FINAL
ANNUAL MONITORING REPORT
YEAR 7 (2016)
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

November 2016

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North Carolina Department of Environmental Quality
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Prepared by:
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Axiom Environmental, Inc.

November 2016

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Appendices

1.0 EXECUTIVE SUMMARY

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.

Success criteria for stream restoration will be assessed using measurements of stream dimension, pattern, and profile; site photographs; visual assessments; and vegetation sampling. Cross-section measurements should show little or no change from the as-built cross-sections. If changes occur, evaluations will be completed to determine whether changes are minor adjustments trending towards a more stable channel or

if changes indicate movement towards an unstable condition. Annual measurements should indicate stable bed form features with little change from the as-built survey. Pools are expected to maintain depth with lower water surface slope and riffles are expected to remain shallower with steeper water surface slopes. Substrate measurements should indicate maintenance of distributions from the design phase and baseline measurements. In addition, there should be an absence of any significant aggradation or degradation of the stream channel. During years 6 and 7, monitoring activities will include measurement of the 4 existing cross-sections as well as the establishment and measurement of 3 additional riffle cross-sections (2 in Monitoring Reach 1 and 1 in Monitoring Reach 2). Profile will not be measured during these years as 5 years of data have already been collected. Vegetation sampling during years 6 and 7 will include the establishment and measurement of 4 temporary 100 square meter plots along the disturbed portions of Monitoring Reach 1. Data will include counts and speciation of planted species and volunteers. A visual assessment of stream and vegetation conditions will also be completed along with all previously reported photo points.

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. The areas in Monitoring Reaches 2 and 3 were less concerning in that they are dominated by surficial scour (8 and 5%, respectively during year 6, and 9 and 6%, respectively during year 7 (Tables 5B-5C, Appendix B)) as opposed to mass wasting. Additionally, these features developed earlier in the project, yet have not advanced significantly in recent years. The bank erosion percentages within these reaches have either remained the same or improved slightly compared to prior years. Erosion was also observed in pool cross-sections 1 and 4 earlier in the projects history; however, these cross-sections have not demonstrated any appreciable change even when exposed to multiple storm flows. The watershed is extremely flashy due to the extensive amount of impervious surface in the contributing watershed and floods quickly even during modest rain events. Therefore, given the lack of change within the last 3 years, the repairs focused on the bottom reach (Monitoring Reach 1) thereby avoiding unnecessary disturbance of sections that appear to have equilibrated.

Success criteria for stream restoration will include documentation of two bankfull channel events during the monitoring period. In the event that less than two bankfull events occur during the first five years, monitoring will continue until the second event is documented. In addition, bankfull events must occur during separate monitoring years. A crest gauge is located within the Site to assist with documentation of bankfull events (Figures 2-2A, Appendix B). One bankfull event was documented during the year 7 (2016) monitoring season making a total of six bankfull events documented within the seven-year monitoring period. Additionally, precipitation data indicates that four geomorphologically relevant flow events occurred onsite during the year 7 (2016) monitoring season for a total of at least fourteen such flows occurring over the seven year monitoring period.

Vegetation success criteria dictate that an average density of 320 stems per acre must be surviving in the first three monitoring years. Subsequently, 290 stems per acre must be surviving in year 4 and 260 stems per acre in year 5. Stem counts will be based on an average of the evaluated vegetation plots. Based on the number of stems counted, average densities were measured at 477 planted stems per acre (excluding livestakes) surviving in year 5 (2014); therefore, the site has met its vegetation success criteria. 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 7 (2016) results indicate an average of 1427 stems per acre with 4 to 6 species per plot, including natural recruits, within this reach.

Vegetation areas of concern within the Site include several patches of multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and kudzu (*Pueraria lobata*). These are depicted on Figures 2A-2B (Appendix B). Invasive species treatments have occurred in late October 2013, early 2014, October 2015, December 2015, and September 2016. The most recent treatments appear to be successful with significantly less invasive species populations observed during year 7 (2016) than previous monitoring years (Table 6, Appendix B).

Two groundwater gauges (Gauges 2 and 3) were installed within the Site within wetland areas created as the result of stream restoration activities. An additional gauge (Gauge 1) was placed just outside of delineated wetland areas created as the result of stream restoration activities. These gauges were monitored during years 1 through 5, and all delineated wetlands are meeting success criteria. Groundwater hydrology data is included in Appendix E.

Beaver activity observed on the Site during previous monitoring years has lessened due to proactive measurements taken by DMS. Some signs of recent beaver activity were observed throughout the Site during monitoring year 7 (2016), however no dams were observed during monitoring activities. Proactive measures to control beaver will continue as necessary.

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

2.1 Vegetation Assessment

Ten vegetation plots were established and marked after construction with four foot metal U-bar post demarking the corners with a ten foot, three-quarter inch PVC at the origin. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed during monitoring years 1 (2010) through 5 (2014) using the *CVS-DMS Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) (http://cvs.bio.unc.edu/methods.htm). During year 6 (2015), 4 temporary 100 square meter plots were established and measured along the disturbed portions of Monitoring Reach 1. Plot data for years 6-7 (2015-2016) included counts and speciation of planted species and volunteers; results are included in Appendix C. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007).

2.2 Stream Assessment

Annual stream monitoring will be conducted following procedures established in the USDA Forest Service Manual, *Stream Channel Reference Sites* (Harrelson et. al 1994) and methodologies utilized in the Rosgen stream assessment and classification system (Rosgen 1994 and 1996). Four permanent cross-sections, two riffle and two pool, were established during year 1 (2010) and were measured each year thereafter. During year 6 (2015), 3 additional cross-sections were established and measured in years 6-7 (2015-2016). Cross-sections will be used to evaluate stream dimension; locations are depicted on Figures 2 and 2A-2B (Appendix B). Cross-sections are permanently monumented with 4-foot metal garden posts at each end point. Cross-sections will be surveyed to provide a detailed measurement of the stream and banks including points on the adjacent floodplain, top of bank, bankfull, breaks in slope, edge of water, and thalweg. Data will be used to calculate width-depth ratios, entrenchment ratios, and bank height ratios for each cross-section. In addition, photographs will be taken at each permanent cross-section location annually.

Three approximately 1000-linear foot monitoring reaches were established during year 1 (2010) and will be used to evaluate stream pattern and longitudinal profile; locations are depicted on Figures 2 and 2A-2B (Appendix B). Measurements of channel pattern included belt-width, meander length, and radius of curvature (only in year one). Subsequently, data was used to calculated meander-width ratios. Longitudinal profile measurements will include average water surface slopes and facet slopes and pool-to-pool spacing. Stream profile will not be measured during years 6 (2015) and 7 (2016). Ten permanent photo points were established throughout the restoration reach; locations are depicted on Figures 2 and 2A-2B (Appendix B) and plots are included in Appendix B. In addition, visual stream morphology stability assessments will be completed in each of the three monitoring reaches annually to assess the channel bed, banks, and in-stream structures.

2.3 Wetland Assessment

Three groundwater monitoring gauges were installed at the Site in February 2011 and have been maintained and monitored throughout years 1 (2010) through 5 (2014) growing seasons. Two gauges (Gauges 2 and 3) are located within delineated wetlands created by stream restoration activities and one gauge (Gauge 1) is located within a marginal area not in the delineated wetlands to assist with making a determination in marginal areas. Graphs of years 1 through 5 groundwater hydrology and precipitation are included in Appendix E.

3.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-DMS Protocol for Recording Vegetation, Version 4.2. (online). Available: http://cvs.bio.unc.edu/methods.htm.

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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.

Weather Underground. 2016. Station at Charlotte Douglas International Airport (KCLT) in Charlotte, North Carolina. (online). Available: http://www.wunderground.com/history/airport/KCLT/2016/04/04/CustomHistory.html [April 4, 2016].

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

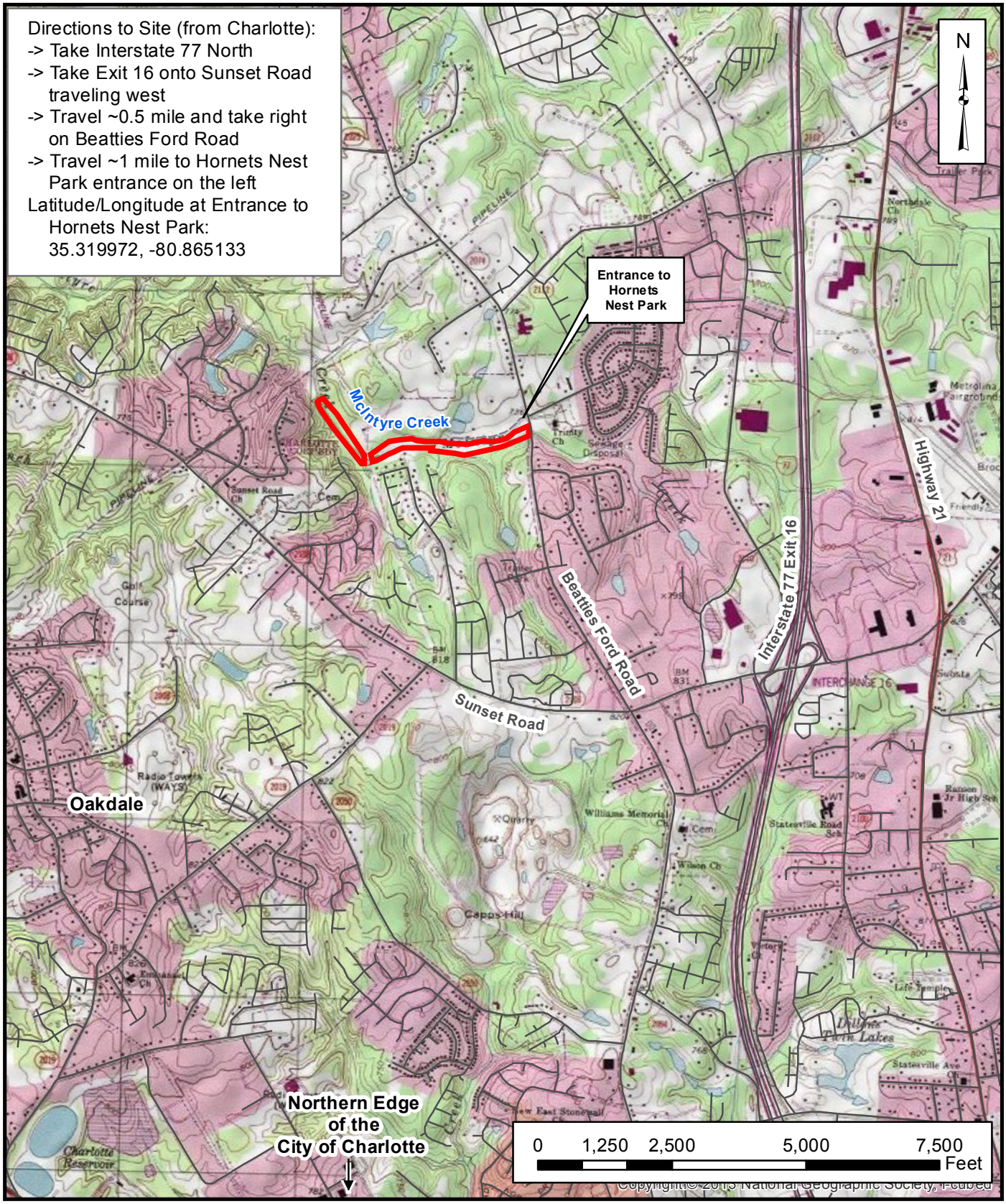
Figure 1. Vicinity Map

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***		**--**		**--**		**0.57**
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.
Wetland	--	0	--	Creation	1.71	3:1	--

Component Summation		
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acres)**
Restoration	5178	--
Creation	--	1.71
Totals	**5178**	**1.71**
Mitigation Units	**5129 SMUs***	**0.57**

*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: 8 years
Elapsed Time Since Planting Complete: 8 years
Number of Reporting Years: 7

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

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

Tables 5A-5C. Visual Stream Morphology Stability Assessment Tables

Table 6. Vegetation Condition Assessment Table

Stream Fixed-Station Photos

Vegetation Monitoring Plot Photos

Temporary Vegetation Monitoring Plot Photos

Legend

- Conservation Easement
- Wetlands
- Cross-sections
- Monitoring Reaches
- Stream Fixed-Station Photo Points
- Groundwater Gauges
- Crest Gauge
- Structures
- Streams
- Temporary Vegetation Plots (MY6-7)
- CVS Plots (MY1-5)

Photo Point	Bearing	Latitude	Longitude
1	154	35.32065	-80.87796
2	140	35.32022	-80.87791
3	324	35.31867	-80.87613
4	188	35.31823	-80.87550
5	135	35.31823	-80.87550
6	78	35.31802	-80.87389
7	90	35.31835	-80.87224
8	120	35.31841	-80.86887
9	90	35.31839	-80.86747
10	~260	35.31927	-80.86491

Feature	Latitude	Longitude
plot 1 origin	35.31901	-80.87667
plot 2 origin	35.31859	-80.87602
plot 3 origin	35.31784	-80.87533
plot 4 origin	35.31792	-80.87444
plot 5 origin	35.31851	-80.87234
plot 6 origin	35.31847	-80.87068
plot 7 origin	35.31824	-80.86931
plot 8 origin	35.31837	-80.86792
plot 9 origin	35.31873	-80.86621
plot 10 origin	35.31895	-80.86570
xsect 2 right bank	35.31820	-80.87568
xsect 2 left bank	35.31816	-80.87581
xsect 1 left bank	35.31922	-80.87688
xsect 1 right bank	35.31929	-80.87679
xsect 3 right bank	35.31859	-80.86774
xsect 3 left bank	35.31849	-80.86773
xsect 4 left bank	35.31893	-80.86579
xsect 4 right bank	35.31901	-80.86584

N

Figure 2A

Figure 2B

Aerial Photography Source: CGIA 2015 Orthoimagery

0 250 500 1,000 1,500 Feet

NC 911 Board, NCCGIA, NCDOT

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

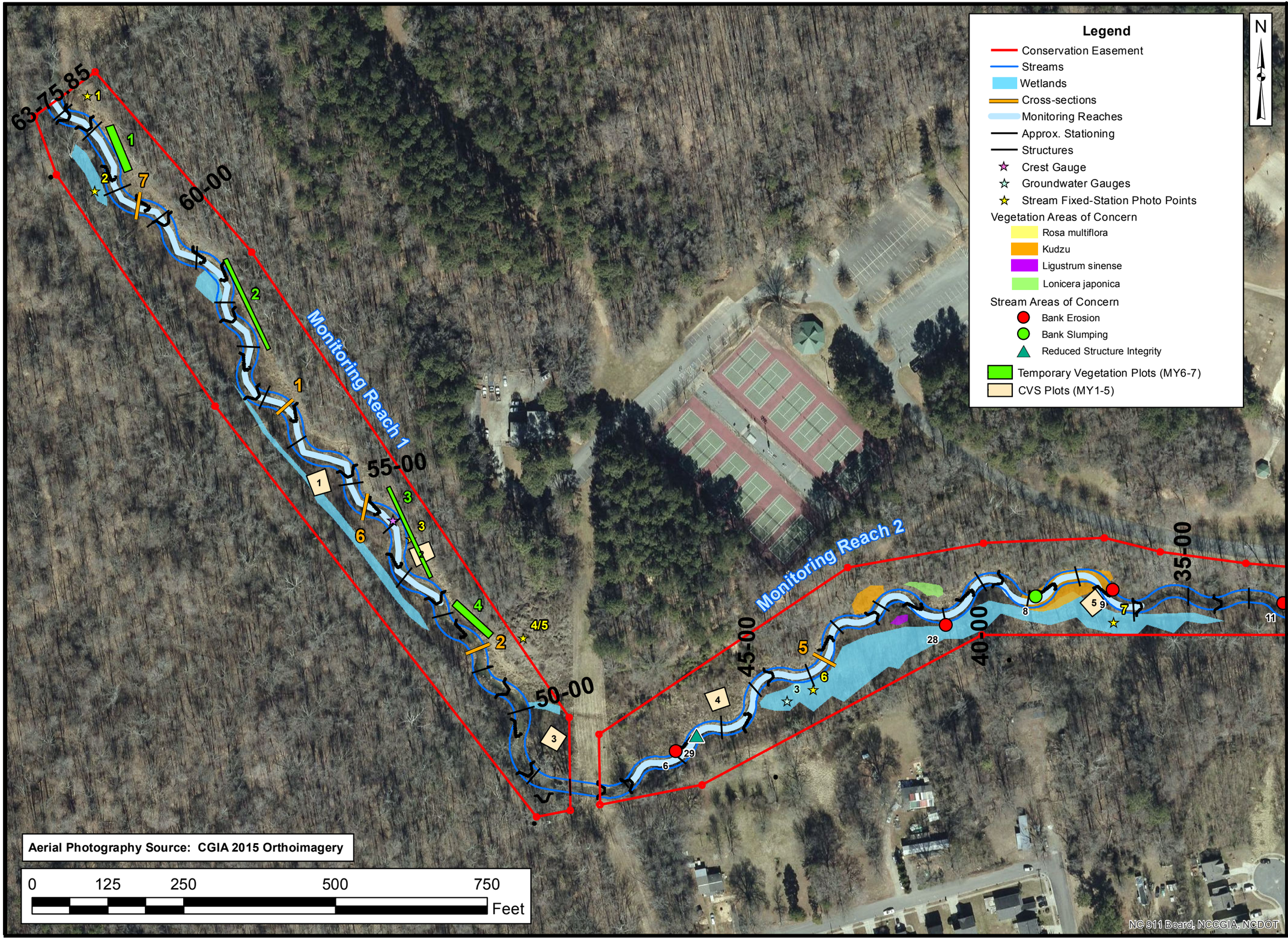
Date: OCT 2016

Scale: 1:3600

Project No.: 12-004.03

FIGURE

2



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Project:

MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK

Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF/KRJ

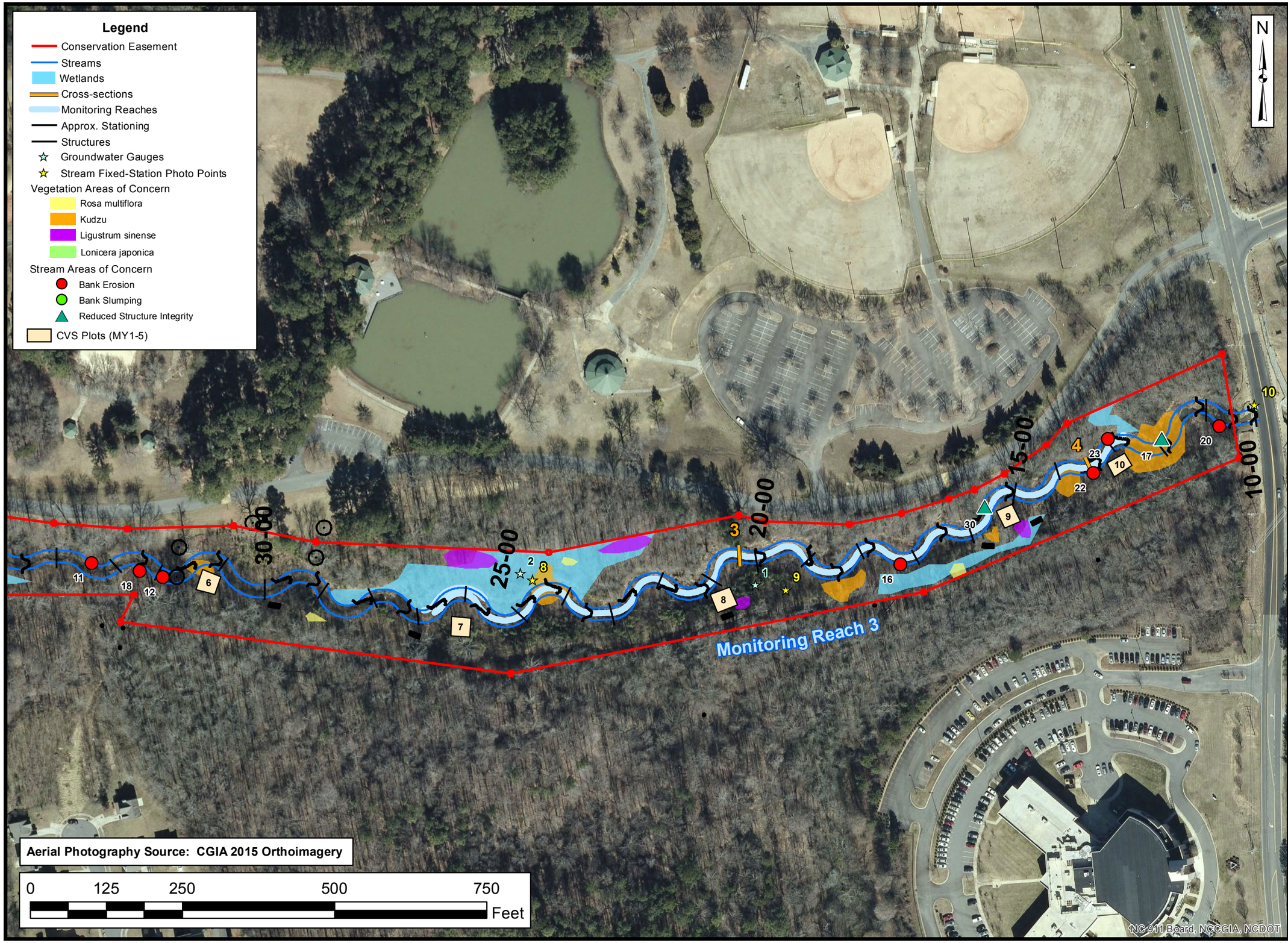
Date: NOV 2016

Scale: 1:1800

Project No.: 12-004.03

FIGURE

2A



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Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF/KRJ

Date: NOV 2016

Scale: 1:1800

Project No.: 12-004.03

FIGURE

2B

Table 5A. 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%			

Table 5B. Visual Stream Morphology Stability Assessment

McIntyre Creek Restoration Site at Hornets Nest Park (DMS Project Number 243)

Reach ID Reach 2

Assessed Length 1113

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	18			94%			
	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)	17	18			94%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	18	18			100%			
		2. Thalweg centering at downstream of meander (Glide)	18	18			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			3	105	95%	0	0	95%
	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.			2	75	97%	1	10	97%
	3. Mass Wasting	Bank slumping, calving, or collapse			1	55	98%	1	20	98%
				Totals	6	235	89%	2	30	91%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	7	8			88%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	7	8			88%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	8			88%			
	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	8			88%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	7	8			88%			

Table 5C. Visual Stream Morphology Stability Assessment

McIntyre Creek Restoration Site at Hornets Nest Park (DMS Project Number 243)

Reach ID Reach 3

Assessed Length 1172

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	16	17			94%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	16	16			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	15	16			94%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	16	16			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			3	110	95%	2	35	97%
	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.			1	65	97%	1	25	98%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	4	175	93%	3	60	95%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	4	6			67%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	6			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	6			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)	4	6			67%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	6	6			100%			

Table 6 **Vegetation Condition Assessment**

McIntyre Creek Restoration Site (DMS Project 243)

Planted Acreage[1] **17**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	NA	None	NA	0	0.00	0.0%
2. Low Stem Density Areas	NA	NA	NA	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	NA	NA	NA	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2] **17**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Several small patches of kudzu (*Pueraria lobata*), multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*).	20 SF	Yellow, orange, purple, and green	18	0.69	4.1%
5. Easement Encroachment Areas[3]	NA	NA	NA	0	0.00	0.0%

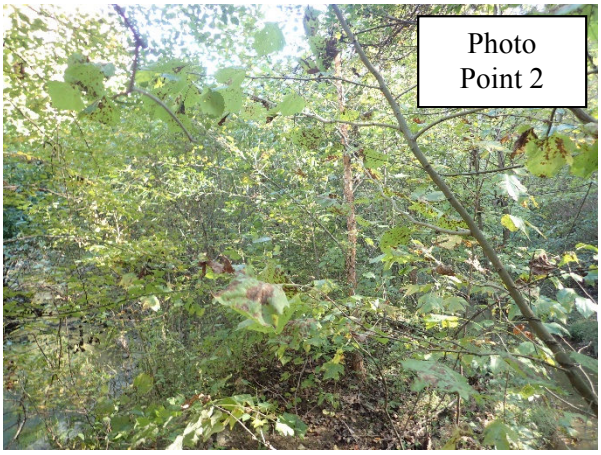
1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

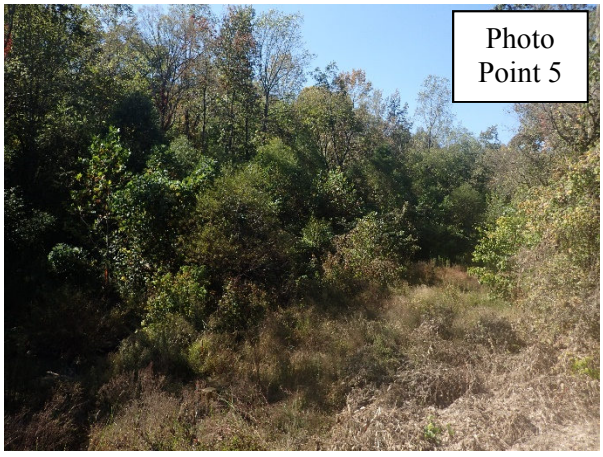
2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by DMS such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

McIntyre Creek
Stream Fixed-Station Photographs
Taken October 2016



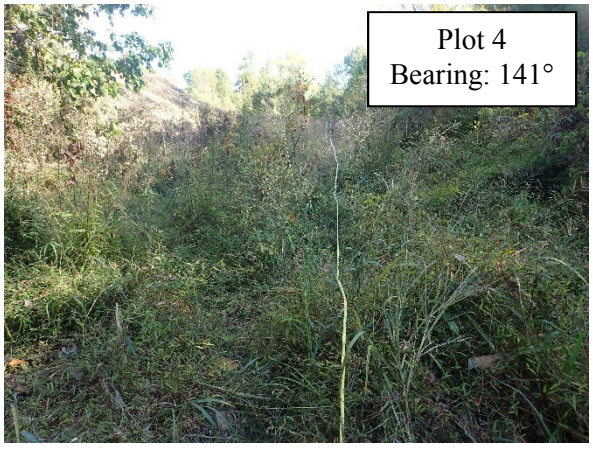


McIntyre Creek
Stream Fixed-Station Photographs
Taken October 2016
(continued)

McIntyre Creek
Vegetation Monitoring Plot Photographs
Taken October 2016

McIntyre Creek
Vegetation Monitoring Plot Photographs
Taken October 2016
(continued)

McIntyre Creek
Temporary Vegetation Monitoring Plot Photographs
Taken October 2016



APPENDIX C

VEGETATION PLOT DATA

Table 7. Year 7 (2016) Total and Planted Stems by Plot and Species

Table 7. Year 7 (2016) 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	MY7 (2016)
Fraxinus pennsylvanica	Green ash	Tree	20	29	5	7	61
Betula nigra	River birch	Tree	1	3	1	0	5
Platanus occidentalis	Sycamore	Tree	13	25	9	2	49
Quercus rubra	Northern red oak	Tree	0	0	0	0	0
Ulmus Americana	Slippery elm	Tree	4	9	2	1	16
Liriodendron tulipifera	Tulip poplar	Tree	2	1	0	2	5
Acer negundo	Box elder	Tree	0	0	2	0	2
Nyssa. Sp.	Gum	Tree	0	1	0	0	1
Celtis laevigata	Hackberry	Tree	0	0	0	1	1
Corunus amomum	Silky dogwood	Tree	0	0	1	0	1
		Stem Count	**40**	**68**	**20**	**13**	**141**
		Size (Ares)	1	1	1	1	4
		Size (Acres)	0.02	0.02	0.02	0.02	0.10
		Species count	6	5	6	4	8
		Stems per acre	**1618.7**	**2751.9**	**809.4**	**526.1**	**1426.5**

APPENDIX D

STREAM SURVEY DATA

Cross-section Plots

Tables 8a-b. Baseline Stream Data Summary

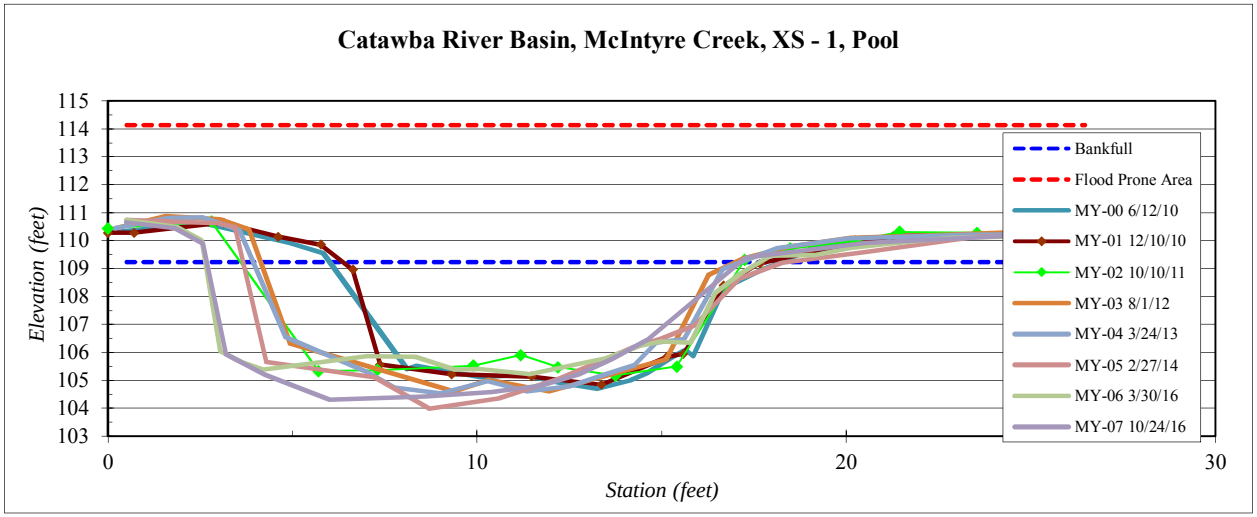
Tables 9a-b. Monitoring Data

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 1, Pool
Feature	Pool
Date:	10/24/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.5	110.7
1.8	110.4
2.6	109.9
3.2	105.9
4.2	105.2
6.0	104.3
8.6	104.4
10.4	104.6
11.7	104.8
12.8	105.2
13.7	105.8
14.6	106.5
17.3	109.4
20.5	109.9
24.7	110.2
26.5	110.2

SUMMARY DATA	
Bankfull Elevation:	109.2
Bankfull Cross-Sectional Area:	53.9
Bankfull Width:	14.5
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	4.9
Mean Depth at Bankfull:	3.7
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C/E

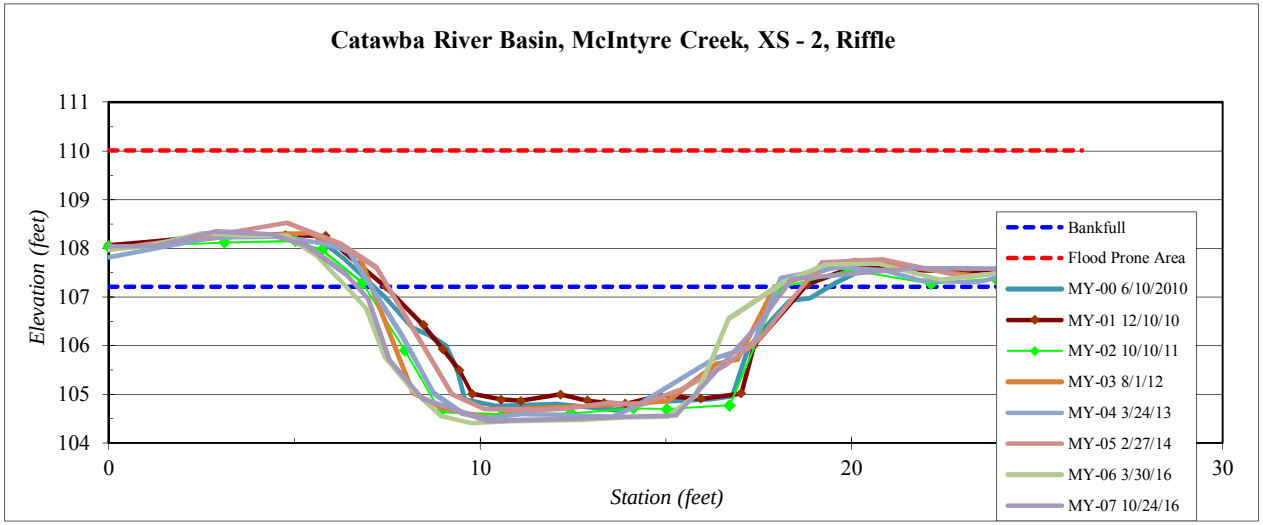


River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 2, Riffle
Feature	Riffle
Date:	10/24/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	108.04
1.26	108.05
2.90	108.35
4.36	108.29
5.32	108.07
6.39	107.47
6.99	106.95
7.55	105.70
8.45	104.91
10.20	104.45
12.60	104.50
13.97	104.54
15.29	104.57
17.45	106.40
18.4	107.37
21.7	107.59
26.2	107.6

SUMMARY DATA	
Bankfull Elevation:	107.2
Bankfull Cross-Sectional Area:	24.5
Bankfull Width:	11.5
Flood Prone Area Elevation:	110.0
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	2.1
W / D Ratio:	5.4
Entrenchment Ratio:	13.0
Bank Height Ratio:	1.0

Stream Type	E

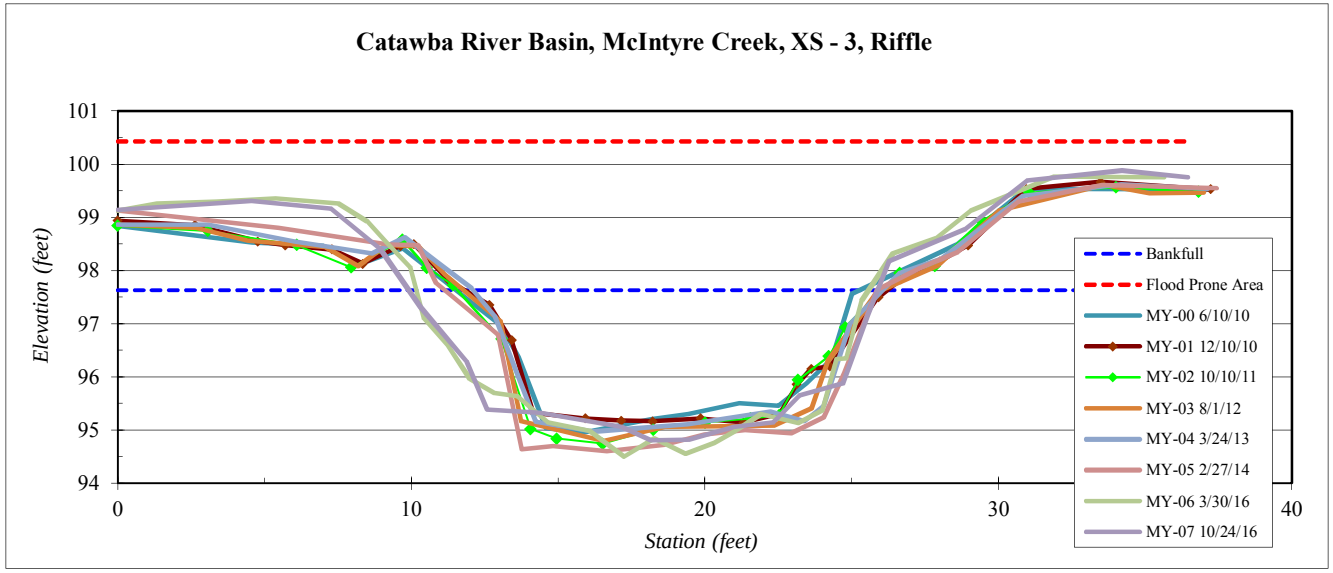


River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 3, Riffle
Feature	Riffle
Date:	10/24/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	99.14
4.56	99.31
7.25	99.17
8.93	98.40
10.32	97.31
11.88	96.29
12.59	95.38
14.40	95.33
17.16	95.05
18.16	94.81
19.47	94.82
21.00	95.06
22.34	95.14
23.23	95.65
24.70	95.88
25.6	97.17
26.3	98.17
28.9	98.78
31.0	99.69
34.2	99.88
36.5	99.76

SUMMARY DATA	
Bankfull Elevation:	97.6
Bankfull Cross-Sectional Area:	33.1
Bankfull Width:	16.0
Flood Prone Area Elevation:	100.4
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	2.1
W / D Ratio:	7.7
Entrenchment Ratio:	9.4
Bank Height Ratio:	1.0

Stream Type	E



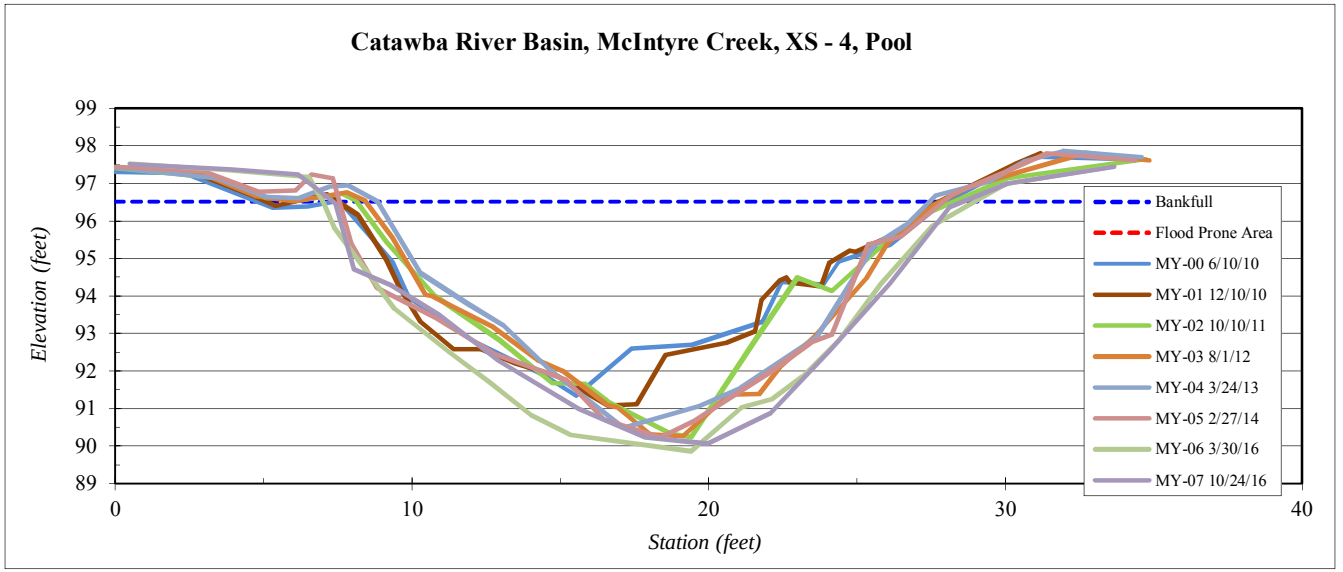
Note: Right bank cross section fixed point was removed during construction and reestablished for Year 6 monitoring.

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 4, Pool
Feature	Pool
Date:	10/24/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.5	97.51
3.9	97.37
6.2	97.23
7.4	96.46
8.0	94.72
9.3	94.28
10.9	93.51
12.9	92.27
15.6	90.99
17.9	90.22
20.0	90.06
22.1	90.88
24.1	92.54
26.1	94.34
28.1	96.37
30.1	97.00
33.7	97.44

SUMMARY DATA	
Bankfull Elevation:	96.5
Bankfull Cross-Sectional Area:	85.4
Bankfull Width:	21.2
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	6.4
Mean Depth at Bankfull:	4.0
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E



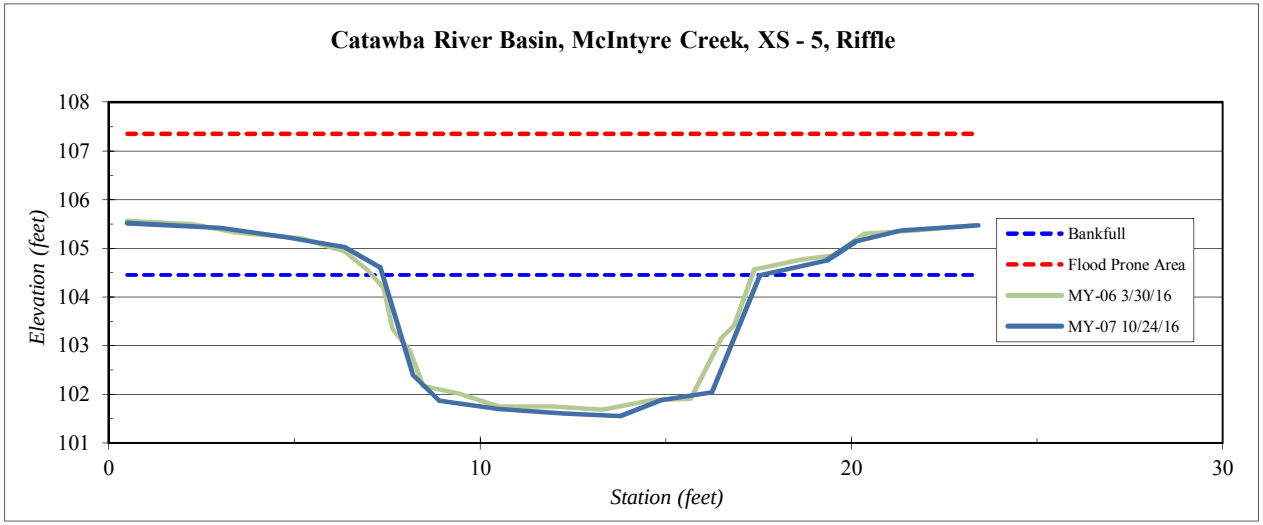
Note: Right bank cross section fixed point was removed during construction and reestablished for Year 6 monitoring.

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 5, Riffle
Feature	Riffle
Date:	10/24/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.50	105.52
3.00	105.42
4.83	105.22
6.34	105.03
7.32	104.60
8.19	102.40
8.90	101.87
10.51	101.70
12.27	101.61
13.77	101.55
14.88	101.89
16.24	102.04
17.54	104.45
19.34	104.74
20.1	105.14
21.4	105.36
23.4	105.5

SUMMARY DATA	
Bankfull Elevation:	104.5
Bankfull Cross-Sectional Area:	24.0
Bankfull Width:	10.2
Flood Prone Area Elevation:	107.4
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.9
Mean Depth at Bankfull:	2.4
W / D Ratio:	4.3
Entrenchment Ratio:	14.7
Bank Height Ratio:	1.0

Stream Type	E



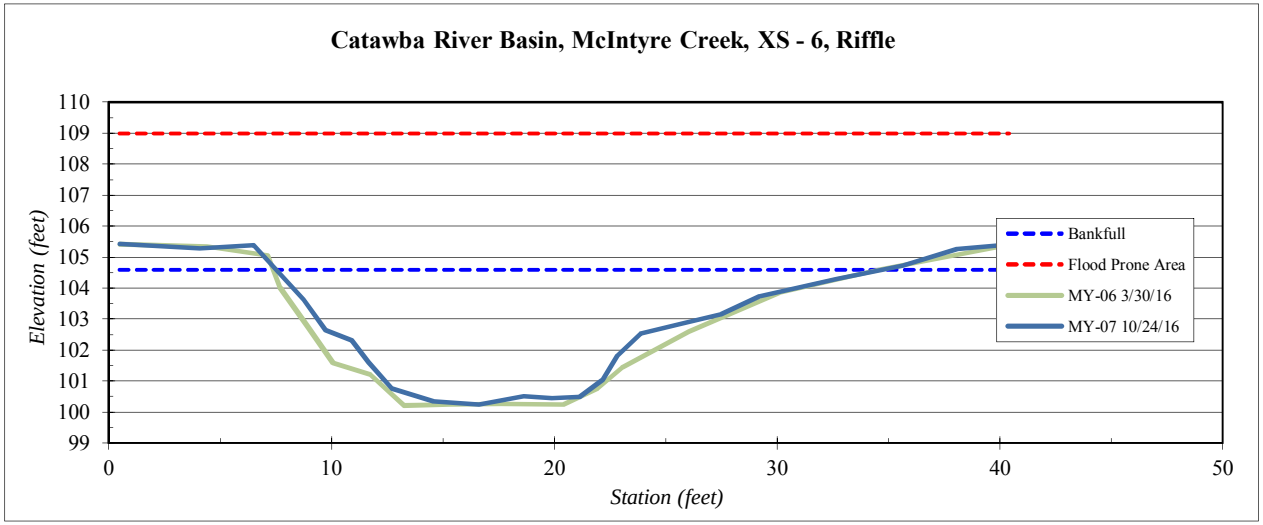
* Note: Cross Section was established after repairs conducted at the Site.

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 6, Riffle
Feature	Riffle
Date:	10/24/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.50	105.42
4.09	105.29
6.52	105.38
8.76	103.64
9.75	102.63
10.93	102.31
11.67	101.60
12.72	100.76
14.57	100.35
16.61	100.24
18.64	100.51
19.89	100.46
21.17	100.48
22.17	101.04
22.8	101.81
23.9	102.54
25.7	102.8
27.5	103.2
29.2	103.7
32.7	104.3
35.6	104.7
38.1	105.3
40.4	105.4

SUMMARY DATA	
Bankfull Elevation:	104.6
Bankfull Cross-Sectional Area:	64.3
Bankfull Width:	27.2
Flood Prone Area Elevation:	109.0
Flood Prone Width:	150.0
Max Depth at Bankfull:	4.4
Mean Depth at Bankfull:	2.4
W / D Ratio:	11.5
Entrenchment Ratio:	5.5
Bank Height Ratio:	1.0

Stream Type	E



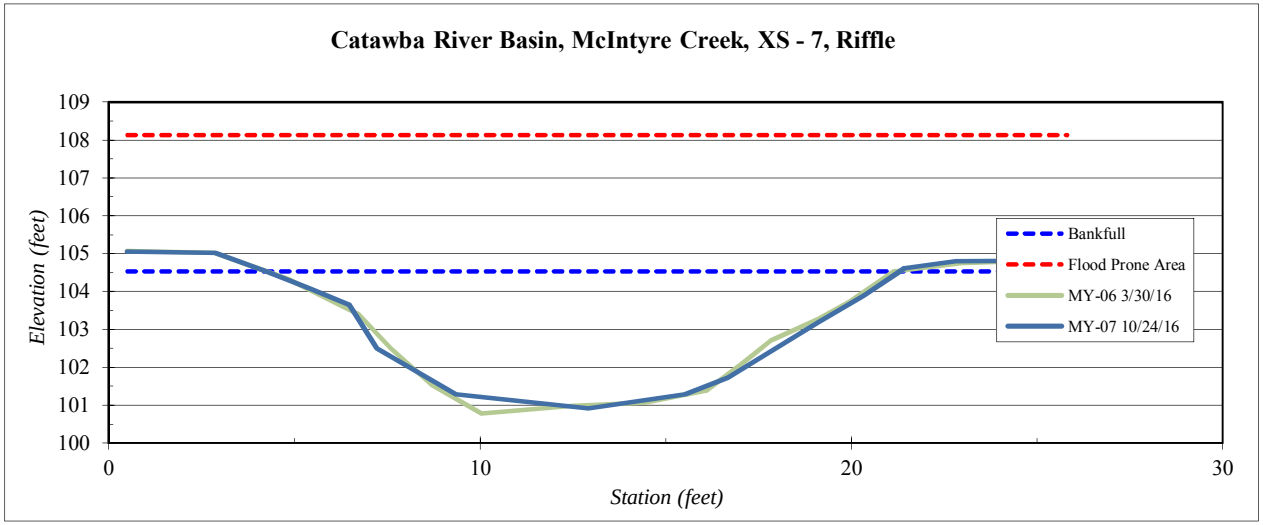
* Note: Cross Section was established after repairs conducted at the Site.

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 7, Riffle
Feature	Riffle
Date:	10/24/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.50	105.05
2.88	105.02
4.21	104.55
5.38	104.09
6.47	103.65
7.21	102.51
9.34	101.29
11.62	101.05
12.92	100.92
15.51	101.28
16.67	101.72
19.12	103.20
20.32	103.89
21.43	104.62
22.8	104.81
25.8	104.82

SUMMARY DATA	
Bankfull Elevation:	104.5
Bankfull Cross-Sectional Area:	38.9
Bankfull Width:	17.0
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:	7.4
Entrenchment Ratio:	8.8
Bank Height Ratio:	1.0

Stream Type	E



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

Table 8a. 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 8b. 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 9a. 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
BF Width (ft)	15.5	15.5	13.7	13.1	13.5	14.7	15.0	14.5	17.6	17.0	11.1	10.9	10.9	11.2	11.6	11.5	16.7	17.0	15.9	16.1	15.2	14.7	15.4	16.0	20.0	19.6	19.4	19.4	18.6	20.3	22.0	21.2
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)	3.1	3.0	3.3	3.5	3.5	3.4	3.2	3.7	1.5	1.5	2.1	2.1	2.0	1.9	2.1	2.1	2.0	2.0	2.1	2.1	2.1	2.3	2.2	2.1	2.8	3.0	3.2	3.6	3.6	3.7	4.1	4.0
BF Max Depth (ft)	5.3	5.2	4.1	4.8	4.8	5.2	4.0	4.9	2.9	2.8	2.6	2.7	2.7	2.5	2.8	2.8	3.2	3.0	3.2	3.1	3.0	3.0	3.1	2.8	5.0	5.3	6.1	6.3	6.0	6.3	6.7	6.4
BF Cross Sectional Area (ft^2)	48.1	47.0	45.2	46.2	47.6	50.1	47.6	53.9	26.4	25.2	23.8	22.4	21.9	20.9	24.0	24.5	32.9	33.8	33.5	33.8	32.6	33.6	34.1	33.1	55.4	58.5	61.3	70.0	66.5	76.1	90.6	85.4
Width/Depth Ratio	NA	NA	NA	NA	NA	NA	NA	NA	11.7	11.4	5.2	5.3	5.5	6.0	5.6	5.4	8.5	8.6	7.5	7.7	7.1	6.5	7.0	7.7	NA	NA	NA	NA	NA	NA	NA	NA
Entrenchment Ratio	NA	NA	NA	NA	NA	NA	NA	NA	8.5	8.8	13.5	13.8	13.7	13.4	12.9	13.0	9.0	8.8	9.4	9.3	9.9	10.2	9.7	9.4	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)	6.3	0.1	0.2	NA	NA	NA	---	---	13.6	8.7	4.4	0.2	0.3	0.6	---	---	15.6	11.7	0.4	1.8	0.7	0.4	---	---	3.1	0.4	0.3	NA	0.3	0.6	---	---

Parameter	Cross Section 5* Riffle								Cross Section 6* Riffle								Cross Section 7* Riffle							
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
BF Width (ft)							10.4	10.2							27.3	27.2							16.9	17.0
Floodprone Width (ft) (approx)							150.0	150.0							150.0	150.0							150.0	150.0
BF Mean Depth (ft)							2.3	2.4							2.6	2.4							2.3	2.3
BF Max Depth (ft)							2.9	2.9							4.4	4.4							3.7	3.6
BF Cross Sectional Area (ft^2)							23.7	24.0							71.8	64.3							38.9	38.9
Width/Depth Ratio							4.6	4.3							10.4	11.5							7.4	7.5
Entrenchment Ratio							14.4	14.7							5.5	5.5							8.9	8.8
Bank Height Ratio							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 9b. 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																																								

APPENDIX E

HYDROLOGY DATA

Table 10. Verification of Bankfull Events

Figure 3. Annual Climatic Data vs. 30-year Historic Data

Table 11. Years 1-5 Wetland Hydrology Criteria Attainment Summary

Table 10. Verification of Bankfull Events

McInytre Creek Restoration Site (DMS Project Number 243)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
September 23, 2010	July 12, 2010	Total of 2.14 inches* of rain reported to fall over 2 days (July 11-12, 2010), in addition to large wrack/debris piles and evidence of overbank flows within the adjacent floodplain.	1-2
September 23, 2010	August 19, 2010	Total of 1.1 inches* of rain reported to fall over 2 days (August 18-19, 2010) after a total of 4.43 inches* of rain the preceding 4 weeks, in addition to laid back vegetation and evidence of recent standing water within the floodplain.	3
October 18, 2010	September 29, 2010	Overbank event likely occurred after a total of 4.04 inches* of rain reported to fall over 6 days (September 25-30, 2010).	---
October 21, 2011	August 5, 2011	Overbank event likely occurred after a total of 2.50 inches* of rain reported to fall on August 5, 2011.	4
August 6, 2012	May 8, 2012	Overbank event likely occurred after a total of 2.77 inches* of rain reported to fall on May 8-9, 2012.	--
August 6, 2012	May 16, 2012	Overbank event likely occurred after a total of 2.71 inches* of rain reported to fall on May 13-16, 2012.	--
February 21, 2013	January 17, 2013	Debris, wrack, and laid back vegetation observed on the floodplain after a total of 2.38 inches* of rain reported to fall on January 17, 2013.	5-6
November 18, 2013	April 28, 2013	Overbank event likely occurred after a total of 2.73 inches* of rain reported to fall on April 27-29, 2013.	--
November 18, 2013	May 6, 2013	Overbank event likely occurred after a total of 2.13 inches* of rain reported to fall on May 5-6, 2013.	--
November 18, 2013	June 3, 2013	Overbank event likely occurred after a total of 2.52 inches* of rain reported to fall on June 2-3, 2013 with an additional 3.10 on June 4-13, 2013.	--
November 18, 2013	July 4, 2013	Overbank event likely occurred after a total of 4.23 inches* of rain reported to fall on July 4-11, 2013 with numerous small rain events (0.1-0.9 inches) in the proceeding and following days.	--
May 7, 2014	April 19, 2014	Wrack and laid back vegetation observed on the floodplain after a total of 2.80 inches* of rain reported to fall on April 18-19. 2014.	--
November 10, 2014	May 15, 2014	Overbank event likely occurred after a total of 2.11 inches* of rain reported to fall on May 15, 2014	--
November 3, 2014	August 1, 2014	Wrack and laid back vegetation observed on the floodplain after a total of 3.84 inches* of rain reported to fall July 31-August 1, 2014	--
March 29, 2016	April 19, 2015	Overbank event likely occurred after a total of 2.65 inches* of rain reported to fall on April 19, 2015 after 2.00 inches were reported during the previous week.	--

* Reported at KCLT Weather Station at the Charlotte Airport (Weatherunderground 2016).

Table 10. Verification of Bankfull Events (continued)

McInytre Creek Restoration Site (DMS Project Number 243)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
March 29, 2016	November 2, 2015	Overbank event likely occurred after a total of 2.60 inches* of rain reported to fall on November 2, 2015 after 2.00 inches were reported during the previous week.	--
March 29, 2016	December 30, 2015	Overbank event likely occurred after a total of 3.25 inches* of rain reported to fall over 2 days (December 29-30, 2015).	--
October 17, 2016	September 26, 2016	Overbank event likely occurred after a total of 3.89 inches* of rain reported to fall on September 26, 2016.	--
October 17, 2016	October 8, 2016	Sediment and laid-back vegetation observed after a total of 2.12 inches* of rain reported to fall on October 8, 2016.	7

* Reported at KCLT Weather Station at the Charlotte Airport (Weatherunderground 2016).

Photos 1-2: Evidence of overbank including flow within adjacent floodplain, laid back vegetation, and large debris/wrack piles.

Photo 3: Evidence of overbank including laid back vegetation and recent standing water within the floodplain.

Photo 4: Evidence of overbank including wrack within the floodplain.

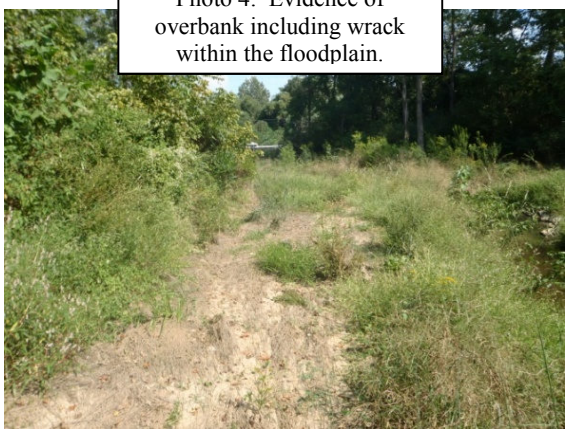


Photo 5: Evidence of overbank including wrack and laid back vegetation in the floodplain.

Photo 6: Evidence of overbank including wrack and laid back vegetation in the floodplain.

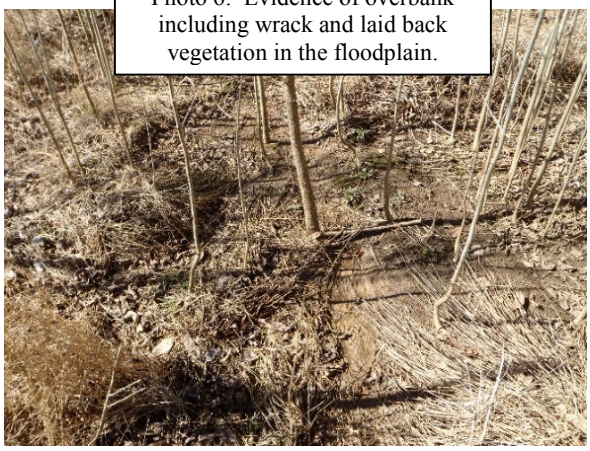
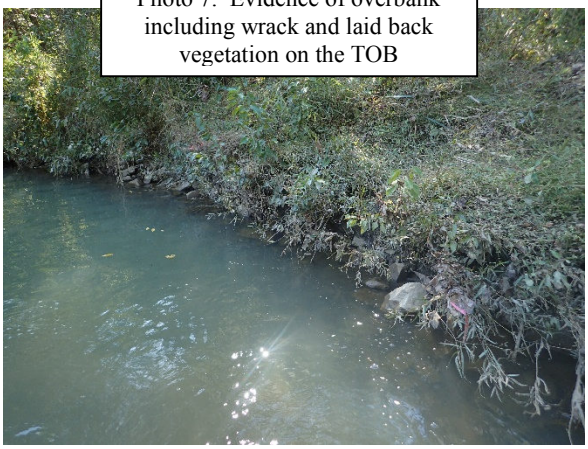


Photo 7: Evidence of overbank including wrack and laid back vegetation on the TOB



Month	30th %*	70th %*	2010**	2011**	2012**	2013**	2014**	2015**	2016**
Jan	2.79	4.76	4.88	1.36	2.29	4.28	2.9	2.80	2.28
Feb	2.27	4.28	3.79	3.44	1.30	3.46	4.01	3.02	4.5
Mar	2.84	5.28	4.37	4.52	3.89	3.44	4.48	2.19	0.85
Apr	1.85	3.57	1.44	3.32	1.67	4.56	7.39	6.14	2.03
May	2.34	4.41	3.37	4.73	5.92	3.00	4.05	0.32	5.63
June	2.02	4.16	2.89	3.10	1.02	7.31	2.85	2.73	2.67
July	2.38	4.58	2.48	3.53	3.98	7.46	4.38	1.21	1.55
Aug	2.29	4.51	4.75	5.18	3.11	1.80	3.74	3.84	1.88
Sept	2	4.68	4.18	5.55	4.82	3.06	3.99	2.75	5.44
Oct	1.77	4.52	1.13	3.04	1.21	0.48	1.35	5.57	2.78
Nov	2.3	4.01	1.38	3.34	0.65	3.63	3.79	9.56	0
Dec	2.09	3.81	1.74	3.41	3.84	7.14	2.57	8.70	0

*Charlotte Douglas International Airport 30-year historic data (NOAA 2004)

**Charlotte Douglas International Airport rainfall data (Weatherunderground 2016)

Figure 3. Annual Climatic Data vs. 30-year Historic Data

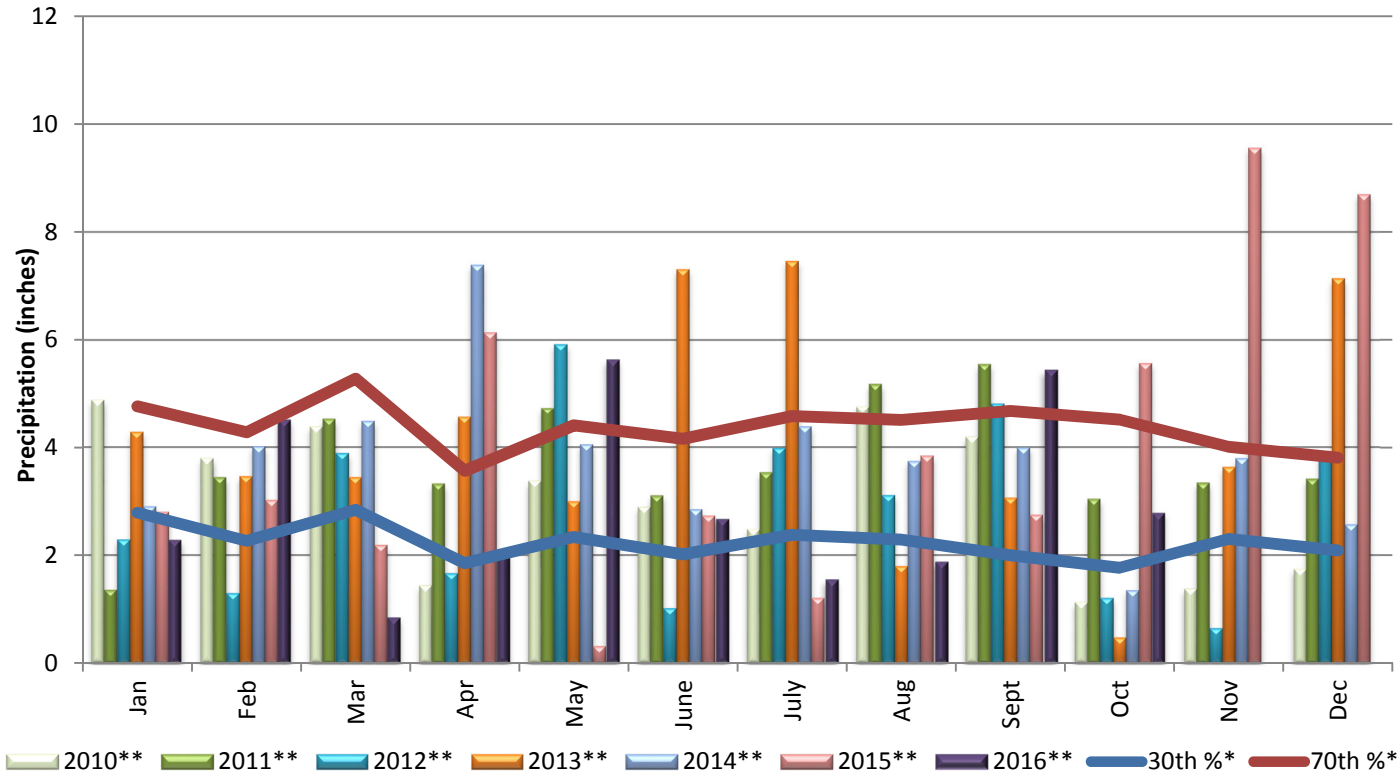


Table 11. Years 1-5 Wetland Hydrology Criteria Attainment Summary
McInytre Creek Restoration Site (DMS Project Number 243)

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2010)*	Year 2 (2011)*	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
1	--	No/7 day (3.0 %)	No/8 day (3.4 %)	Yes/23 day (10.0 %)	No/16 days (6.8%)
2	--	Yes/38 day (16.3 %)	Yes/23 day (10 %)	Yes/34 day (15.2 %)	Yes/72 Days (30.6%)
3	--	Yes/41 day (17.6 %)	No/22 day (9.4 %)	Yes/36 day (16.1 %)	Yes/63 Days (26.8%)

* Note that gauges were installed in 2011 and no data is available for baseline, or year 1 (2010) monitoring periods.