)	Bankfull Elevation (ft)	Height above Bankfull (ft)	Photo
	Site	Sta.						
10/5/2016	1	Roses Creek Lower	0.00	1212.11	N/A	1213.93	N/A	5.1
10/5/2016	2	UT 1	0.00	1267.45	N/A	1267.95	N/A	5.2
10/5/2016	3	UT 2	0.35	1227.81	1228.16	1228.19	N/A	5.3
10/5/2016	4	UT 3	0.25	1216.94	1217.19	1217.36	N/A	5.4
11/22/2016	1	Roses Creek Lower	0.00	1212.11	N/A	1213.93	N/A	5.5
11/22/2016	2	UT 1	0.00	1267.45	N/A	1267.95	N/A	5.6
11/22/2016	3	UT 2	0.00	1227.81	N/A	1228.19	N/A	5.7
11/22/2016	4	UT 3	0.35	1216.94	1217.29	1217.36	N/A	5.8
6/2/2017	1	Roses Creek Lower	1.89	1212.11	1214.00	1213.93	0.07	5.9
6/2/2017	2	UT 1	0.80	1267.45	1268.25	1267.95	0.30	5.10
6/2/2017	3	UT 2	1.50	1227.81	1229.31	1228.19	1.12	5.11
6/2/2017	4	UT 3	1.80	1216.94	1218.74	1217.36	1.38	5.12
8/15/2017	1	Roses Creek Lower	0.50	1212.11	1212.61	1213.93	N/A	5.13
8/15/2017	2	UT 1	0.38	1267.45	1267.83	1267.95	N/A	5.14
8/15/2017	3	UT 2	0.85	1227.81	1228.66	1228.19	0.47	5.15
8/15/2017	4	UT 3	1.64	1216.94	1218.58	1217.36	1.22	5.16
3/28/2018	1	Roses Creek Lower	2.83	1212.11	1214.94	1213.93	1.01	5.17
3/28/2018	2	UT 1	0.38	1267.45	1267.83	1267.95	N/A	5.18
3/28/2018	3	UT 2	2.50	1227.81	1230.31	1228.19	2.12	5.19
3/28/2018	4	UT 3	1.38	1216.94	1218.32	1217.36	0.96	5.20
8/6/2018	1	Roses Creek Lower	3.75	1212.11	1215.86	1213.93	1.93	5.21
8/6/2018	2	UT 1	1.13	1267.45	1268.58	1267.95	0.63	5.22
8/6/2018	3	UT 2	2.54	1227.81	1230.35	1228.19	2.16	5.23
8/6/2018	4	UT 3	2.92	1216.94	1219.86	1217.36	2.50	5.24

Figure 6.1 – 6.3 Tributary Water Level Gauge Meter Data

Figure 6.1 UT 1 Water Level

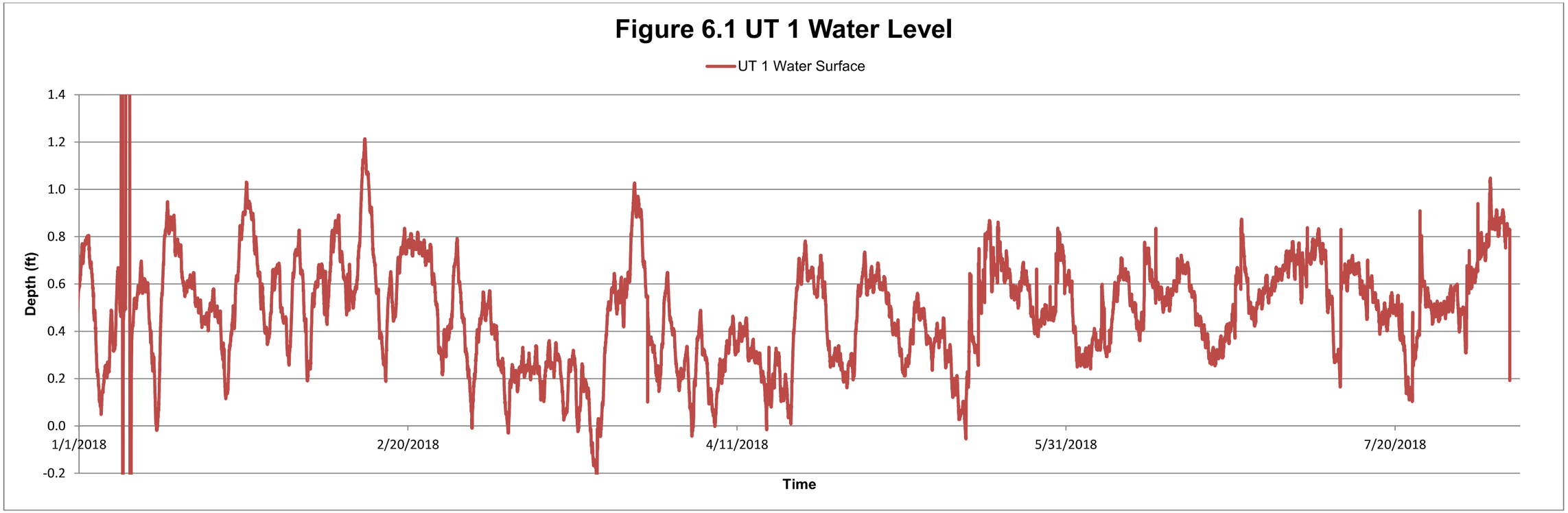


Figure 6.2 UT 2 Water Level

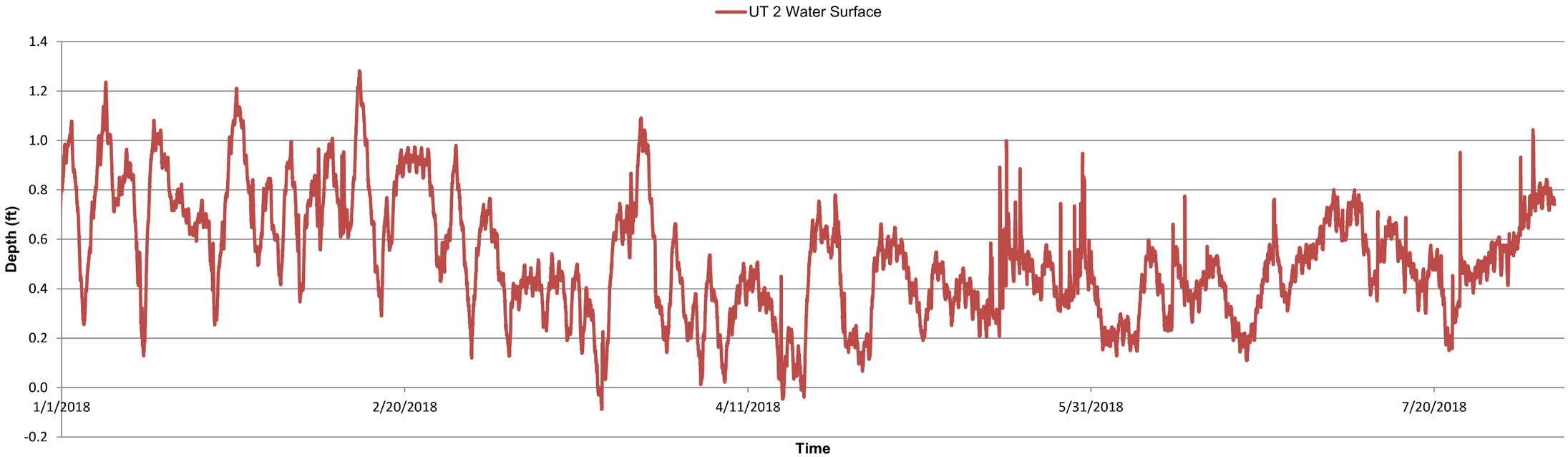


Figure 6.3 UT 3 Water Level

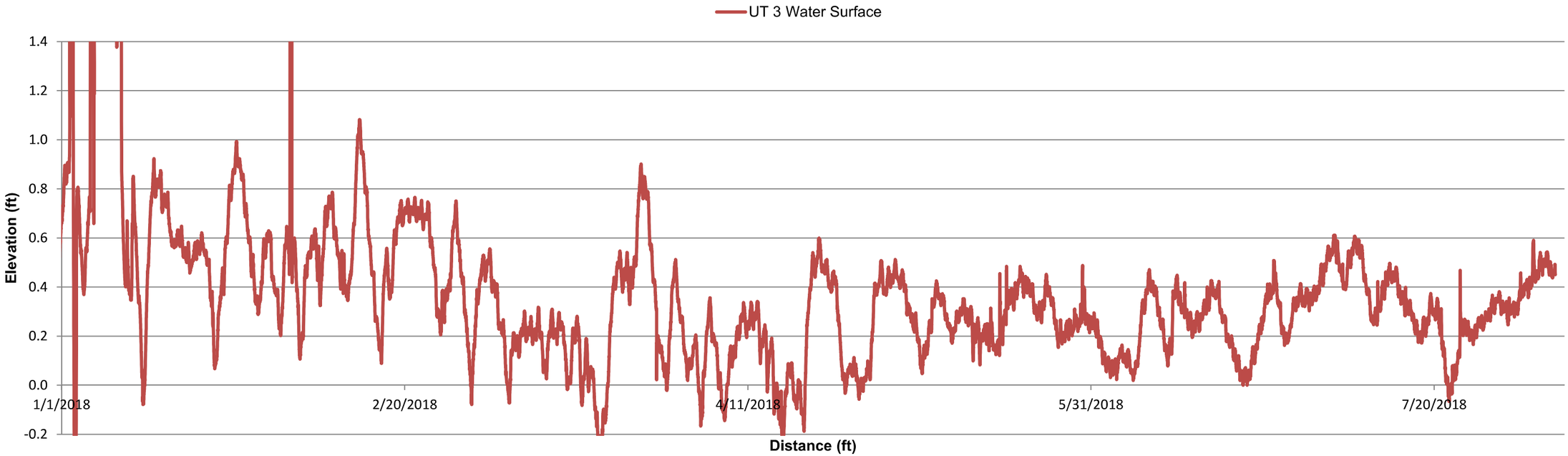


Table 11. Tributary Surface Water Summary

Tributary	Dates	Number of Consecutive Days with Flow
UT 1	6/25/2016 - 7/27/2016	32
UT 1	2/25/2017 - 5/6/2017	70
UT 1	6/1/2017 - 8/14/2017	74
UT 1	1/12/2018 – 3/1/2018	48
UT 1	5/15/2018 – 8/6/2018	83
UT 2	6/9/2016 - 1/22/2017	228
UT 2	1/23/2017 - 5/11/2017	108
UT 2	6/1/2017 – 7/26/2017	55
UT 2	8/30/2017 – 10/3/2017	34
UT 2	11/18/2017 – 3/20/2018	122
UT 2	4/19/2018 – 8/6/2018	109
UT 3	2/15/2017 – 5/11/2017	85
UT 3	6/1/2017 – 7/23/2017	52
UT 3	12/14/2017 – 3/1/2018	77
UT 3	4/27/2018 – 7/22/2018	86

Appendix F. Adaptive Management Plan

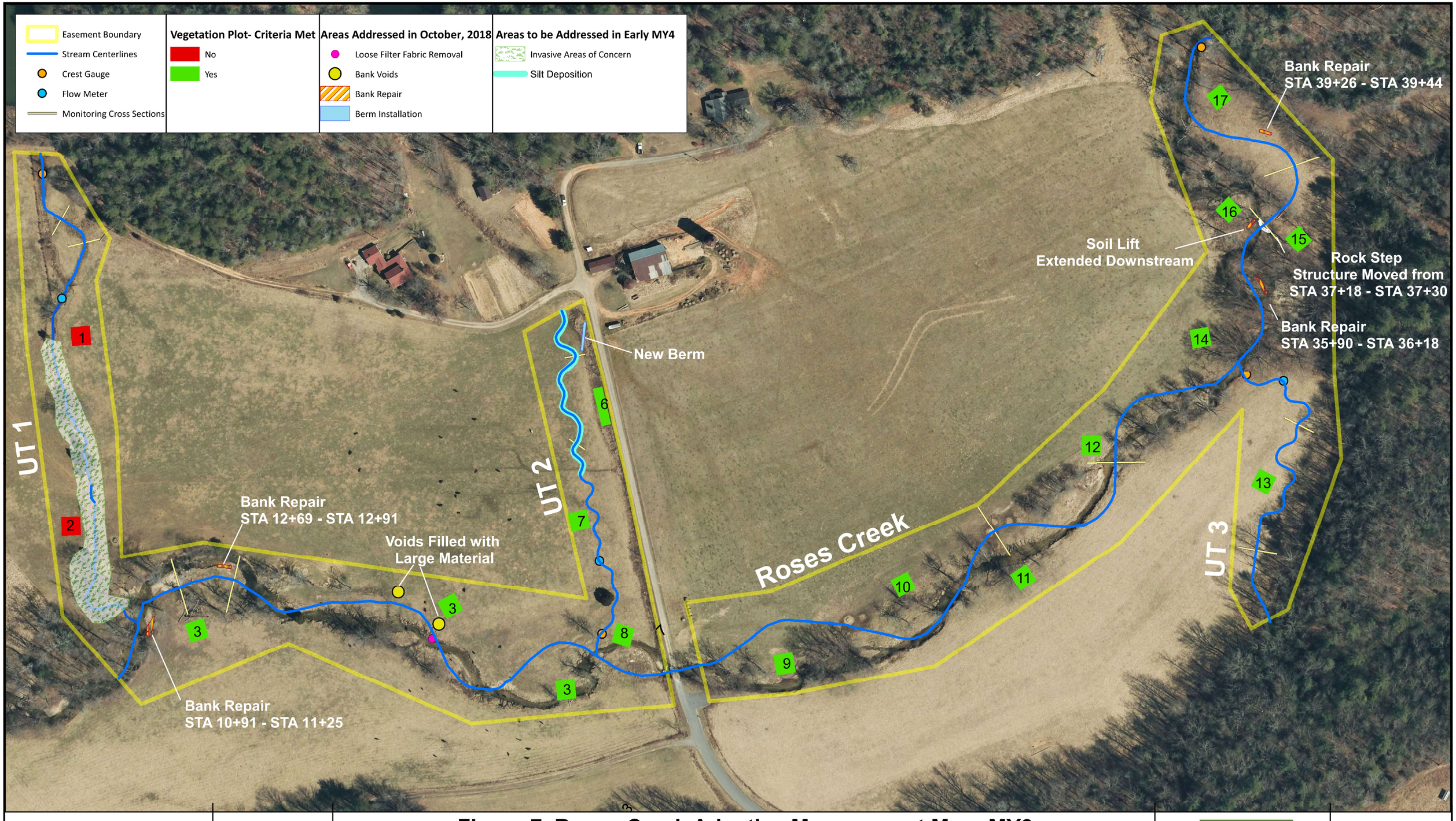


Figure 7. Roses Creek Adaptive Management Map- MY3

Roses Creek Stream Mitigation Site
Burke County, North Carolina

0 325 650 975 1,300 Feet