FINAL
ANNUAL MONITORING REPORT
YEAR 8 (2017)
MCINTYRE CREEK RESTORATION SITE
AT HORNETS NEST PARK
MECKLENBURG COUNTY, NORTH CAROLINA
(DMS Project No. 243, Contract No. 004499)

Submitted to:
North Carolina Department of Environmental Quality
Division of Mitigation Services
Raleigh, North Carolina

December 2017

FINAL
ANNUAL MONITORING REPORT
YEAR 8 (2017)
MCINTYRE CREEK RESTORATION SITE
AT HORNETS NEST PARK
MECKLENBURG COUNTY, NORTH CAROLINA
(DMS Project No. 243, Contract No. 004499)

Submitted to:
North Carolina Department of Environmental Quality
Division of Mitigation Services
Raleigh, North Carolina

Prepared by:
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

Design Firm:
KCI Associates of North Carolina, P.A.
Landmark Center I, Suite 200
4601 Six Forks Road
Raleigh, North Carolina 27609

Axiom Environmental, Inc.

December 2017

Axiom Environmental, Inc.

Axiom Environmental, Inc.

218 Snow Avenue, Raleigh, NC 27603 919-215-1693

December 13, 2017

Mr. Matthew Reid
North Carolina Department of Environmental Quality
Division of Mitigation Services
5 Ravenscroft Drive, #102
Asheville, NC 28801

RE: McIntyre Creek Monitoring (DMS Project # 243, Contract #004499)
Final MY8 (2017) Annual Monitoring Report **12-004.03**

Dear Matthew:

Axiom Environmental, Inc. (AXE) is pleased to provide you with three hard copies and one CD of digital files for the Final McIntyre Creek Annual Monitoring Report. We received your comments via email on December 11, 2017 and have addressed them as follows:

3.0 Vegetation: Please add invasive treatment from June 2017 to invasive species discussion in section.
The June 2017 invasive treatment was added into the discussion.

Table 1: Please remove the Riparian Wetland components from the table. DMS will only be seeking stream credit from this project.
The Riparian Wetland components were removed from Table 1.

Table 2: Please add "Invasive Species Management – June 2017" to table
This entry was added to Table 2.

Please let me know if you have any questions or comments regarding any component of this submittal. Thank you for the opportunity to continue to assist the Division of Mitigation Services with this important project.

Sincerely,
AXIOM ENVIRONMENTAL, INC.

Kenan Jernigan
Project Scientist

Attachments: 3 hard copies Final McIntyre Creek Year 8 (2017) Annual Monitoring Report
1 CD containing digital support files

Table of Contents

Appendices

1.0 PROJECT BACKGROUND

The North Carolina Division of Mitigation Services (NCDMS) has completed restoration of 5178 linear feet of stream at the McIntyre Creek Restoration Site (hereafter referred to as the "Site") to assist in fulfilling stream and wetland mitigation goals in the area.

The goals and objectives of this project focus on improving local water quality, habitat, and stream stability. These goals were accomplished by the following.

1. Restoring stable channel morphology capable of moving flows and sediments provided by the watershed.
2. Improving water quality by reducing soil and riparian vegetation loss resulting from lateral erosion and bed degradation.
3. Improving aquatic habitat with bed variability and the use of in-stream structures.
4. Stabilizing tributaries draining into McIntyre Creek.
5. Providing educational opportunities through Mecklenburg County.
6. Improving the natural aesthetics of Hornets Nest Park.
7. Enhancing vegetation to provide habitat/food sources, shade the stream, filter overland runoff, and remove soil particles and other nutrients from stormwater.
8. Protecting a Site identified in a watershed listed as impaired for elevated levels of copper and turbidity (NCDWQ 2010).

The Site is located in Hornets Nest Park on the northern side of the City of Charlotte in Mecklenburg County. The Site is located in United States Geological Survey (USGS) Hydrologic Unit 03050101170020 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-08-34) of the Catawba River Basin and will service USGS 8-digit Cataloging Unit (CU) 03050101. The Site is located in NCDMS Targeted Local Watershed within the Long Creek watershed targeted for restoration. Waters in the Site drain approximately 2.5 miles into Long Creek (NCDWQ No. 11-120-[2.5]), which is listed as impaired for elevated levels of copper and turbidity negatively affecting aquatic life (NCDWQ 2010).

Prior to construction, the Site contained a degraded stream channel with a disturbed riparian buffer located within Hornets Nest Park. Site streams were characterized by eroding banks, channel widening, high sediment inputs from construction occurring in the upstream watershed and onsite bank erosion, and channel incision as indicated by bank-height-ratios ranging from 1.4 to 1.9. Surrounding land uses include commercial and residential areas with narrow riparian corridors adjacent to streams. At least 50 percent of the contributing watershed had been cleared and developed.

Project construction was completed between March 2007-May 2008 and repairs were completed between August 2009-January 2010. Additional repairs to stabilize banks and structures were completed on Monitoring Reach 1 were completed in March 2016. The project restored 5178 linear feet of stream using Priority I restoration by constructing a new meandering channel within the McIntyre Creek floodplain, incorporating in-stream structures, installing grade control structures at the confluence with two tributaries, and planting native forest species. Site activities provide 5129 Stream Mitigation Units (49 linear feet of the restored channel is located within a utility easement and therefore was not included in the available mitigation credit). The Site is protected by a permanent conservation easement held by the State of North Carolina.

Summary information and data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in tables and figures within this report's appendices. Narrative background and supporting information formerly found

in these reports can be found in the mitigation and restoration plan documents available on DMSs website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

2.0 METHODOLOGY

During years 1 (2010) through 5 (2014), bank erosion was in scattered areas across the site, with those at the bottom of the project (Monitoring Reach 1) being the most concerning in that they represented active mass wasting. As a result, DMS repaired these areas in Monitoring Reach 1 early in 2016. Therefore, monitoring in year 8 (2017) was limited to Monitoring Reach 1, as the remainder of the Site streams remain stable and have met success criteria. The following summarizes data collected this year.

MY8 (2017) Data Collected within Monitoring Reach 1

- Measurement of Cross-sections 5-7
- 4 temporary 100 square meter vegetation plots
- Visual assessments
- Photo points

3.0 RESULTS

Stream

Monitoring Reach 1 is stable in year 8 (2017) as evidenced by cross-section 5-7 measurements (Appendix C) and visual assessments of the reach (Table 5, Appendix B). In addition, all repairs completed in early 2016 are functioning as intended.

Vegetation

Four temporary vegetation plots were established along Monitoring Reach 1 to assess the areas requiring supplemental planting after the repair. Counts and speciation of all stems within these plots was performed. Year 8 (2017) results indicate an average of 1,872 stems per acre with 4 to 7 species per plot, including natural recruits, within this reach (Table 8, Appendix C).

Invasive species such as multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and kudzu (*Pueraria lobata*) have been present throughout the monitoring period. However, treatments have occurred in late October 2013, early 2014, October 2015, December 2015, September 2016, and June 2017. The most recent treatments appear to be successful with significantly less invasive species populations observed during years 7 (2016) and 8 (2017) than previous monitoring years (Table 6, Appendix B). Given the urban nature of the Site and the effectiveness of the treatments, invasive species are no longer considered a concern.

Beaver Activity

Beaver activity observed on the Site during previous monitoring years has lessened due to proactive measurements taken by DMS. No signs of recent beaver activity were observed during monitoring year 8 (2017).

4.0 REFERENCES

North Carolina Division of Water Quality (NCDWQ). 2010. Final North Carolina 2010 Integrated Report Category 4 and 5 (303(d) List EPA Approved August 31, 2010) (online). Available: http://portal.ncdenr.org/c/document_library/get_file?uuid=8ff0bb29-62c2-4b33-810c-2eee5afa75e9&groupId=38364 [December 1, 2010]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

North Carolina Division of Mitigation Services (NCDMS). 2007. Catawba River Basin Restoration Priorities. Available: http://www.nceep.net/services/restplans/RBRPCatawba2007.pdf [June 2010]. North Carolina Department of Environmental Quality, Division of Mitigation Services. Raleigh, North Carolina.

Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: http://www.herbarium.unc.edu/WeakleysFlora.pdf [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

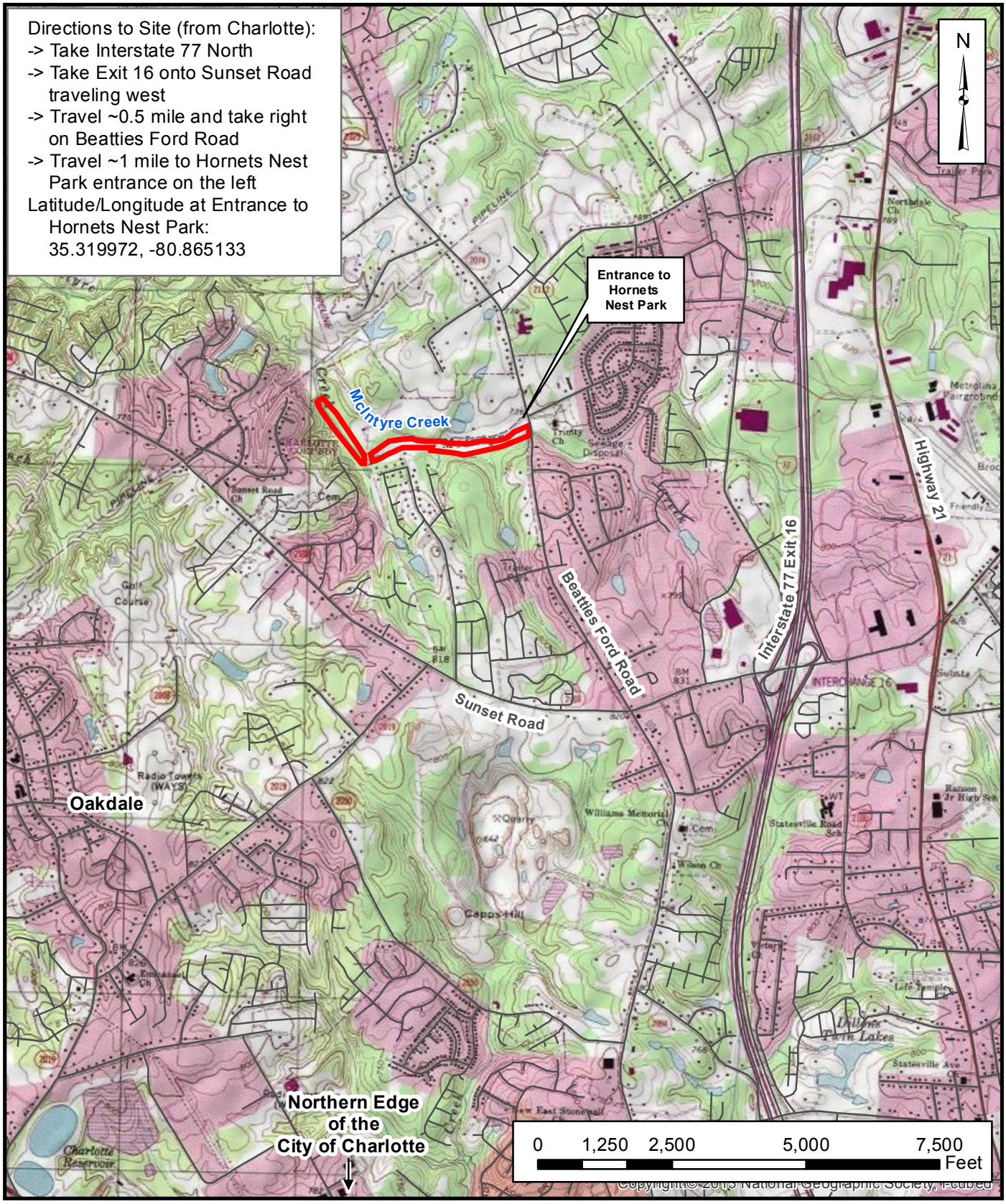
Figure 1. Vicinity Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes



Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693

VICINITY MAP
MCINTYRE CREEK RESTORATION SITE
AT HORNETS NEST PARK
Mecklenburg County, North Carolina

Dwn. by:	CLF/KRJ
Date:	Mar 2016
Project:	12-004.03

FIGURE
1

Table 1. Project Components and Mitigation Credits
McIntyre Creek Restoration Site at Hornets Nest Park (DMS Project Number 243)

Mitigation Credits							
	Stream				Riparian Wetland		
Type	Restoration		Restoration Equivalent		Restoration		Restoration Equivalent
Totals	5129*		--		--		--
Projects Components							
Project Component/ Reach ID	Station Range	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Comment
McIntyre Creek	--	~5000	I	Restoration	5178*	1:1	Priority I stream restoration along the entire project, installation of in-stream structures, stabilizing the confluence of two incoming tributaries, and planting with native forest vegetation.

Component Summation		
Restoration Level	Stream (linear footage)	Riparian Wetland (acres)
Restoration	5178	--
Totals	**5178**	**--**
Mitigation Units	**5129 SMUs***	**--**

*Site activities restored 5178 linear feet of stream; however, 49 linear feet is located within a utility easement and is not included in the SMU calculation.

Table 2. Project Activity and Reporting History
McIntyre Creek Restoration Site at Hornets Nest Park (DMS Project Number 243)

Elapsed Time Since Grading Complete: 9 years
Elapsed Time Since Planting Complete: 9 years
Number of Reporting Years: 8

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	--	December 2002
Construction Plans	--	March 2005
Site Construction and Planting	--	May 2008
As-built Construction Drawings	--	February 2008
Remediation Construction	--	January 2010
As-built Remediation Construction Drawings	--	November 2009
As-built Record Drawings	--	February 2010
Baseline Monitoring Document	July 2010	December 2010
Year 1 (2010) Monitoring Document	December 2010	December 2010
Year 2 (2011) Monitoring Document	November 2011	December 2011
Year 3 (2012) Monitoring Document	November 2012	November 2012
Beaver Management	--	Ongoing
Invasive Species Management	--	October 2013
Year 4 (2013) Monitoring Document	November 2013	December 2013
Invasive Species Management	--	April 2014
Year 5 (2014) Monitoring Document	November 2014	December 2014
Invasive Species Management	--	October 2015
Invasive Species Management	--	December 2015
Remediation Construction	--	March 2016
Year 6 (2015) Monitoring Document	March 2016	April 2016
Invasive Species Management	--	September 2016
Year 7 (2016) Monitoring Document	October 2016	November 2016
Invasive Species Management	--	June 2017
Year 8 (2017) Monitoring Document	November 2017	December 2017

Table 3. Project Contacts Table
McIntyre Creek Restoration Site at Hornets Nest Park (DMS Project Number 243)

Designer	KCI Associates of North Carolina, P.A. Landmark Center I, Suite 220 4601 Six Forks Road Raleigh, NC 27609 Gary Mryncza 919-783-9214
Construction and Planting Contractor	United Construction, Inc. 6000 Old Pineville Road Charlotte, NC 28217 704-679-9229
As-built Surveyor	CSC of NC PC 4455 Morris Park Drive, Suite F Charlotte, NC 28227 Mohammad Zamani 704-573-0112
Baseline Data Collection and Monitoring Performers	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Baseline Information and Attributes
McIntyre Creek Restoration Site at Hornets Nest Park (DMS Project Number 243)

Project Information	
Project Name	McIntyre Creek Restoration Site
Project County	Mecklenburg County, North Carolina
Project Area	17 acres
Project Coordinates	35.319972, -80.865133
Project Watershed Summary Information	
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Catawba
USGS 8-digit HUC	03050101
USGS 14-digit HUC	03050101170020
NCDWQ Subbasin	03-08-34
Project Drainage Area	2.55 square miles
Project Drainage Area Impervious Surface	>50%
CGIA Land Use Classification	Urban High
Reach Summary Information	
Restored length	5178 linear feet
Drainage Area	2.55 square miles
NCDWQ Index Number	11-120-3-(1)
NCDWQ Classification	C
Valley Type/Morphological Description	VIII/E5
Dominant Soil Series	Monacan
Drainage Class	Moderately well-somewhat poorly
Soil Hydric Status	Contains 5% hydric Wehadkee soils
Slope	0.0033
FEMA Classification	100-Year Floodzone
Native Vegetation Community	Bottomland Hardwood Forest
Percent Composition of Exotic Invasives	5.9%
Regulatory Considerations	
Regulation	**Applicable**
Waters of the U.S. –Sections 404 and 401	Yes-Received Appropriate Permits
Endangered Species Act	No
Historic Preservation Act	No
CZMA/CAMA	No
FEMA Floodplain Compliance	Yes-Received a No Rise Certification
Essential Fisheries Habitat	No

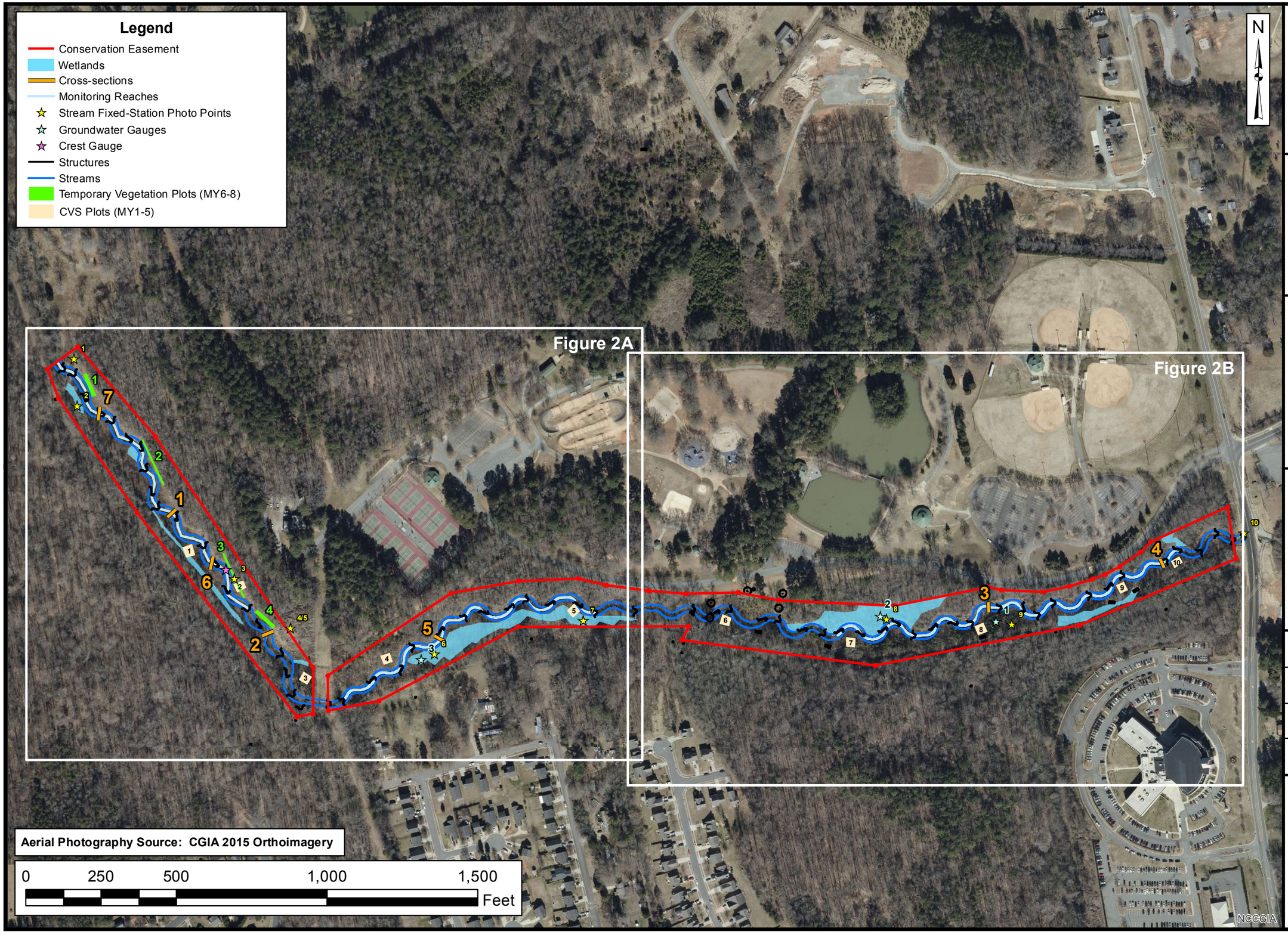
APPENDIX B

VISUAL ASSESSMENT DATA

Figures 2 and 2A-2B. Current Conditions Plan View

Table 5. Visual Stream Morphology Stability Assessment: Monitoring Reach 1

Stream Fixed-Station Photos



Axiom Environmental, Inc.

Prepared for:

NC Department of Environmental Quality

Division of Mitigation Services

Project:

MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK

Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF/KRJ

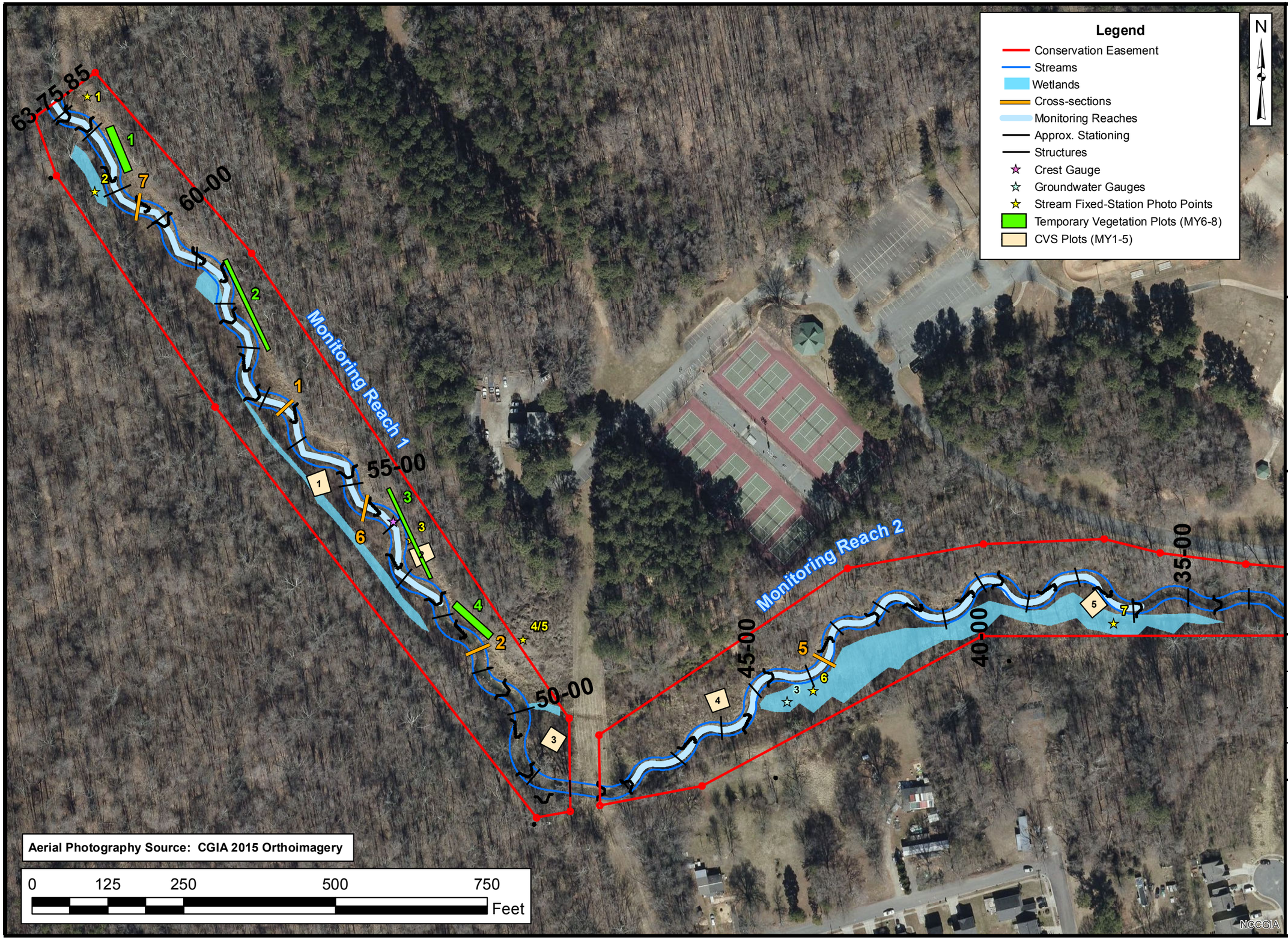
Date: NOV 2017

Scale: 1:3600

Project No.: 12-004.03

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

NC Department of Environmental Quality

Division of Mitigation Services

Project:

MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK

Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF/KRJ

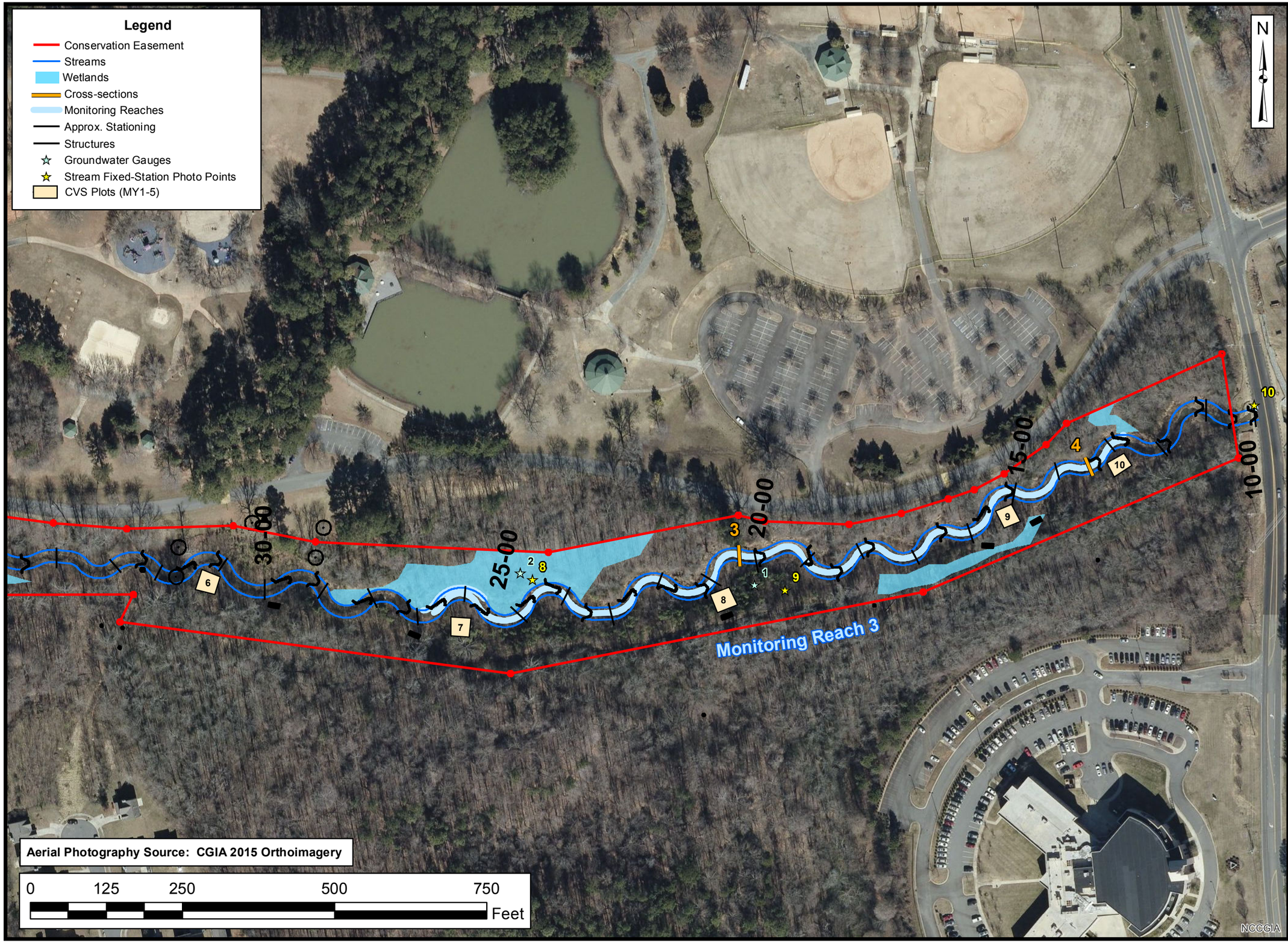
Date: NOV 2017

Scale: 1:1800

Project No.: 12-004.03

FIGURE

2A



Axiom Environmental, Inc.

Prepared for:

NC Department of Environmental Quality

Division of Mitigation Services

Project:

MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK

Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF/KRJ

Date: NOV 2017

Scale: 1:1800

Project No.: 12-004.03

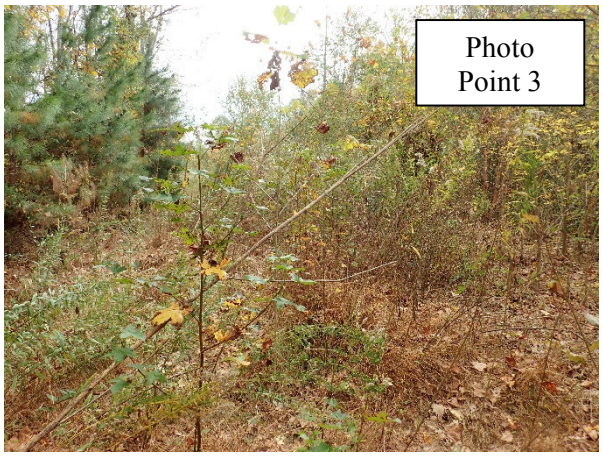
FIGURE

2B

Table 5. Visual Stream Morphology Stability Assessment
McIntyre Creek Restoration Site at Hornets Nest Park (DMS Project Number 243)
Reach ID Reach 1
Assessed Length 1152

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	17	17			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	17	17			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	17	17			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			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	7	7			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	7	7			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	7			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)	7	7			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	7	7			100%			

McIntyre Creek
Monitoring Reach 1: Stream Fixed-Station Photographs
Taken November 2017



APPENDIX C

DATA

Cross-section 5-7 Plots

Tables 6a-b. Baseline Stream Data Summary

Tables 7a-b. Monitoring Data

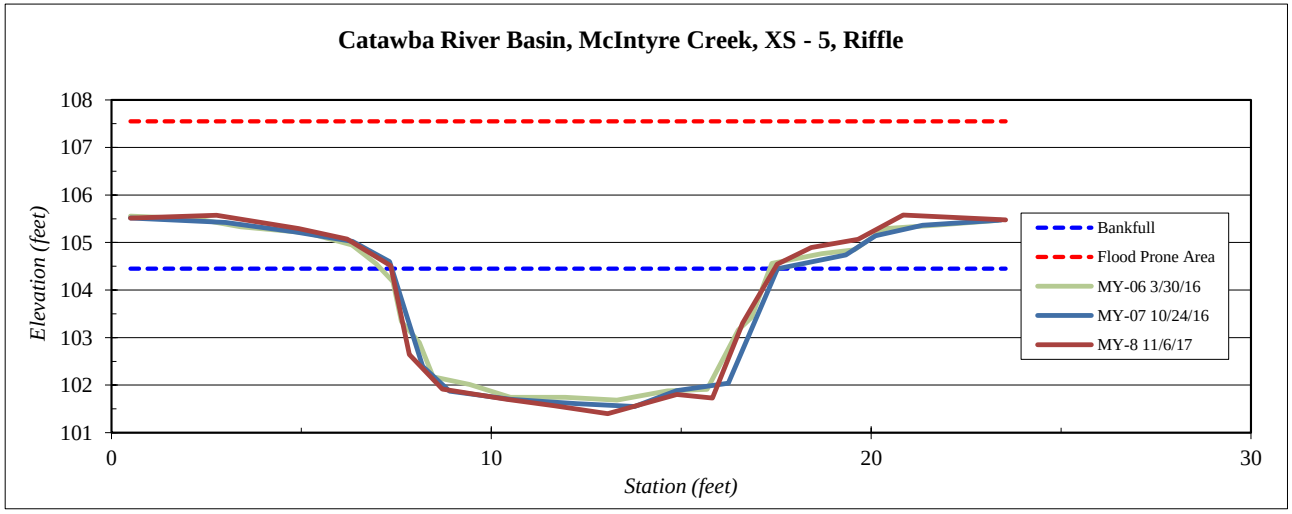
Table 8. Temporary Vegetation Plot Data

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 5, Riffle
Feature	Riffle
Date:	11/6/2017
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.50	105.52
2.76	105.57
4.93	105.29
6.20	105.07
7.35	104.51
7.84	102.65
8.71	101.92
10.41	101.70
11.65	101.57
13.06	101.40
14.89	101.80
15.82	101.73
16.61	103.30
17.53	104.54
18.4	104.90
19.7	105.07
20.8	105.6
23.5	105.5

SUMMARY DATA	
Bankfull Elevation:	104.5
Bankfull Cross-Sectional Area:	24.2
Bankfull Width:	10.1
Flood Prone Area Elevation:	107.6
Flood Prone Width:	150.0
Max Depth at Bankfull:	3.1
Mean Depth at Bankfull:	2.4
W / D Ratio:	4.2
Entrenchment Ratio:	14.9
Bank Height Ratio:	1.0

Stream Type	E



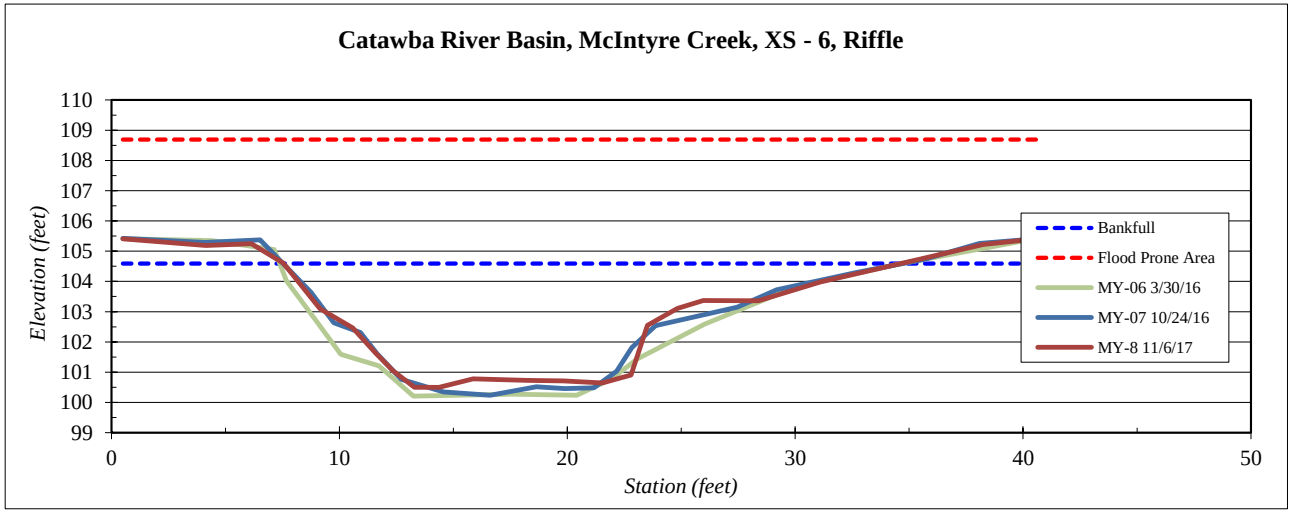
* Note: Cross Section was established after repairs conducted at the Site.

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 6, Riffle
Feature	Riffle
Date:	11/062017
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.50	105.41
4.13	105.19
6.14	105.25
7.54	104.61
9.14	103.10
10.58	102.46
11.58	101.64
12.36	101.04
13.29	100.50
14.37	100.50
15.87	100.78
18.27	100.73
19.83	100.71
21.54	100.64
22.8	100.90
23.5	102.55
24.8	103.1
26.0	103.4
28.4	103.4
31.1	104.0
35.5	104.7
38.3	105.2
40.7	105.4

SUMMARY DATA	
Bankfull Elevation:	104.6
Bankfull Cross-Sectional Area:	61.9
Bankfull Width:	27.1
Flood Prone Area Elevation:	108.7
Flood Prone Width:	150.0
Max Depth at Bankfull:	4.1
Mean Depth at Bankfull:	2.3
W / D Ratio:	11.9
Entrenchment Ratio:	5.5
Bank Height Ratio:	1.0

Stream Type	E



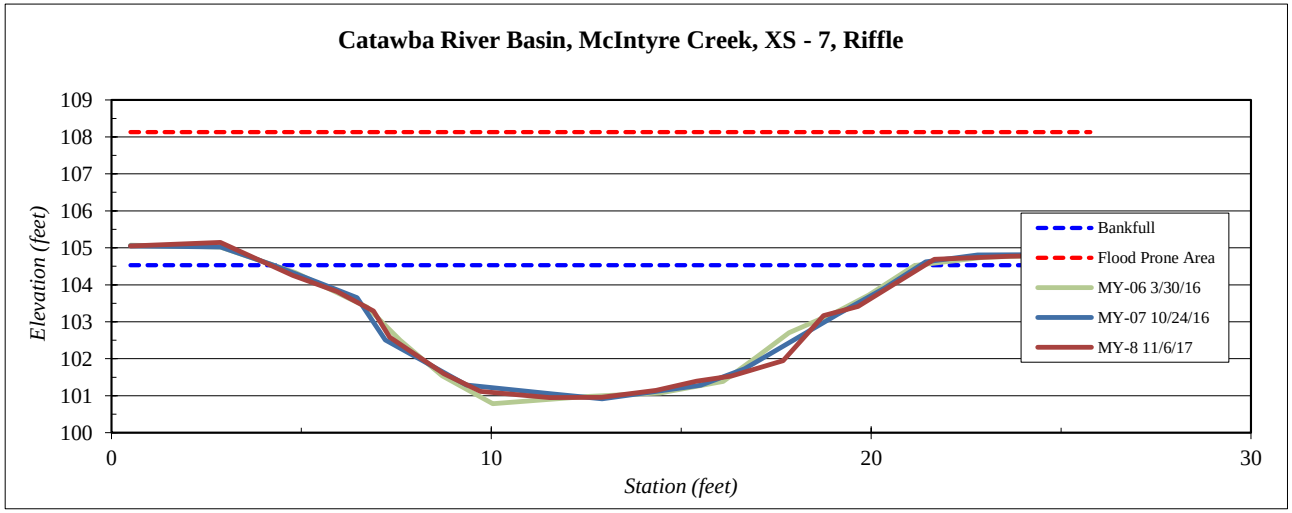
* Note: Cross Section was established after repairs conducted at the Site.

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 7, Riffle
Feature	Riffle
Date:	11/6/2017
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.50	105.05
2.87	105.15
4.78	104.25
5.94	103.81
6.90	103.29
7.32	102.59
8.75	101.59
9.71	101.12
11.53	100.95
12.91	100.95
14.34	101.14
15.40	101.39
16.32	101.53
17.68	101.95
18.7	103.16
19.7	103.41
21.7	104.7
23.7	104.8
25.8	104.8

SUMMARY DATA	
Bankfull Elevation:	104.5
Bankfull Cross-Sectional Area:	39.4
Bankfull Width:	17.2
Flood Prone Area Elevation:	108.1
Flood Prone Width:	150.0
Max Depth at Bankfull:	3.6
Mean Depth at Bankfull:	2.3
W / D Ratio:	7.5
Entrenchment Ratio:	8.7
Bank Height Ratio:	1.0

Stream Type	E



* Note: Cross Section was established after repairs conducted at the Site.

Table 6a. Baseline Stream Data Summary
McIntyre Creek at Hornets Nest Park (DMS Project Number 243)

Parameter	Gauge	Regional Curve			Pre-Existing Condition					Reference Reach(es) Data					Design			Monitoring Baseline				
Dimension and Substrate - Riffle Only		**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Max**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)					17.0			23.8			13.1				18.7	22.9		16.7			17.6	
Floodprone Width (ft)					100			300			78				100	300		150			150	
BF Mean Depth (ft)					2.5			2.7			1.6				2.3	2.8		1.5			2.0	
BF Max Depth (ft)					3.1			3.7			2.8				3.3	4.0		2.9			3.2	
BF Cross Sectional Area (ft^2)					42.1			58.6			21.3				42.0	70.0		26.4			32.9	
Width/Depth Ratio					6.9			9.7			8.1				8.1	8.1		8.5			11.7	
Entrenchment Ratio					4.5			17.5			5.9				5.0	16.0		8.5			9.0	
Bank Height Ratio					1.3			1.9			1.0				1.0	1.0		1.0			1.0	
Profile																						
Riffle length (ft)					----			----			----							10.1	32.1	32.8	91.7	
Riffle slope (ft/ft)					0.003			0.006		0.0050			0.0110		0.0025	0.0065		0.0000	0.0012	0.0042	0.0313	
Pool length (ft)					----			---		7.0			18.0		12.0	37.0		4.3	17.3	15.6	59.6	
Pool Max depth (ft)					4.1			4.1			3.2				2.9	3.4		5.0			5.3	
Pool spacing (ft)					----			----		11.0			45.0		46.0	115.0		48.0	77.0	76.0	169.0	
Pattern																						
Channel Beltwidth (ft)					34			58			38				95	115		19	45	41	107	
Radius of Curvature (ft)					60.3			148.1		10.3			25.6		37	70		24	49	40	246	
Rc:Bankfull width (ft/ft)					2.6			6.3		0.8			2		2	4		1.4	2.8	2.3	14.3	
Meander Wavelength (ft)					4.1			7.3		60			71		90	230		88	132	128	220	
Meander Width ratio					1.4			2.5		4.6			5.4		5	10		1.1	2.6	2.4	6.2	
Transport parameters																						
Reach Shear Stress (competency) lbs/ft^2																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m^2																						
Additional Reach Parameters																						
Rosgen Classification					E5-type					E5-type					E5-type			E-type				
Bankfull Velocity (fps)					4.0 - 4.5										4.2 - 4.4			------				
Bankfull Discharge (cfs)					180 - 280																	
Valley Length (ft)					-----					240												
Channel Thalweg Length (ft)					-----					300					5178			5178				
Sinuosity					1.1 - 1.22					1.25					1.4			1.4				
Water Surface Slope (ft/ft)					0.0021 - 0.0027					0.0044					0.0021-0.0025			0.0035				
BF slope (ft/ft)					-----					-----					-----			------				
Bankfull Floodplain Area (acres)					-----					-----					-----			------				
% of Reach with Eroding Banks					-----					-----												
Channel Stability or Habitat Metric					34 - 39 BEHI					-----												
Biological or Other					-----					-----												

Table 6b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
McIntyre Creek at Hornets Nest Park (DMS Project Number 243)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							Monitoring Baseline						
Ri%/RU%P%G%/S%																						45	14	25	15	NA		
SC%/SA%/G%/C%/B%BE%																												
d16/d35/d50/d84/d95			0.2-0.3	4.0-12.0						0.5	3.0-5.0																	
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																												
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0								300														5178						

Table 7a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
McIntyre Creek at Hornets Nest Park (DMS Project Number 243)

Parameter	Cross Section 1 Pool								Cross Section 2 Riffle								Cross Section 3 Riffle								Cross Section 4 Pool							
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation	96.36	96.36	96.32	96.51	96.51	96.51	96.51	96.51	98.11	98.11	97.96	97.93	97.93	97.63	97.63	97.63	107.6	107.6	107.18	107.21	107.21	107.21	107.21	107.21	110	110	109.3	109.36	109.36	109.23	109.23	109.23
BF Width (ft)	20.0	19.6	19.4	19.4	18.6	20.3	22.0	21.2	16.7	17.0	15.9	16.1	15.2	14.7	15.4	16.0	17.6	17.0	11.1	10.9	10.9	11.2	11.6	11.5	15.5	15.5	13.7	13.1	13.5	14.7	15.0	14.5
Floodprone Width (ft) (approx)	NA	NA	NA	NA	NA	NA	NA	NA	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	NA	NA	NA	NA	NA	NA	NA	NA
BF Mean Depth (ft)	2.8	3.0	3.2	3.6	3.6	3.7	4.1	4.0	2.0	2.0	2.1	2.1	2.1	2.3	2.2	2.1	1.5	1.5	2.1	2.1	2.0	1.9	2.1	2.1	3.1	3.0	3.3	3.5	3.5	3.4	3.2	3.7
BF Max Depth (ft)	5.0	5.3	6.1	6.3	6.0	6.3	6.7	6.4	3.2	3.0	3.2	3.1	3.0	3.0	3.1	2.8	2.9	2.8	2.6	2.7	2.7	2.5	2.8	2.8	5.3	5.2	4.1	4.8	4.8	5.2	4.0	4.9
BF Cross Sectional Area (ft^2)	55.4	58.5	61.3	70.0	66.5	76.1	90.6	85.4	32.9	33.8	33.5	33.8	32.6	33.6	34.1	33.1	26.4	25.2	23.8	22.4	21.9	20.9	24.0	24.5	48.1	47.0	45.2	46.2	47.6	50.1	47.6	53.9
Width/Depth Ratio	NA	NA	NA	NA	NA	NA	NA	NA	8.5	8.6	7.5	7.7	7.1	6.5	7.0	7.7	11.7	11.4	5.2	5.3	5.5	6.0	5.6	5.4	NA	NA	NA	NA	NA	NA	NA	NA
Entrenchment Ratio	NA	NA	NA	NA	NA	NA	NA	NA	9.0	8.8	9.4	9.3	9.9	10.2	9.7	9.4	8.5	8.8	13.5	13.8	13.7	13.4	12.9	13.0	NA	NA	NA	NA	NA	NA	NA	NA
Bank Height Ratio**	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 (mm)	3.1	0.4	0.3	NA	0.3	0.6	---	---	15.6	11.7	0.4	1.8	0.7	0.4	---	---	13.6	8.7	4.4	0.2	0.3	0.6	---	---	6.3	0.1	0.2	NA	NA	NA	---	---

Parameter	Cross Section 5* Riffle								Cross Section 6* Riffle								Cross Section 7* Riffle							
Dimension	MY1	MY2	MY3	MY4	MY5	MY6	MY7	MY8	MY1	MY2	MY3	MY4	MY5	MY6	MY7	MY8	MY1	MY2	MY3	MY4	MY5	MY6	MY7	MY8
Bankfull Elevation						104.56	104.45	104.45						104.59	104.59	104.59						104.53	104.53	104.53
BF Width (ft)						10.4	10.2	10.1						27.3	27.2	27.1						16.9	17.0	17.2
Floodprone Width (ft) (approx)						150.0	150.0	150.0						150.0	150.0	150.0						150.0	150.0	150.0
BF Mean Depth (ft)						2.3	2.4	2.4						2.6	2.4	2.3						2.3	2.3	2.3
BF Max Depth (ft)						2.9	2.9	3.1						4.4	4.4	4.1						3.7	3.6	3.6
BF Cross Sectional Area (ft^2)						23.7	24.0	24.2						71.8	64.3	61.9						38.9	38.9	39.4
Width/Depth Ratio						4.6	4.3	4.2						10.4	11.5	11.8						7.4	7.5	7.5
Entrenchment Ratio						14.4	14.7	14.9						5.5	5.5	5.5						8.9	8.8	8.7
Bank Height Ratio						1.0	1.0	1.0						1.0	1.0	1.0						1.0	1.0	1.0
d50 (mm)						---	---	---						---	---	---						---	---	---

* Note: Cross Sections were established after repairs conducted at the Site.

Table 7b. Monitoring Data - Stream Reach Data Summary
McIntyre Creek at Hornets Nest Park (DMS Project Number 243)

Parameter	Baseline					MY-1					MY-2					MY-3					MY-4					MY-5					MY-6					MY-7				
Dimension and Substrate - Riffle Only	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**
BF Width (ft)	16.7			17.6		17.0			17		11.1			15.9		10.9			16.1		10.9			15.2		11.2			14.7		10.4	16.3	15.4	27.3	6.7	10.2	16.4	16.0	27.2	6.7
Floodprone Width (ft)	150			150		150			150		150			150		150			150		150			150		150			150		150			150		150			150	
BF Mean Depth (ft)	1.5			2.0		1.5			2.0		2.1			2.1		2.1			2.1		2.0			2.1		1.9			2.3		2.1	2.3	2.3	2.6	0.2	2.1	2.3	2.3	2.4	0.2
BF Max Depth (ft)	2.9			3.2		2.8			3.0		2.6			3.2		2.7			3.1		2.7			3.0		2.5			3.0		2.8	3.4	3.1	4.4	0.7	2.8	3.3	2.9	4.4	0.7
BF Cross Sectional Area (ft^2)	26.4			32.9		25.2			33.8		23.8			33.5		22.4			33.8		21.9			32.6		20.9			33.6		23.7	38.5	34.1	71.8	19.7	24.0	37.0	33.1	64.3	16.5
Width/Depth Ratio	8.5			11.7		8.6			11.4		5.2			7.5		5.3			7.7		5.5			7.1		6.0			6.5		4.5	7.0	7.0	10.5	2.3	4.3	7.2	7.4	11.3	2.7
Entrenchment Ratio	8.5			9.0		8.8			8.8		9.4			13.5		9.3			13.8		9.9			13.7		10.2			13.4		5.5	10.3	10.3	14.4	3.5	5.5	10.3	10.3	14.7	3.6
Bank Height Ratio**	1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0	
Profile - Reach 1																																								
Riffle length (ft)	10.1	32.1	32.8	91.7		10.9	25.9	24.5	50.5		7.4	27	21.1	76.8		15	41.2	33.8	99.3	25.7	12.1	33.8	34.4	75.9	15.1	14.6	36.3	32	91.8	20.4										
Riffle slope (ft/ft)	0.0000	0.0012	0.0042	0.0313		0.0000	0.0047	0.0008	0.0296		0.0000	0.0023	0.0007	0.0126		0.0000	0.0034	0.0001	0.0221	0.01	0.0000	0.0040	0.0006	0.0201	0.0068	0.0000	0.0048	0.0008	0.0211	0.0076										
Pool length (ft)	4.3	17.3	15.6	59.6		6.4	19.6	19.3	35.8		10.4	20.7	20.3	35.9		4.3	17.9	18.5	29.0	6.7	4.6	17.3	16.0	32.1	7.1	9.5	24.6	19.9	95.2	19.4										
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1		4.8			6.3		4.8			6.0		5.2			6.3											
Pool spacing (ft)	48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0										
Profile - Reach 2																																								
Riffle length (ft)	10.1	32.1	32.8	91.7		11.9	30.1	30.1	58.2		4.7	24.7	22.4	61.2		5.9	28	19.4	102.5	25.2	9.1	37.6	32.7	81.7	22.9	7.7	31.3	31.5	65.9	17.5										
Riffle slope (ft/ft)	0.0000	0.0012	0.0042	0.0313		0.0000	0.0100	0.0001	0.0061		0.0000	0.0014	0.0010	0.0046		0.0000	0.0012	0.0005	0.0050	0.00	0.0000	0.0014	0.0008	0.0076	0.0020	0.0000	0.0005	0.0000	0.0032	0.0009										
Pool length (ft)	4.3	17.3	15.6	59.6		4.0	14.7	9.5	43.3		2.5	10.7	9.9	22.2		4.2	14.6	13.1	32.1	8.7	3.6	17.1	18.8	43.7	9.9	6.3	20.0	17.3	50.9	13.3										
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1		4.1			6.1		4.8			6.0		5.2			6.3											
Pool spacing (ft)	48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0										
Profile - Reach 3																																								
Riffle length (ft)	10.1	32.1	32.8	91.7		9.7	34.6	34.7	63.7		7.5	28	27	61.1		5.5	27.3	28.6	48.4	11.7	6.6	30.2	29.4	64.4	14.2	8.6	36.8	39.7	65.3	16.1										
Riffle slope (ft/ft)	0.0000	0.0012	0.0042	0.0313		0.0010	0.0027	0.0011	0.0150		0.0000	0.0007	0.0003	0.0041		0.0000	0.0022	0.0008	0.0089	0.00	0.0000	0.0021	0.0012	0.0124	0.0029	0.0000	0.0022	0.0013	0.0078	0.0027										
Pool length (ft)	4.3	17.3	15.6	59.6		4.5	12.2	12.1	21.2		1.3	15.5	11.5	42.2		5.1	15.9	15.6	33.7	8.0	6.7	17.3	13.9	41.7	9.7	5.3	16.6	14.2	38.9	8.8										
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1		4.1			6.1		4.8			6.0		5.2			6.3											
Pool spacing (ft)	48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0										
Pattern																																								
Channel Beltwidth (ft)	19	45	41	107																																				
Radius of Curvature (ft)	24	49	40	246																																				
Rc:Bankfull width (ft/ft)	1.4	2.8	2.3	14.3																																				
Meander Wavelength (ft)	88	132	128	220																																				
Meander Width ratio	1.1	2.6	2.4	6.2																																				
Additional Reach Parameters																																								
Rosgen Classification	E-type					E-type					E-type					E-type					E-type					E-type					E-type					E-type				
Channel Thalweg Length (ft)	5178					5178					5178					5178					5178					5178					5178					5178				
Sinuosity	1.4					1.4					1.4					1.4					1.4					1.4					1.4					1.4				
Water Surface Slope (Channel) (ft/ft)	0.0035					0.0020 - 0.0042					0.0002 - 0.0041					0.0026 - 0.0043					0.0025 - 0.0046					0.0021 - 0.0045					-------					-------				
BF slope (ft/ft)	------					------					------					------					------					------					------					------				
Ri%/RU%P%G%/S%	45	14	25	15		41	17	22	20		38	21	24	17		45	13	26	16		45	12	27	16		43	11	32	14											
SC%/SA%/G%/C%/B%/BE%																																								
d16/d35/d50/d84/d95											NA	0.18	0.3	7	15	NA	NA	0.2	9	25	NA	NA	0.2 9	9	24	NA	NA	0.1	8	21										
% of Reach with Eroding Banks																																								
Channel Stability or Habitat Metric																																								
Biological or Other																																								

**Note: As per NCDMS guidance, bankfull cross sectional area is calculated using a fixed elevation. Therefore, bankfull maximum depth and low bank height are measured from the fixed elevation to the bottom of the thalweg. Given the fixed nature of bankfull, both values of bankfull maximum depth and low bank height fluctuate at the same amount, resulting in a bank height ratio that does not change dramatically from year to year.

Table 8. Year 8 (2017) Total Planted and Natural Recruit Stems by Plot and Species

McIntyre Creek (DMS Project #243)

Scientific Name	Common Name	Species Type	Temporary Plot 1 4m x 25m	Temporary Plot 2 2m x 50m	Temporary Plot 3 2m x 50m	Temporary Plot 4 4m x 25m	MY8 (2018)
Fraxinus pennsylvanica	Green ash	Tree	22	19	12	12	65
Betula nigra	River birch	Tree	1	25	4	7	37
Platanus occidentalis	Sycamore	Tree	12	30	12	2	56
Quercus rubra	Northern red oak	Tree	2	1	2	0	5
Ulmus Americana	Slippery Elm	Tree	0	4	0	0	4
Liquidambar styraciflua	Sweetgum	Tree	5	4	1	0	10
Liriodendron tulipifera	Tulip poplar	Tree	3	0	0	1	4
Acer negundo	Box elder	Tree	0	0	2	0	2
Corunus amomum	Silky dogwood	Tree	0	1	1	0	2
		Stem Count	**45**	**84**	**34**	**22**	**185**
		Size (Ares)	1	1	1	1	4
		Size (Acres)	0.02	0.02	0.02	0.02	0.10
		Species count	6	7	7	4	9
		Stems per acre	**1821.1**	**3399.4**	**1375.9**	**890.3**	**1871.7**