Monitoring Year 5 & Closeout Report

Bowman
(Mt. Pleasant Creek Restoration Project)
DMS Project Number 44
401: DWR 07-2252v2
404: SAW-2008-01382

Randolph County, North Carolina

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Mitigation Services
ENVIRONMENTAL QUALITY

Monitoring Data Collected: July-October 2021

TABLE OF CONTENTS

PROJECT SUMMARY 1
GOALS AND OBJECTIVES 1
DESIGN APPROACH & IMPLEMENTATION 1
MONITORING 2
SUCCESS CRITERION 2
MONITORING RESULTS 2
Figure 1. Project Site Vicinity Map 3
Figure 2. Site Asset Map 4
REFERENCES 6

Appendix A – Background Tables

Table 1. Project Components and Mitigation Credits
Table 2. Project History
Table 3. Project Contacts
Table 4. Project Information

Appendix B – Visual Assessment Data

Table 5. Visual Assessment
CCPV
Photo Reference Points
Vegetation Plot Photos

Appendix C – Vegetation Plot Data

Table 6. Tree Planting
Table 7. Invasive Treatment
Table 8. Stem Count Total and Planted by Plot and Species

Appendix D – Stream Measurement and Geomorphology Data

Table 9. Bankfull Events
Table 10. Cross-section Morphology Data Table
Cross-section Graphs
Precipitation Data

Appendix E – Additional Data

PROJECT SUMMARY

Project work at the Mt. Pleasant Creek Restoration Project, Bowman Property ("Bowman") was completed in February 2017, and included construction, planting, invasive treatment, and gate/fence installation. Through this project work, a total of 1,866 linear feet of stream were enhanced or preserved, and 358,604 sf of buffer were protected, enhanced, or restored. The project stream is perennial and drains a 5.2-acre watershed in the Cape Fear River Basin (03030003 8-digit cataloging unit) of Randolph County, North Carolina. The Bowman site has a history of unrestricted livestock access, compacted soils, bank erosion, and discontinuity between the stream and its associated floodplain. The completed project will reduce sediment inputs from failing banks, reduce nutrients and bacteria entering the stream from livestock and will enhance the forested corridor along the stream floodplain.

The project is protected by a 9.61-acre permanent conservation easement, held by the NC Department of Transportation. Bowman is located off Whites Chapel Road, approximately 5 miles southwest of Liberty, North Carolina. The project site is bounded by interspersed pastureland and forested land to the east, forest to the south, pasture and forest to the north, and agricultural land and forest to the west. Bowman is within a parent parcel involved with agricultural production for cattle, chicken houses, goats, and hay pasture.

GOALS & OBJECTIVES

The 2009 Cape Fear River Basin RBRP identified HUC 03030003020010 (Sandy Creek) as a Targeted Local Watershed, of which the project site is a part (NCEEP 2009). The project goals are in line with the following basin priorities:

- Reduce sources of sediment and nutrients by enhancing riparian buffer vegetation, excluding livestock, and enhancing stream and buffer function.

The goals for the project are to:

- Restore long term stability to exposed banks and reduce susceptibility to scour.
- Eliminate stream bacteria and nutrient exposure from animal waste and wallow.
- Restore a contiguous riparian buffer that connects to the surrounding forested mature buffer.

The project goals will be addressed through the following objectives:

- Conduct Enhancement I level stream restoration on 530 linear feet of stream by repairing actively eroding banks and re-establishing the stream pattern where there has been excessive sediment deposition.
- Conduct Enhancement II level stream restoration on 1,046 linear feet of stream through a permanent conservation easement and removing cattle access.
- Install Preservation on an additional 290 linear feet of stream by putting the stream in a permanent conservation easement.
- Riparian buffer restoration, enhancement, and preservation throughout the stream corridor.

DESIGN APPROACH & IMPLEMENTATION

The Bowman site was acquired by DOT as a Conservation Easement in 2006 and proposed for full-scale restoration in 2007. Due to site conditions including existing bedrock control, lack of belt width, and scale of watershed, the project was put on hold and later scaled back to address objectives described above.
Project work was completed in February 2017 per the IRT approved Mitigation Plan. The as-built and baseline surveys found that the stream was constructed as designed and all structures were installed as planned. Stream work included installation of 7 soil lifts fortified with live willow whips, a ford crossing, and constructed riffle in the Enhancement I credit area. Bio-engineering with live staking, temporary and permanent seeding occurred along all exposed banks, and sloped banks; and transplants were installed where possible. Invasive treatment occurred throughout the entire easement,

using a stump herbicide treatment method initially and spraying for maintenance. The only modification during construction was the extension of the stone on both sides of the ford crossing.

On March 9, 2017, 1.23-acres of riparian buffer was planted per the Mitigation Plan specifications. Five species of trees were installed at a density of approximately 600 trees per acre. There were two substitutions from the Mitigation Plan species due to availability and vigor of trees (*Nyssa sylvatica* and *Quercus nigra* substituted for *Quercus Michauxii, Ulmus Americana* and *Vibrunum dentatim*). Initially, a 3-strand high tensile electric fencing was installed in the crossing area. Due to the size of the stream (5 square mile drainage area), the fence was constantly under repair and causing damage. DMS worked with the landowner to employ temporary electric fence during active crossing with the caveat that the gates are always closed. This has been a successful solution throughout the project, and the landowner is compliant.

MONITORING

The monitoring components were installed in March 2017 per the Mitigation Plan monitoring specifications. Three permanent cross-sections were established at stations 12+12 (XS2), 15+25 (XS3) and 17+00 (XS4). Two of these cross-sections (12+12 and 17+00) were established at location where previous, pre-construction cross-sections were installed for comparison. The third cross-section (15+25) was placed across the newly constructed riffle. A manual cork crest gauge was installed to record the occurrence of bankfull events.

For vegetation monitoring, one permanent and two random 10 m^2 vegetation monitoring plots were established. The location of the planted stems relative to the origin within the permanent plot, as well as the species in all plots, was recorded by size. Volunteers were recorded by species and size separately from planted stems. Six permanent photo reference points were established and will be taken annually.

SUCCESS CRITERION

Stream performance standards are based on 2003 Stream Mitigation Guidelines for determination of channel stability and vegetative success. Stream stability will be documented through 1) annual visual assessment 2) demonstration of bankfull events, 3) stream photo points and 4) monitoring three cross sections (for the Enhancement I section only). A minimum of two bankfull events in separate years must be recorded during the five-year monitoring period to meet success.

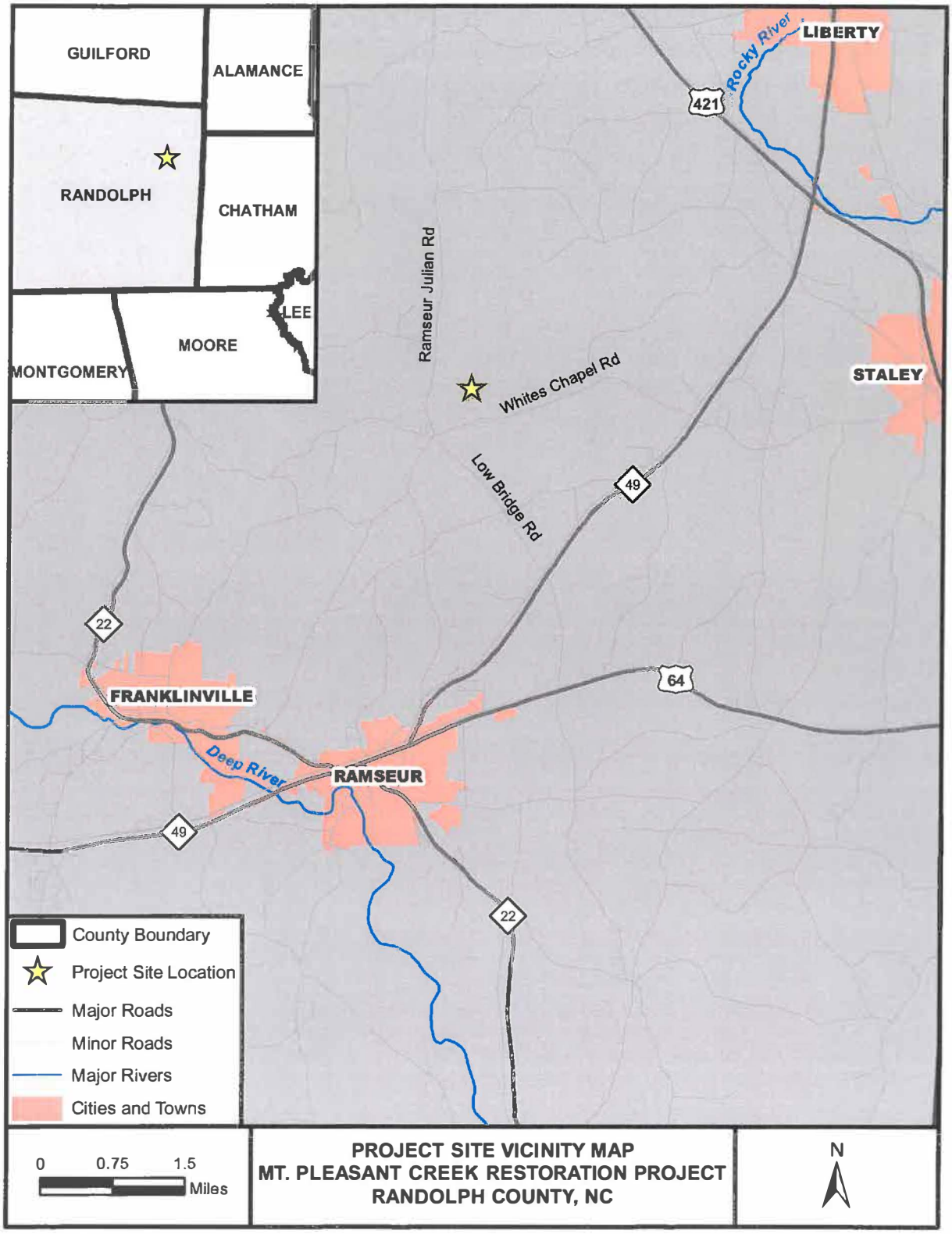
Vegetative success criterion is in accordance with North Carolina Division of Water Resources Administrative Code 15A NCAC 02B.0295 (NCDWR 2014 Temporary Rule). After five years of monitoring, an average density of 260 woody stems per acre must be surviving and diffuse flow maintained. The 2003 Stream Mitigation Guidelines also indicates a 260 stem per acre survival requirement at monitoring year five.

MONITORING YEAR 5 RESULTS

Monitoring occurred on September 30, 2021. Vegetation monitoring, visual assessments, and cross-sectional surveys results are summarized in tables below. All plots met success when volunteers are considered. Walnut volunteers continue to thrive on the planted areas of the site, as there are many "parent" walnut trees that are large and mast producing. At this point in the project, the alleopathic properties of the walnut volunteers are evident as they dominate the planted areas. During the monitoring period, additional planting occurred in the dormant 2019-20. On 2/26/2020, 100 stems of silky dogwood were planted. Invasive treatment occurred in spring and fall of every monitoring year, primarily for privet.

Bankfull events occurred and are documented in every monitoring year through the manual crest gauge, and visual evidence of significant and repeated bankfull events were apparent. There were several very large trees lifted into the floodplain, and evidence of significant rack and debris. Stream banks area stable, but riffles showed evidence of bankfull deposition, especially XS 4. This is likely due to the significant events occurring in such a large drainage area, and some downstream debris that is slowing flow. Willow whip live stakes are vigorous and have established a strong bank foothold.

2.3 Project Site Vicinity Map



Bowman Site (Mount Pleasant Creek), DMS ID #44
Asset Map

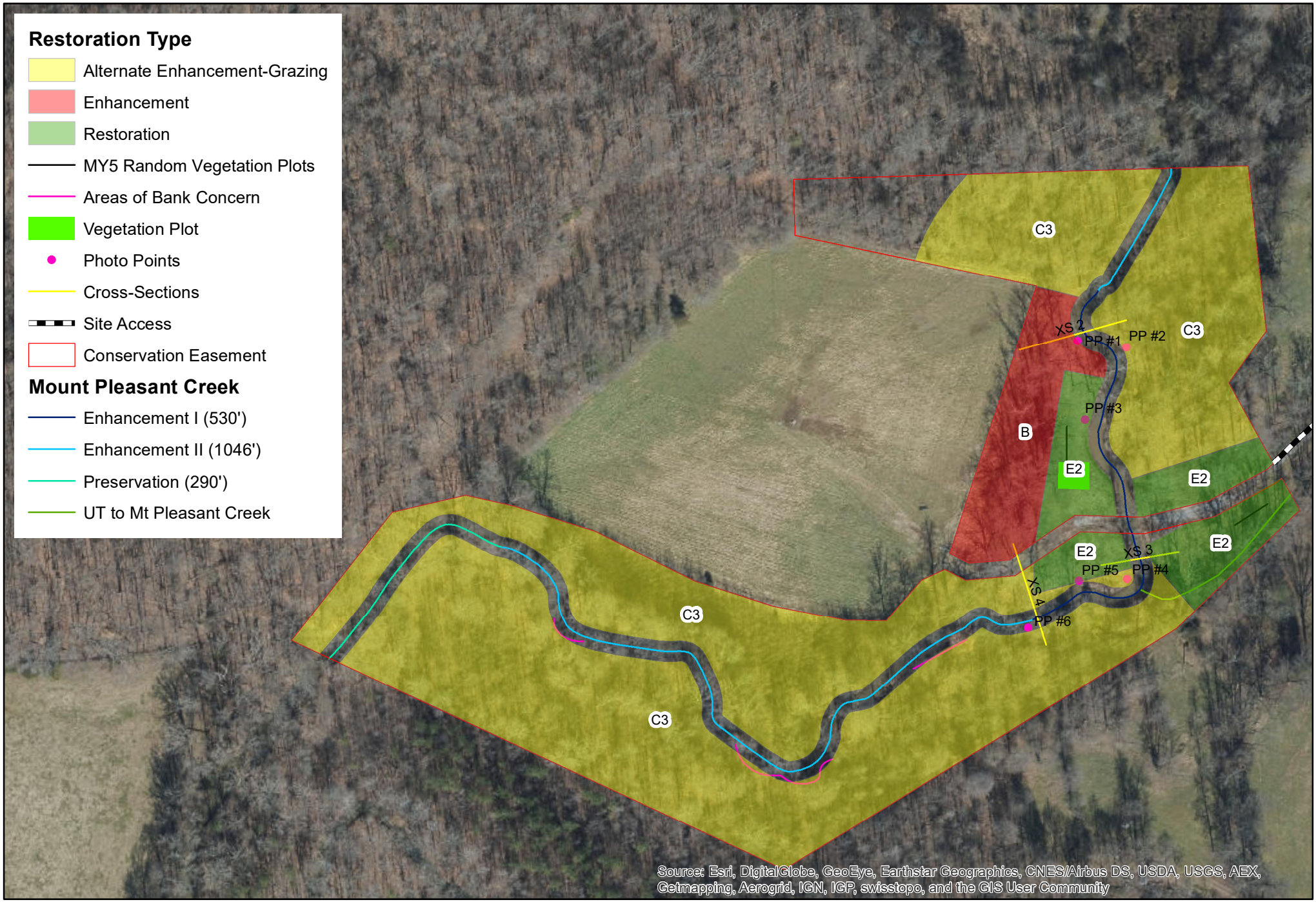
0 75 150 300 Feet

N W E S

Bowman Site (Mount Pleasant Creek), DMS ID #44
Current Condition Plan View

0 75 150 300 Feet

N W E S



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APPENDIX A

Background Tables

Table 1. Project Components and Mitigation Credits
Mt. Pleasant Creek Restoration Project-Bowman Property, DMS Project #44
Mitigation Credits

	Stream		Riparian Buffer	
Type	R	RE	R	E
Size (ft/sf)	1,576	290	37,474	321,130
Credits (SMU/BMU)	772	58	33,359	144,090
TOTAL CREDITS		830		177,448

STREAM MITIGATION

Project Component	Location	Existing Length (ft)	Approach	Mitigation Ratio (x: 1)	Restoration Length (ft)	Credits (SMU)
Mount Pleasant Creek	10 + 00 to 11+75	175	Enhancement II	2.5	175	70
	11+75 to 14+91 15+11 to 17+25	530	Enhancement I	1.5	530	353
	17 + 25 to 25 + 96	871	Enhancement II	2.5	871	348
	25 + 96 to 28 + 86	290	Preservation	5	290	58

RIPARIAN BUFFER MITIGATION: Randleman Lake Water Supply Watershed

Project Component	Proximity to TOB (ft)	Existing Area (sqft)	Approach	Mitigation Ratio (x: 1)	Eligible Restoration Area (sqft)	Credits (BMU)
A	0-100	16,404	Restoration	1	16,404	16,404
E1	0-100	5,222	Restoration	1	5,222	5,222
E1	100-200	3,091	Restoration	2	3,091	1,546
E2	0-100	7,617	Restoration	1	7,617	7,617
E2	100-200	5,140	Restoration	2	5,140	2,570
B	0-100	19,982	Enhancement	2	19,982	9,991
B	100-200	6,611	Enhancement	4	6,611	1,653
C1, C2, C3 & D	0-100	246,962	Alt. Enhancement	2	246,962	123,481
C1, C2, C3 & D*	100-200	47,575	Alt. Enhancement	4	35,860	8,965
SUM		**358,604**			**346,889**	**177,448**
SUBTOTAL	0-100		Restoration	1	29,243	29,243
SUBTOTAL	100-200		Restoration	2	8,231	4,116
SUBTOTAL	0-100		Enhancement	2	266,944	133,472
SUBTOTAL	100-200		Enhancement	4	42,471	10,618

*Area greater than 100' from TOB must be no greater than 10% of total mitigation. Eligible area was reduced from Mitigation plan to reflect this.
Ratios taken from Temporary Rule 15A NCAC 02B .0295 (i) and (m) as prescribed in 3/1/2016 DWR Viability Letter.
All Stream on Project Site has greater than 30' buffer throughout project.
Alt. Enhancement for grazing (m)(2)(F) is proven through project documentation of unrestricted livestock access and attesting landowner letter.

Table 2. Project Activity & Reporting History Mt. Pleasant Creek Restoration Project-Bowman Property, DMS Project #44		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		March 16
Final Design - Construction Plans		June 16
Construction & Invasive Trtmt		Feb 17
Planting		March 17
Baseline Monitoring/Report	March 17	April 17
Invasive Trtmt		2017-2021
Year 1 Monitoring	October 9, 2017	November 17
Year 2 Monitoring	July 23 & October 23, 2018	November 18
Year 3 Monitoring	June 4 & October 1, 2019	November 19
Supplemental plant- 100 stems		Feb 20
Year 4 Monitoring	22-Oct-20	Feb 21
Year 5 Monitoring	30-Sep-21	21-Dec

Table 3. Project Contacts Mt. Pleasant Creek Restoration Project-Bowman Property, DMS Project #44	
Design Firm	KCI Associates of North Carolina, PC 4505 Falls of Neuse Road, Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	Cole Land and Timber, LLC PO Box 97, Southmont, NC 27351 Contact: Brooks Cole Phone: (336)239-4039
Invasive Treatment Contractor (Initial)	Bruton Natural Systems, Inc. P.O. Box 1197, Fremont, NC 27830 Contact: Charlie Bruton Phone: (919) 242-6555
Planting Contractor (Long-term Invasive Treatment)	Carolina Silvics 1600 Olive Chapel Rd, Suite 232, Apex, NC 27502 Contact: Mary Margaret McKenney Phone: (252) 482-8491
Monitoring Performers	
MY0 **MY1-5**	KCI Associates of North Carolina, PC (Spiller) DMS (Crocker)

Table 4. Project Information Mt. Pleasant Creek Restoration Project-Bowman Property, DMS Project #44			
Project Name	Mt. Pleasant Creek Restoration Project		
County	Randolph County		
Project Area (acres)	9.61 acres		
Project Coordinates (lat. and long.)	35.7938° N, - 79.6363° W		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Cape Fear		
USGS Hydrologic Unit 8-digit	03030003	**USGS Hydrologic Unit 14-digit**	03030003020010
DWQ Sub-basin	03-06-09		
Project Drainage Area (acres)	3,354 acres		
Project Drainage Area Percentage of Impervious Area	1%		
CGIA Land Use Classification	Piedmont Alluvial Forest 21% (3.4 ac), Dry-Mesic-Oak-Hickory Forest 42% (6.6 ac), Pasture/Disturbed Community 37% (5.8 ac)		

Existing Reach Summary Information		
Parameters	**Mt. Pleasant Creek**	**UT to Mt. Pleasant Creek**
Length of reach (linear feet)	1,866	236
Valley classification	3,354 acres	33 acres
Drainage area (acres)	WS-III	WS-III
NCDWQ Water Quality Classification	C4/1	B4/1
Morphological Description (stream type)	Stage VI	N/A
Evolutionary trend	Georgeville silt loam	Georgeville silt loam
Mapped Soil Series	Well drained	Well drained
Drainage class	Non-hydric	Non-hydric
Soil Hydric status	0.7%	0-2%
Slope	Zone AE	Zone AE
FEMA classification	Piedmont Alluvial Forest	Piedmont Alluvial Forest
Existing vegetation community	5%	5%
Percent composition of exotic invasive vegetation		

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	NWP 27
Waters of the United States – Section 401	Yes	Yes	NWP 27
Endangered Species Act	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	N/A
Essential Fisheries Habitat	No	N/A	N/A

APPENDIX B

Visual Assessment Data

Table 5 Visual Assessment

Stream Stability: Mount Pleasant Creek EI section 530'

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	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%
	Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100%
Engineered Structures	Overall Integrity	Structures physically intact with no dislodged boulders or logs.	7	7			100%
	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			N/A
	Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			N/A
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	7	7			100%
	Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A

Stream Stability: Mount Pleasant Creek EII section 1,046' (2,092' both banks)

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	95	95%
	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.			1	100	95%
	Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	3	195	91%

Table 5 Visual Assessment (cont)

Stream Stability: Mount Pleasant Creek Preservation section 290'

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	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%
	Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100%

Vegetative Condition Planted Acreage 1.23

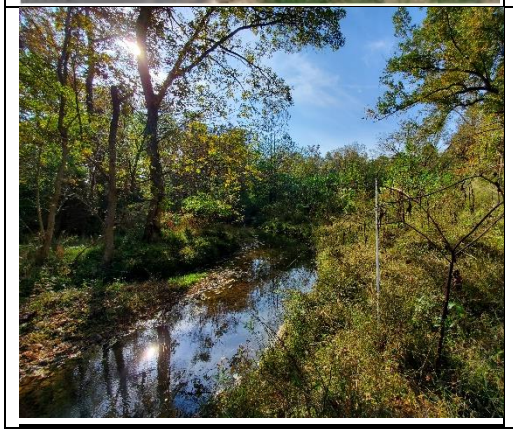
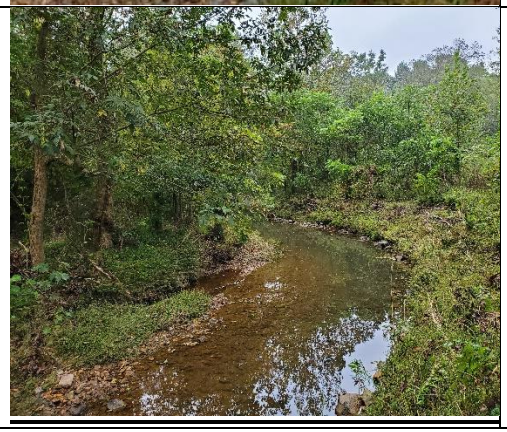
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
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	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo points by Monitoring Year			
MY0: 3/30/2017	MY1: 11/9/2017	MY2:7/1/2019	MY3: 6/4/2019
PP1			
			
MY4: 10/22/2020	MY5: 9/20/2021		
			
PP2			
			


PP3





PP4






PP5





PP6






Other Photos

10/22/2020. Bankfull debris deposited in stream.

10/22/2020. Cork indicating stream flow reached 11” above bankfull flow (bankfull is at 24”).


10/22/2020. Large and small woody debris from bankfull events floated onto the floodplain.

9/30/2021. Deposition of fines and bar development at top of project.

9/30/2021. Temporary fence installed along crossing.

9/30/2021. Crossing gates stay closed.

APPENDIX C

Vegetation Plot Data

Table 6. Tree Planting Mt. Pleasant Creek Restoration Project-Bowman Property, DMS Project #44			
Species	**Quantity**	**Type**	**Nursery**
Cornus ammomum	200	tubelings	Mellow Marsh Farm
Liriodendron tulipifera	200	bare roots	Superior Trees
Nyssa sylvatica	200	bare roots	Superior Trees
Platanus occidentalis	40	tubelings	Mellow Marsh Farm
Quercus nigra	200	bare roots	Superior Trees
Supplemental Cornus ammomum	100	bare roots	Claridge NCFC

Table 7. Invasive Treatment

Date	Treatment & Method
4/1/2017	Privet, stump cut and paint
9/14/2017	Privet, multiflora rose, tree of heaven foliar spray
6/1/2018	Privet, multiflora rose, tree of heaven foliar spray
3/19/2019	Privet, multiflora rose, tree of heaven foliar spray
5/17/2019	Privet, multiflora rose, tree of heaven foliar spray
8/20/2019	Privet, multiflora rose, tree of heaven foliar spray
5/29/2020	Privet, multiflora rose, tree of heaven foliar spray
6/2/2020	Privet, multiflora rose, tree of heaven foliar spray
11/3/2020	Privet, multiflora rose, tree of heaven foliar spray
6/24/2021	Privet, multiflora rose, tree of heaven foliar spray
11/16/2021	Privet, multiflora rose, tree of heaven foliar spray

Table 8. Stem Count by Plot and Species
Bowman (Mt. Pleasant Creek), DMS Project #44

Species	Current Plot Data (MY5 2021)						Annual Means MY0 (2017)		Annual Means MY1 (2017)		Annual Means MY2 (2018)		Annual Means MY3 (2019)		Annual Means MY4 (2020)		Annual Means MY5 (2020)	
	Plot P1		Plot T1		Plot T2													
	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
American Sycamore (*Platanus occidentalis*)	2	2			1	1	18	18	6	6	3	3	3	3	7	7	3	3
Blackgum (*Nyssa sylvatica*)	2	2			1	1	9	9	4	4	15	15	5	5	2	2	3	3
Silky dogwood (*Cornus amomum*)	1	2	2	2			13	13	14	14	11	11	2	2	1	3	3	4
Tulip Poplar (*Liriodendron tulipifera*)							12	12	11	11	9	9	2	2	3	3		
Water Oak (*Quercus nigra*)							14	14	7	7	1	1	2	2	2	2		
Black Walnut (*Juglans nigra*)		1				17		1		1		6		5		19		18
Persimmon (*Diospyros virginiana*)		1										2		1		1		1
Green Ash (*Fraxinus pennsylvanica*)						1						1		1		5		1
Hackberry (*Celtis occidentalis*)						2												2
Sweetgum (*Liquidambar styraciflua*)						1												1
Stem count	5	8	2	2	2	23	66	67	42	43	39	48	14	21	15	42	9	32
Number of plots	1		1		1		3		3		3		3		3		3	
size (acres)	0.02		0.02		0.02		0.07		0.07		0.07		0.07		0.07		0.07	
Species count	3	5	1	1	3	5	5	6	5	6	5	8	5	8	5	8	4	7
Stems per ACRE	202	324	81	81	81	931	890	904	560	573	520	640	187	280	202	567	121	432

Meets Success Criteria
Below Success Criteria

APPENDIX D

Stream Measurement and Geomorphology Data

Table 9. Bankfull Events from Crest gage

Bowman (Mount Pleasant Creek, DMS Project #44

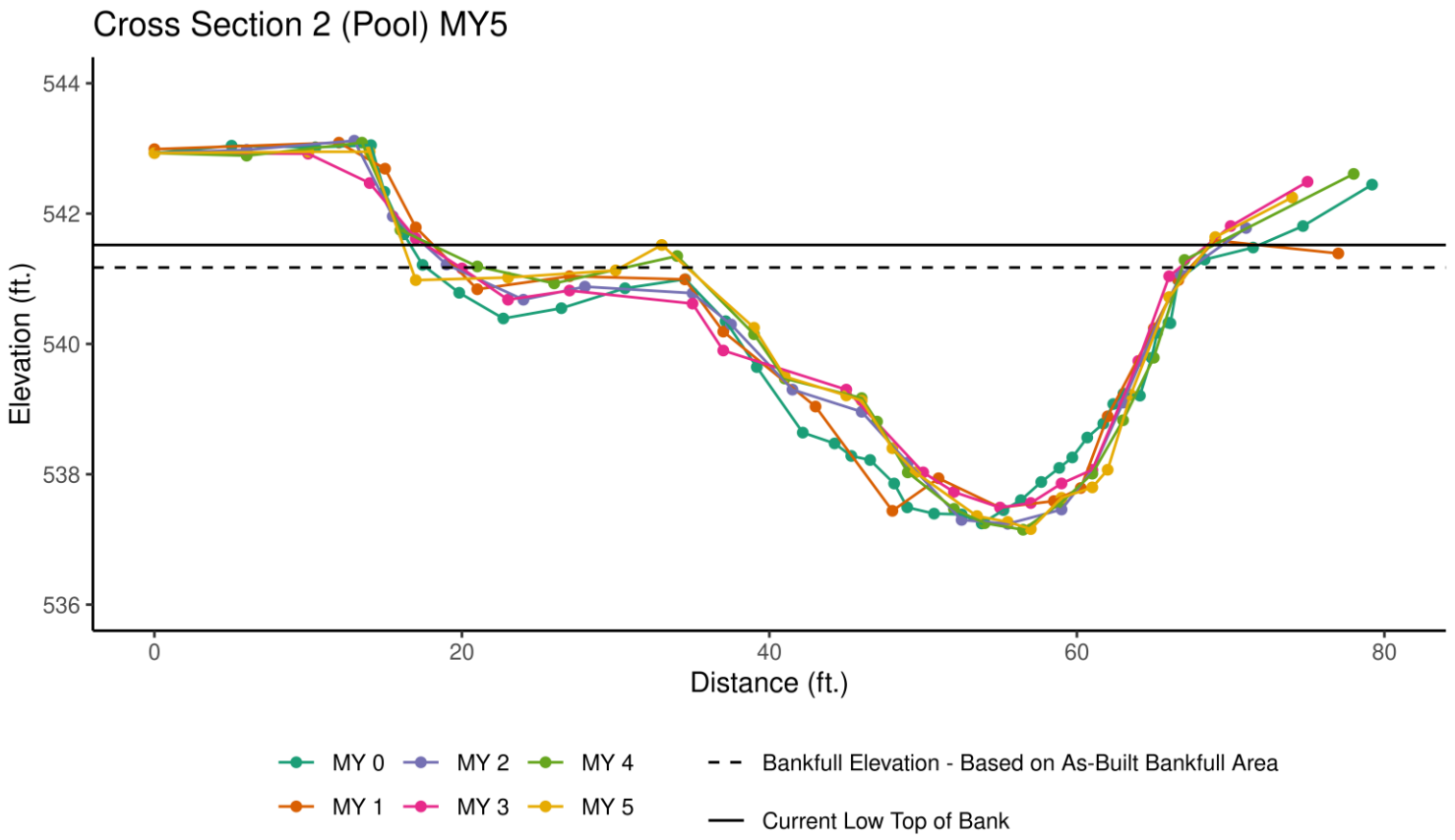
Date of Bankfull Event	Supporting Evidence
5/25/2017	Rack, deposition on banks
6/27/2017	Rack, deposition on banks, large logs moved in the stream and floodplain
7/16/2018	Rack and debris on stream banks
10/23/2018	Large debris, rack lines in floodplain and on bankfull benches
4/13/2019	Large debris, rack lines in floodplain
6/4/2019	Large debris in floodplain
10/22/2020	Large debris lifted onto floodplain
9/30/2021	Evidence of vegetation in floodplain laid over, large debris in floodplain

Table 10. Cross-Section Morphology Data Tables

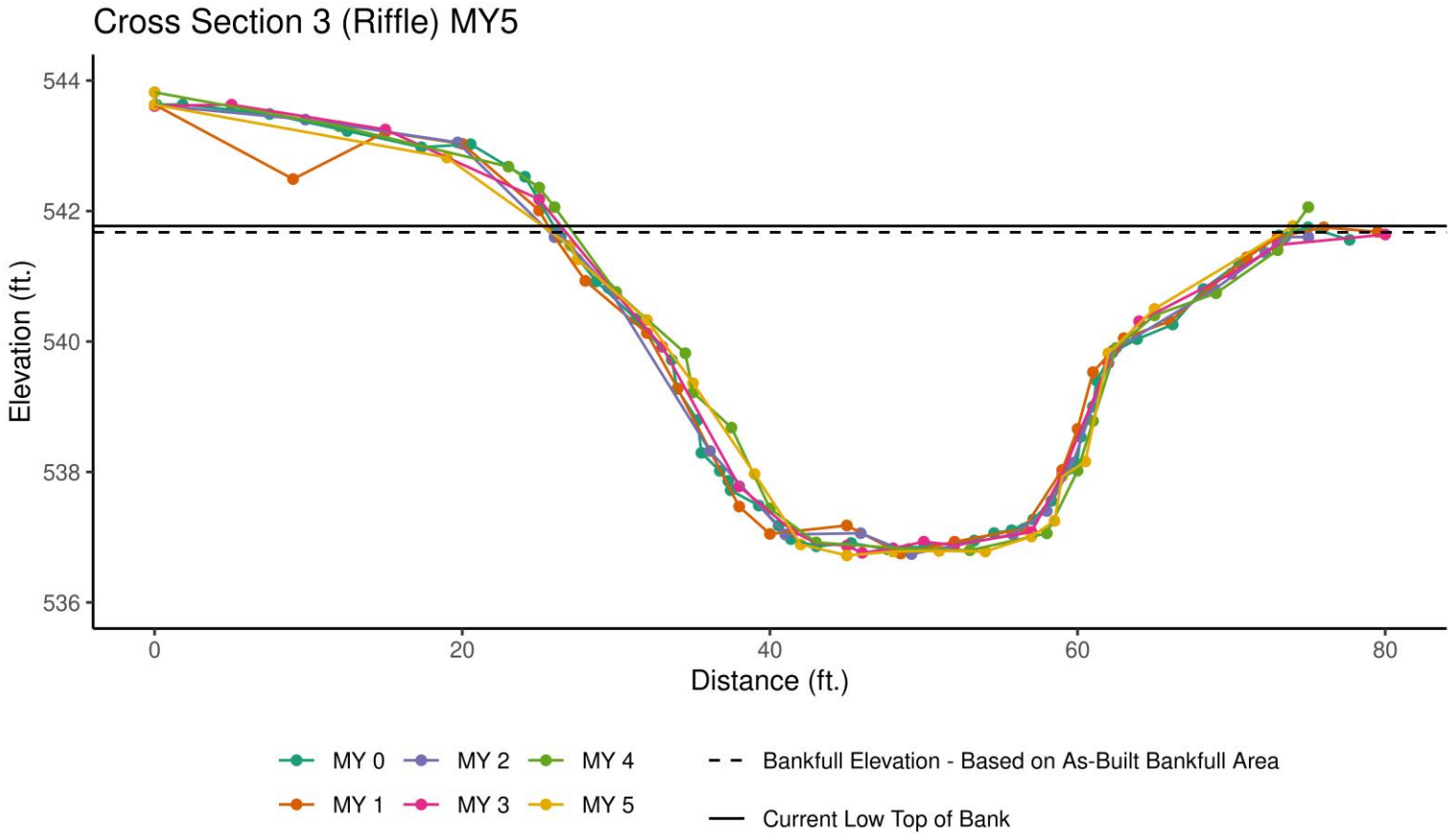
Bowman (Mount Pleasant Creek), DMS Project #44

Dimension and Substrate	Cross-Section 2 (Pool), Station 12+12							Cross-Section 3 (Riffle), Station 15+25					
Based on fixed baseline elevation	Pre	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	30.5	32.1	32.1	31.8	31.0	33.0	35.0	46.7	47.0	47.5	48.0	49.0	47.0
Floodprone Width (ft)	-	-	-	-	-	-	-	>100	>100	>100	>100	>100	>100
Bankfull Mean Depth (ft)	2.1	2.5	2.3	2.0	1.8	2.5	2.7	2.9	2.8	2.9	2.6	3.3	2.6
Bankfull Max Depth (ft)	3	3.7	3.6	3.5	3.1	4.2	4.4	4.8	4.9	4.9	4.7	5.3	5.1
Bankfull Cross-Sectional Area (ft^2)	64.5	75.5	73.4	64.8	56.2	82.3	87.4	135.3	134.2	135.8	126.7	154.2	139.9
Bankfull Width/Depth Ratio	-	-	-	-	-	-	-	16.0	16.6	16.6	18.1	15.1	18.0
Bankfull Entrenchment Ratio	-	-	-	-	-	-	-	2.0	2.1	2.1	2.1	2.0	2.1
Bankfull Bank Height Ratio	-	-	-	-	-	-	-	1.0	1.0	1.0	0.96	1.08	1.02

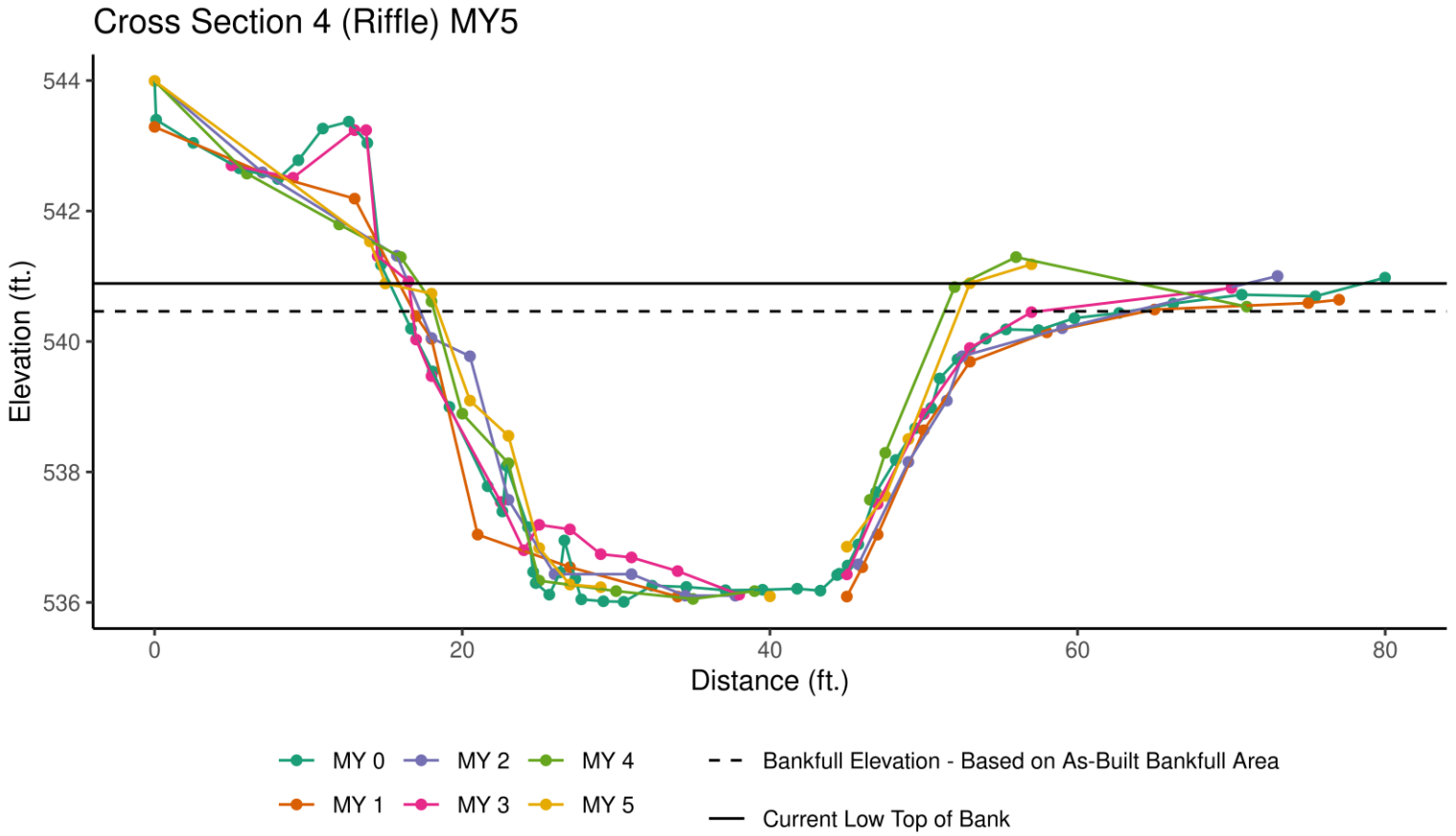
		Cross-Section 4 (Riffle) Station 17+25					
Based on fixed baseline elevation	Pre	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	28	37.4	40.0	41.0	40.0	40.0	38.0
Floodprone Width (ft)	>100	>100	>100	>100	>100	>100	>100
Bankfull Mean Depth (ft)	3	2.9	2.8	2.5	2.5	3.7	3.9
Bankfull Max Depth (ft)	3.9	4.2	4.3	4.3	4.6	5.5	4.8
Bankfull Cross-Sectional Area (ft^2)	83.5	109.5	115.7	108.6	115.9	142.0	124.4
Bankfull Width/Depth Ratio	9.4	12.8	14.4	16.5	16.1	10.8	9.8
Bankfull Entrenchment Ratio	1.1	3.3	3.1	3.0	3.1	3.1	3.3
Bankfull Bank Height Ratio	1.4	1.0	1.0	1.0	1.0	1.2	1.1



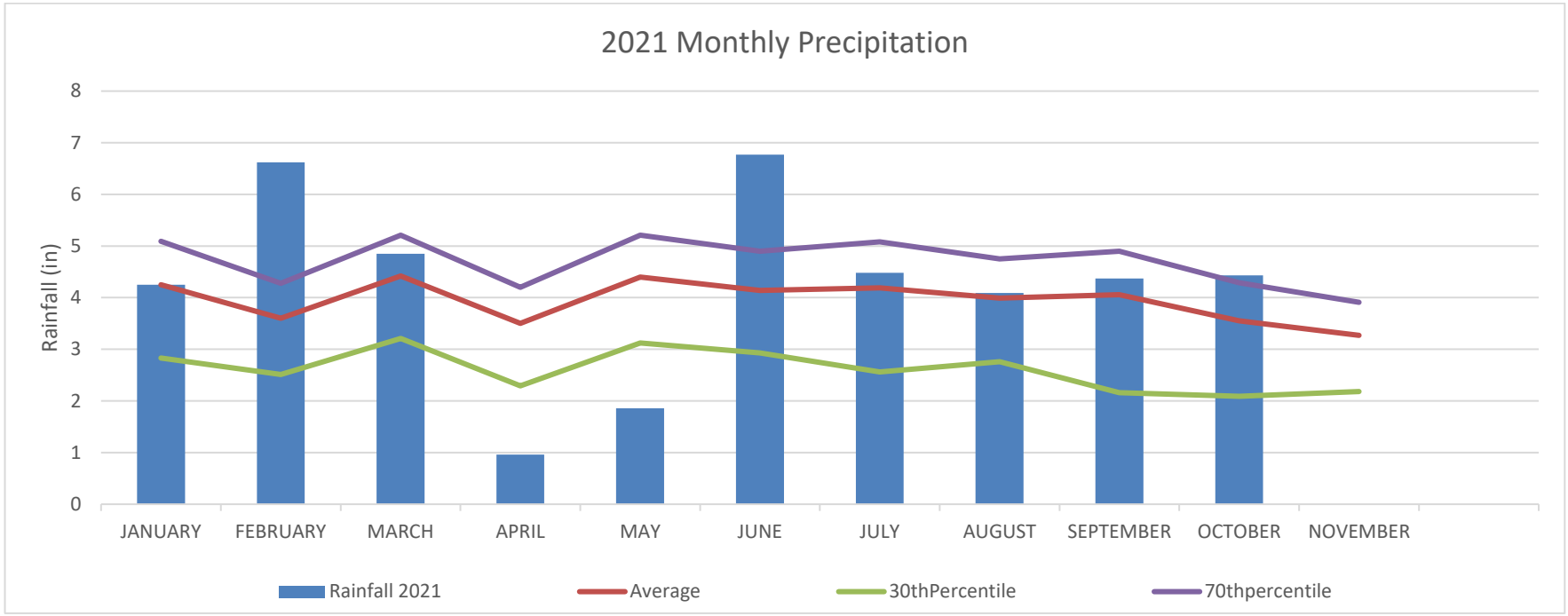
	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Elevation - Based on As-Built Bankfull Area	540.99	541.06	541.12	541.25	541.14	541.17
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.98	0.91	0.83	1.05	1.09
Thalweg Elevation	537.24	537.44	537.24	537.49	537.15	537.16
LTOB Elevation	540.99	540.99	540.78	540.62	541.35	541.52
LTOB Max Depth	3.75	3.55	3.54	3.13	4.20	4.36
LTOB Cross Sectional Area	75.52	73.40	64.79	56.23	82.27	87.40



	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Elevation - Based on As-Built Bankfull Area	541.60	541.62	541.59	541.66	541.66	541.67
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	1.00	1.00	0.96	1.08	1.02
Thalweg Elevation	536.82	536.75	536.74	536.76	536.80	536.72
LTOB Elevation	541.60	541.60	541.60	541.48	542.06	541.77
LTOB Max Depth	4.78	4.85	4.86	4.72	5.26	5.05
LTOB Cross Sectional Area	135.29	134.19	135.77	126.91	154.17	139.91



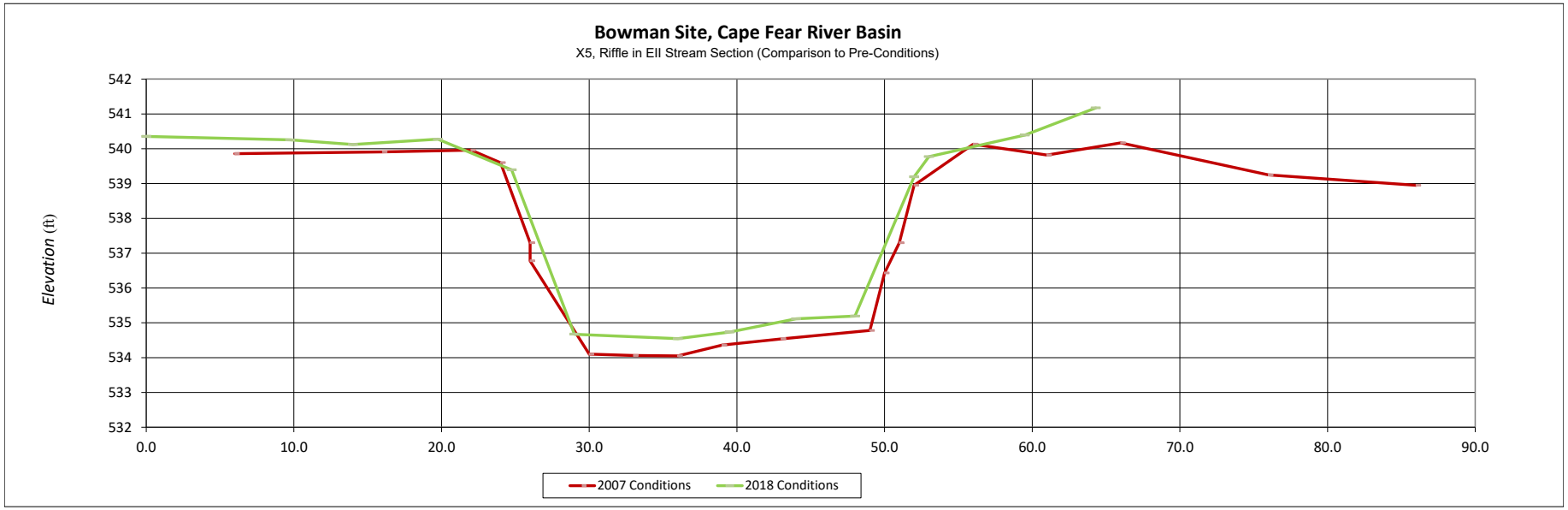
	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Elevation - Based on As-Built Bankfull Area	540.20	539.98	540.22	540.29	540.37	540.46
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	1.04	1.00	1.04	1.20	1.10
Thalweg Elevation	536.01	535.84	535.92	535.89	535.77	536.09
LTOB Elevation	540.20	540.14	540.20	540.45	541.29	540.89
LTOB Max Depth	4.19	4.30	4.28	4.56	5.52	4.80
LTOB Cross Sectional Area	109.47	115.74	108.56	115.90	142.03	124.35



Historic and Observed Data from Randleman, NC Station AgACIS

APPENDIX E

Additional Data


Bowman Site, Cape Fear River Basin
X5, Riffle in EII Stream Section (Comparison to Pre-Conditions)
Elevation (ft)
542
541
540
539
538
537
536
535
534
533
532
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
2007 Conditions
2018 Conditions