FINAL

ANNUAL MONITORING REPORT
YEAR 2 (2011)
MCINTYRE CREEK RESTORTION SITE
AT HORNETS NEST PARK
MECKLENBURG COUNTY, NORTH CAROLINA
(EEP Project No. 243)

Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
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Axiom Environmental, Inc.

Ecosystem Enhancement PROGRAM

December 2011

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Appendices

1.0 EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (NCEEP) 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 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 within a NCEEP 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. Greater than 50-55 percent of the contributing watershed had been cleared and developed.

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 that is listed as impaired for elevated levels of copper and turbidity (NCDWQ 2010).

Project construction was completed between March 2007-May 2008 and remediation construction to repair structures, stabilize banks, provide grade control, and dissipate stormwater energy was completed between August 2009-January 2010. 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 with 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 will be 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 measurement should indicate stable bedform 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.

Several areas of bank erosion are located throughout the project as the result of high stream flows, vertical banks, urbanized watershed, flashy flows, and tight radius of curvatures. These areas are depicted on Figures 2 and 2A-2B (Appendix B) and should continue to be monitored closely. Currently, the stream channel is considered to be within an acceptable range of variation compared to the as-built construction channel. However, due to the extensive impervious surfaces located within the upstream watershed the Site has periods of flashy flood flows even during smaller rain events. Flashy flood flows, compiled with minor bank instability has resulted in some degradation of the channel including eroding outer bends and slumping banks with loss of planted vegetation and reduced integrity of several structures. The loss of planted stems due to sloughing banks will most likely make the banks, particularly outer bends, more vulnerable to erosive flows and continued bank loss. Degradation is anticipated to continue to occur due to the characteristics of the watershed.

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 2 (2011) monitoring season for a total of four bankfull events.

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 534 stems per acre surviving in year 2 (2011). The dominant species identified at the Site were planted stems of river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), cherrybark oak (*Quercus pagoda*), and willow oak (*Quercus phellos*). Five of the ten individual plots met success criteria based on planted stems alone. Plots 2, 4, and 7 were below success criteria based on planted stems alone; however, when including naturally recruited stems of appropriate species such as box elder (*Acer negundo*), river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), and gum (*Nyssa* sp.) these plots were well-above 320 stems per acre.

Vegetation problem areas within the Site include a large patch of multiflora rose (*Rosa multiflora*) and Chinese privet (Ligustrum sinense) north of the stream near cross-section 3, a large of kudzu (*Pueraria lobata*) north of the stream near cross-section 2, and scattered smaller patches of multiflora rose, Chinese privet, and kudzu (depicted on Figures 2A-2B, Appendix B).

Three groundwater gauges were installed within the Site within wetland areas created as the result of stream restoration activities. Success criteria for wetland groundwater hydrology at the Site require inundation or saturation within 12 inches of the ground surface for a consecutive period of 10 percent of

the growing season or greater than 23 consecutive days (the growing season in Mecklenburg County begins March 22 and ends November 11 [233 days]). Gauges 2 and 3 were inundated greater than 12.5 percent of the growing season and are considered successful in year 2 (2011).

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 EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP 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 in September for the year 1 (2010) monitoring season using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); 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 and will be used to evaluate stream dimension; locations are depicted on Figure 2 (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 and pebble counts will be conducted at each permanent cross-section location annually.

Three approximately 1000-linear foot monitoring reaches were established and will be used to evaluated stream pattern and longitudinal profile; locations are depicted on Figure 2 (Appendix B). Measurement of channel pattern will include belt-width, meander length, and radius of curvature (only in year one). Subsequently, data will be used to calculated meander-width ratios. Longitudinal profile measurements will include average water surface slopes and facet slopes and pool-to-pool spacing. Ten permanent photo points were established throughout the restoration reach; locations are depicted on Figure 2 (Appendix B) and 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 within wetlands created by stream restoration activities in February 2011 and have been maintained and monitored throughout growing season. Graphs of 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. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0. (online). Available: http://cvs.bio.unc.edu/methods.htm.

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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.

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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.

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APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

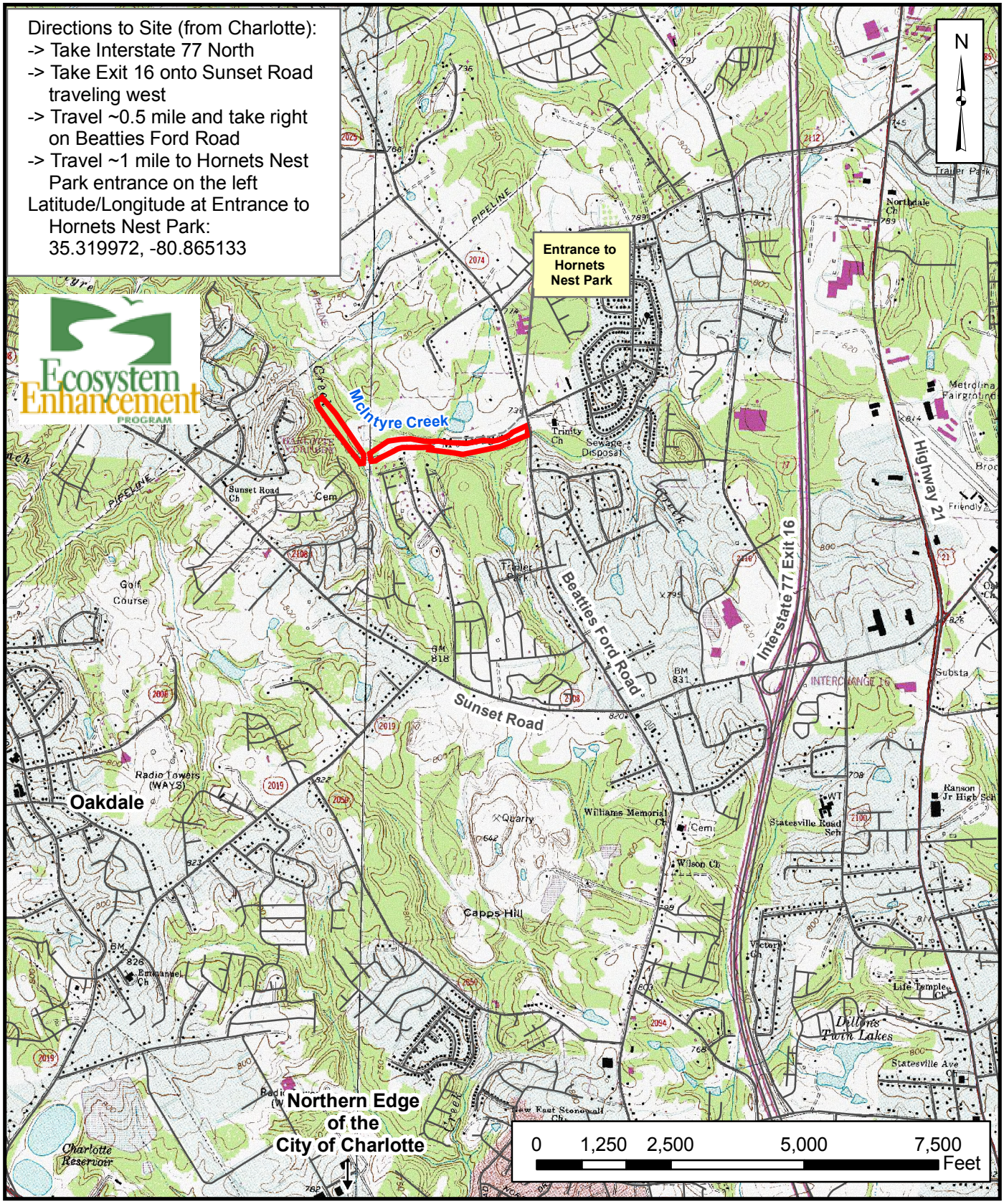
Figure 1. Vicinity Map

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



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

Dwn. by.	FIGURE
CLF	1
Date: Nov 2010	
Project: 10-009	

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

Mitigation Credits							
	Stream		Riparian Wetland		Buffer		
Type	Restoration	Restoration Equivalent	Restoration	Restoration Equivalent			
Totals	5129*	--	--	To be Determined**			156,816
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	To Be Determined**	3:1	--

Component Summation			
Restoration Level	Stream (linear footage)	Riparian Wetland (acres)	Buffer (square footage)
Restoration	5178	--	156,816
Creation	--	To Be Determined**	--
Totals	**5178**		156,816
Mitigation Units	**5129 SMUs***		**156,816 BMUs**

*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.
**The wetland creation boundary will be determined after gathering gauge data for at least two years.

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

Elapsed Time Since Grading Complete: 2 years
Elapsed Time Since Planting Complete: 3.5 year
Number of Reporting Years: 2

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

Table 3. Project Contacts Table
McIntyre Creek Restoration Site at Hornets Nest Park (EEP 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 (EEP 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

Legend

- Conservation Easement
- Cross-sections
- Monitoring Reaches
- Stream Fixed-Station Photo Points
- Groundwater Gauges
- Crest Gauge
- Structures
- Streams

Vegetation Plots

- Met Success Criteria Based on Planted Stems
- Did Not Meet Success Criteria Based on Planted Stems Alone

***Based on planted stems alone, these plots don't meet success criteria; however, when including naturally recruited stems of appropriate species such as box elder (Acer negundo), river birch (Betula nigra), green ash (Fraxinus pennsylvanica), and gum (Nyssa sp.) these plots were well-above 320 stems per acre.**

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

Figure 2A

Figure 2B

2009 Mecklenburg County Aerial Photography

0 245 490 980 1,470 1,960 Feet

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Prepared for:

Ecosystem Enhancement Program

Project:

MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK

Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF

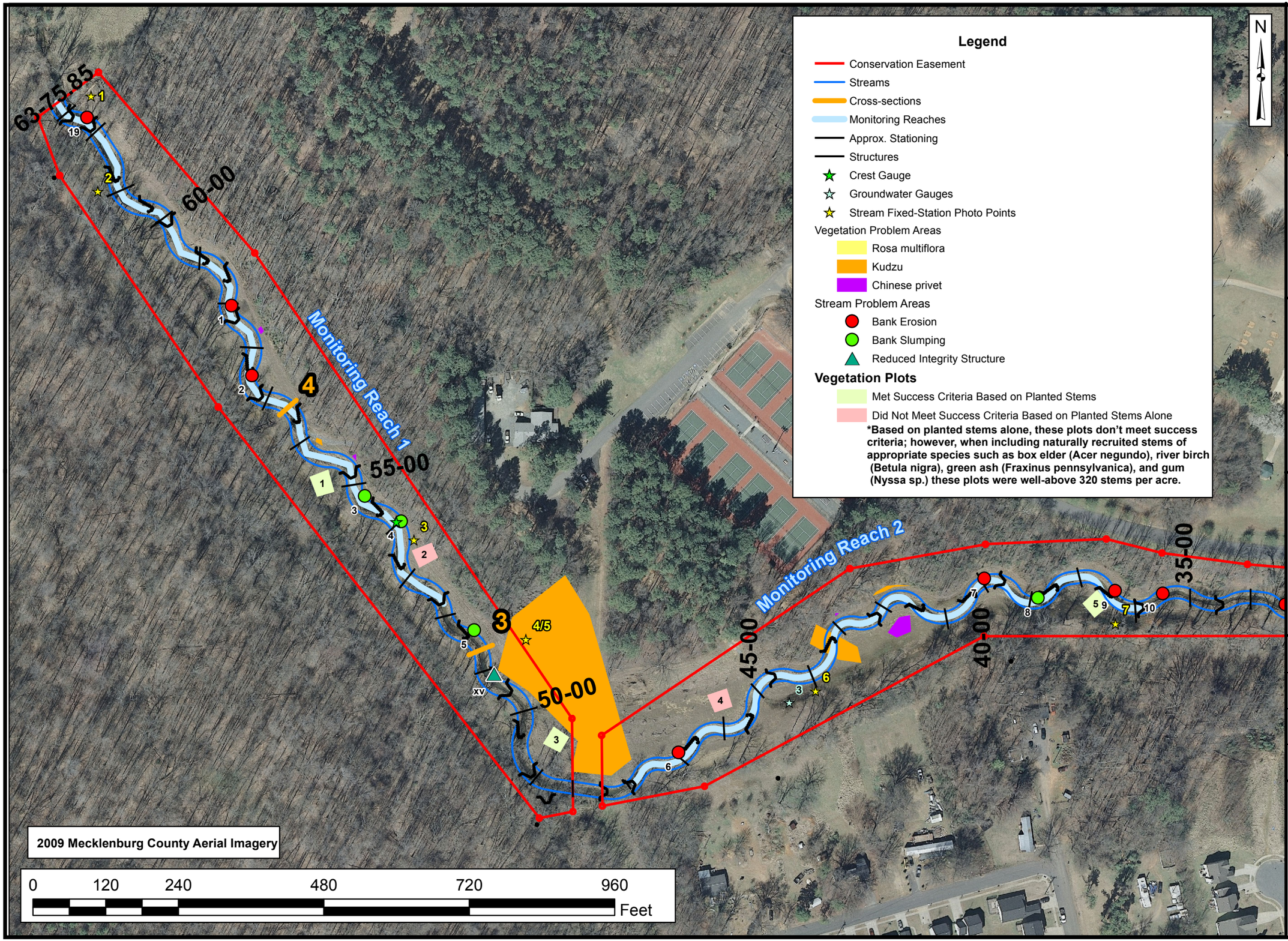
Date: DEC 2011

Scale: 1:3600

Project No.: 10-009

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

Ecosystem Enhancement Program

Project:

MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK

Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by:	CLF
Date:	DEC 2011
Scale:	1:1800
Project No.:	10-009

FIGURE

2A

Legend

- Conservation Easement
- Streams
- Cross-sections
- Monitoring Reaches
- Approx. Stationing
- Structures
- Crest Gauge
- Groundwater Gauges
- Stream Fixed-Station Photo Points

Vegetation Problem Areas

- Rosa multiflora
- Kudzu
- Chinese privet

Stream Problem Areas

- Bank Erosion
- Bank Slumping
- Reduced Integrity Structure

Vegetation Plots

- Met Success Criteria Based on Planted Stems
- Did Not Meet Success Criteria Based on Planted Stems Alone

***Based on planted stems alone, these plots don't meet success criteria; however, when including naturally recruited stems of appropriate species such as box elder (Acer negundo), river birch (Betula nigra), green ash (Fraxinus pennsylvanica), and gum (Nyssa sp.) these plots were well-above 320 stems per acre.**

N

1

2

Monitoring Reach 3

2009 Mecklenburg County Aerial Imagery

0 112.5 225 450 675 900 Feet

Axiom Environmental, Inc.

Prepared for:

Ecosystem Enhancement Program

Project:

MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK

Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF

Date: DEC 2011

Scale: 1:1800

Project No.: 10-009

FIGURE

2B

Table 5A. Visual Stream Morphology Stability Assessment
McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)
Reach ID Reach 1
Assessed Length 1000

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)			8	155	85%			
		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			2	25	99%	2	15	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.			2	40	98%	1	5	98%
	3. Mass Wasting	Bank slumping, calving, or collapse			6	155	92%	3	27	94%
				Totals	10	220	89%	6	47	91%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	5	7			71%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	7			71%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	7			71%			
	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)	5	7			71%			
	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 (EEP Project Number 243)
Reach ID Reach 2
Assessed Length 1000

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			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.			5	80	96%	2	10	97%
	3. Mass Wasting	Bank slumping, calving, or collapse			6	155	92%	3	40	94%
				Totals	11	235	88%	5	50	91%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	6	8			75%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	8			75%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	8			75%			
	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)	6	8			75%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

Table 5C. Visual Stream Morphology Stability Assessment

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

Reach ID Reach 3

Assessed Length 1000

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	30	99%	0	0	99%
	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.			5	65	97%	1	10	97%
	3. Mass Wasting	Bank slumping, calving, or collapse			6	85	96%	2	15	97%
				Totals	14	180	91%	3	25	92%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	3	6			50%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	6			50%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	6			50%			
	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)	3	6			50%			
	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 (EEP Project 243)

Planted Acreage[1] **17**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very small area of limited cover of both woody and herbaceous material near vegetation plot 2.	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]	Areas of thick multiflora rose (*Multiflora rose*), kudzu (*Pueraria lobata*), and scattered Chinese privet (Ligustrum sinense).	1000 SF	Pattern and Color	6	1.00	5.9%
5. Easement Encroachment Areas[3]	NA	NA	NA	0	0.00	0.0%

McIntyre Creek
Stream Fixed-Station Photographs
Taken June 2011

McIntyre Creek
Stream Fixed-Station Photographs
Taken June 2011
(continued)

McIntyre Creek
Vegetation Monitoring Photographs
Taken June 2011

McIntyre Creek
Vegetation Monitoring Photographs
Taken June 2011
(continued)

APPENDIX C

VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9. Total and Planted Stems by Plot and Species

Table 7. Vegetation Plot Criteria Attainment
McIntyre Creek Restoration Site (EEP Project Number 234)

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	70%
2	No*	
3	Yes	
4	No*	
5	Yes	
6	Yes	
7	No*	
8	Yes	
9	Yes	
10	Yes	

*Based on planted stems alone, these plots don't meet success criteria; however, when including naturally recruited stems of appropriate species such as box elder (Acer negundo), river birch (Betula nigra), green ash (Fraxinus pennsylvanica), and gum (Nyssa sp.) these plots were well-above 320 stems per acre.

Table 8. CVS Vegetation Plot Metadata
McIntyre Creek Restoration Site (EEP Project Number 234)

Report Prepared By	Corri Faquin
Date Prepared	6/14/2011 12:31
database name	Axiom-EEP-2011-B.mdb
database location	C:\Axiom\Business\CVS
computer name	CORRI-PC
file size	29462528
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
ALL Stems by Plot and spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	243
project Name	McIntyre Creek @ Hornets Nest Park
Description	stream restoration
River Basin	Catawba
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	10

Table 9. Total and Planted Stems by Plot and Species
EEP Project Code 243. Project Name: McIntyre Creek @ Hornets Nest Park

			Current Plot Data (MY2 2011)																											Annual Means								
			243-AXE-0001			243-AXE-0002			243-AXE-0003			243-AXE-0004			243-AXE-0005			243-AXE-0006			243-AXE-0007			243-AXE-0008			243-AXE-0009			243-AXE-0010			MY2 (2011)			MY1 (2010)			MY0 (2010)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree			12			8	3	3	15						16			11			54			13			9			18	3	3	156	3	3	58	3	3	127
Acer rubrum	red maple	Tree			2												1			1			12											16						50
Alnus serrulata	hazel alder	Shrub Tree													2	2	2	2	2	2	1	1	1	2	2	2							7	7	7	6	6	9	6	6	7
Asimina triloba	pawpaw	Shrub Tree	1	1	1																												1	1	1	1	1	1	1	1	18
Baccharis halimifolia	eastern baccharis	Shrub Tree												5						5			1			2									13			8			22
Betula nigra	river birch	Tree	1	1	1	1	1	1	1	1	1				2	2	2	16	16	36	4	4	4	4	4	4	2	2	2	4	4	4	35	35	55	13	13	29	14	14	67
Carya	hickory	Tree																												1	1	1	1	1	1	1	1	1	1	1	1
Catalpa bignonioides	southern catalpa	Tree																																							2
Cornus amomum	silky dogwood	Shrub				1	1	1	1	1	1				3	3	3	2	2	2	1	1	1	1	1	1	1	1	1				10	10	10	9	9	9	9	9	9
Cornus florida	flowering dogwood	Shrub Tree																																							2
Diospyros virginiana	common persimmon	Tree																																							5
Euonymus alatus																																								1	1	1
Fraxinus pennsylvanica	green ash	Tree	2	2	16	3	3	22	8	8	16			93			119	3	3	17			122			70	5	5	9	6	6	29	27	27	513	27	27	278	25	25	1513
Juglans nigra	black walnut	Tree															1																	1						3
Juniperus virginiana	eastern redcedar	Tree									1																							1						3
Lindera benzoin	northern spicebush	Shrub Tree	2	2	2																												2	2	2	2	2	2	2	2	2
Liquidambar styraciflua	sweetgum	Tree			11			5			4			9						3			4			1						20			57			43			82
Liriodendron tulipifera	tuliptree	Tree	2	2	2													6	6	9						3				1	1	2	9	9	16	9	9	19	9	9	25
Morella	bayberry	Shrub Tree																																				1			
Morella cerifera	wax myrtle	Shrub Tree																																							2
Morus rubra	red mulberry	Tree																																							5
Nyssa	tupelo	Tree																																							3
Pinus taeda	loblolly pine	Tree												6						17			11			20									54			40			76
Platanus occidentalis	American sycamore	Tree			6	1	1	1																									1	1	7	1	1	6	1	1	8
Populus deltoides	eastern cottonwood	Tree			2									4			1			7			9			3									26						35
Populus heterophylla	swamp cottonwood	Tree																																							4
Prunus serotina	black cherry	Shrub Tree			1															3															4						4
Quercus	oak	Shrub Tree										1	1	1																			1	1	1	1	1	1	1	1	1
Quercus lyrata	overcup oak	Tree							1	1	1																						1	1	1	1	1	1			
Quercus michauxii	swamp chestnut oak	Tree																			1	1	1										1	1	1	1	1	1	1	1	1
Quercus pagoda	cherrybark oak	Tree	4	4	4				2	2	2	1	1	1	2	2	2	1	1	1				3	3	3	1	1	1	1	1	1	15	15	15	13	13	13	14	14	14
Quercus phellos	willow oak	Tree	3	3	3				2	2	2	3	3	3	1	1	1																9	9	9	10	10	10	10	10	10
Quercus rubra	northern red oak	Tree																												1	1	1	1	1	1	1	1	1	1	1	1
Salix	willow	Shrub Tree																																							1
Salix nigra	black willow	Tree																		1															1						
Ulmus	elm	Tree	4	4	4	1	1	1												1													5	5	6	4	4	4	5	5	9
Ulmus alata	winged elm	Tree							3	3	3																						3	3	3	3	3	3			2
		Stem count	19	19	67	7	7	39	21	21	46	5	5	122	10	10	148	30	30	116	7	7	220	10	10	122	9	9	22	14	14	76	132	132	978	106	106	538	104	104	2115
		size (ares)	1			1			1			1			1			1			1			1			1			1			10			10			10		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.25			0.25			0.25		
		Species count	8	8	14	5	5	7	8	8	10	3	3	8	5	5	10	6	6	15	4	4	11	4	4	11	4	4	5	6	6	8	18	18	27	18	18	22	17	17	34
		Stems per ACRE	768.9	768.9	2711	283.3	283.3	1578	849.8	849.8	1862	202.3	202.3	4937	404.7	404.7	5989	1214	1214	4694	283.3	283.3	8903	404.7	404.7	4937	364.2	364.2	890.3	566.6	566.6	3076	534.2	534.2	3958	429	429	2177	420.9	420.9	8559

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

PnoLS = Planted exclusing livestakes
P-all = All planted stems including livestakes
T = All planted and natural recruit stems including livestakes
Total includes natural recruit stems

APPENDIX D

STREAM SURVEY DATA

Cross-section Plots

Longitudinal Profile Plots

Substrate Plots

Tables 10a-b. Baseline Stream Data Summary

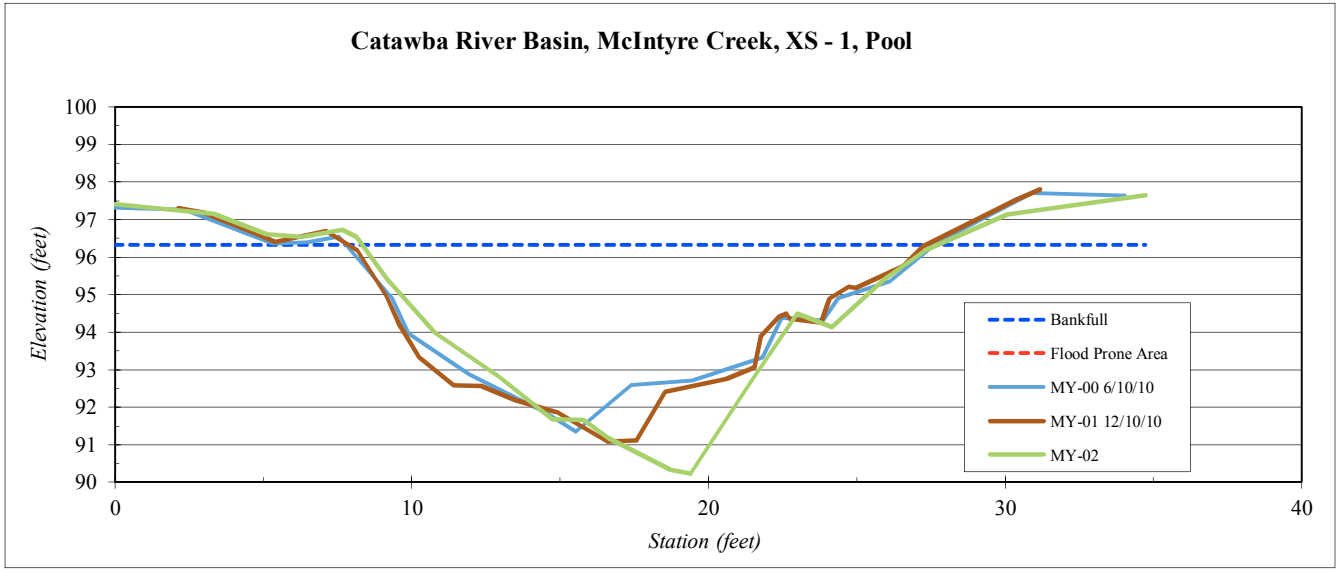
Tables 11a-b. Monitoring Data

River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 1, Pool
Feature	Pool
Date:	10/28/2011
Field Crew:	Thomas, Perkinson

Station	Elevation
0.0	97.41
3.3	97.15
5.1	96.61
6.3	96.55
7.7	96.73
8.1	96.54
9.2	95.42
10.8	94.00
13.0	92.81
14.7	91.67
15.8	91.66
16.6	91.18
18.7	90.33
19.4	90.24
21.5	92.71
23.0	94.49
24.2	94.13
25.9	95.40
27.3	96.20
30.1	97.13
34.7	97.6

SUMMARY DATA	
Bankfull Elevation:	96.3
Bankfull Cross-Sectional Area:	61.3
Bankfull Width:	19.4
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	6.1
Mean Depth at Bankfull:	3.2
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	E

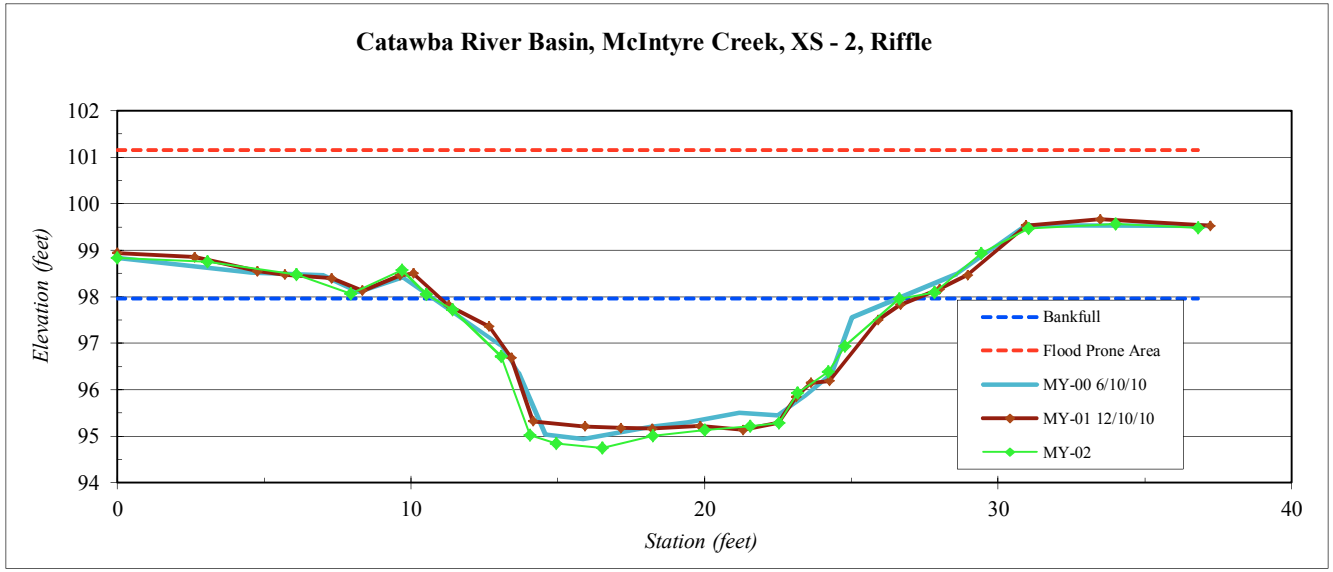


River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 2, Riffle
Feature	Riffle
Date:	10/28/2011
Field Crew:	Thomas, Perkinson

Station	Elevation
0.00	98.84
3.06	98.75
6.09	98.48
7.96	98.06
9.70	98.58
10.53	98.05
11.41	97.73
13.06	96.71
14.06	95.02
14.94	94.84
16.52	94.75
18.24	95.01
20.00	95.14
21.56	95.22
22.53	95.28
23.2	95.94
24.2	96.39
24.8	96.94
26.6	97.96
27.8	98.09
29.4	98.93
31.0	99.47
34.0	99.57
36.8	99.48

SUMMARY DATA	
Bankfull Elevation:	98.0
Bankfull Cross-Sectional Area:	33.5
Bankfull Width:	15.9
Flood Prone Area Elevation:	101.2
Flood Prone Width:	150.0
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	2.1
W / D Ratio:	7.5
Entrenchment Ratio:	9.4
Bank Height Ratio:	1.0

Stream Type	E

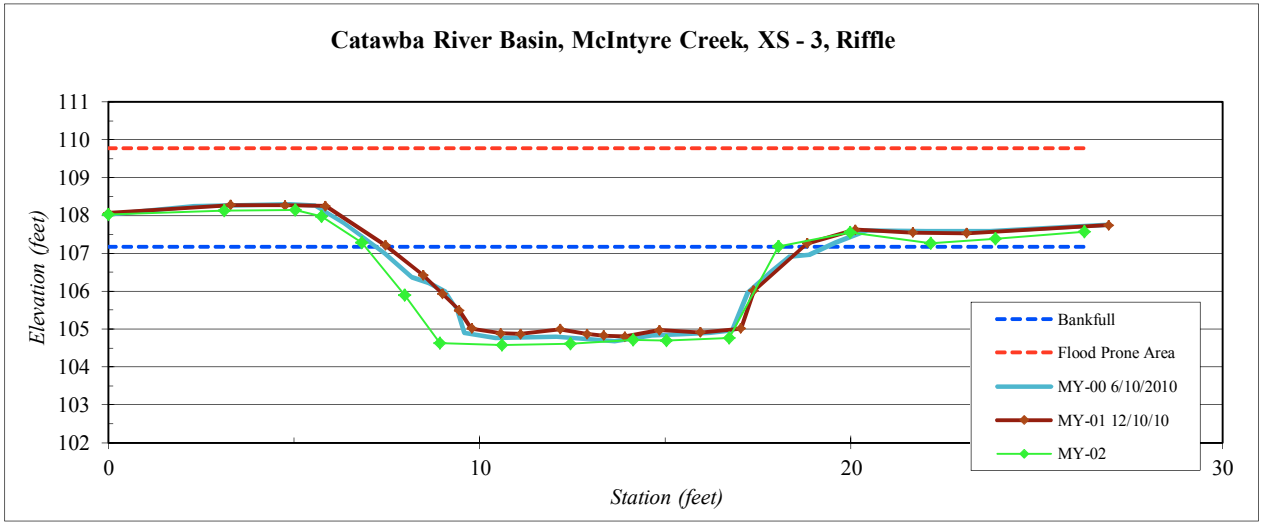


River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 3, Riffle
Feature	Riffle
Date:	10/28/2011
Field Crew:	Thomas, Perkinson

Station	Elevation
0.00	108.03
3.12	108.12
5.03	108.15
5.74	107.97
6.83	107.28
7.98	105.90
8.93	104.63
10.59	104.59
12.44	104.61
14.13	104.72
15.03	104.69
16.72	104.77
18.04	107.18
19.97	107.55
22.1	107.27
23.9	107.38
26.3	107.6

SUMMARY DATA	
Bankfull Elevation:	107.2
Bankfull Cross-Sectional Area:	23.8
Bankfull Width:	11.1
Flood Prone Area Elevation:	109.8
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	2.1
W / D Ratio:	5.2
Entrenchment Ratio:	13.5
Bank Height Ratio:	1.0

Stream Type	E

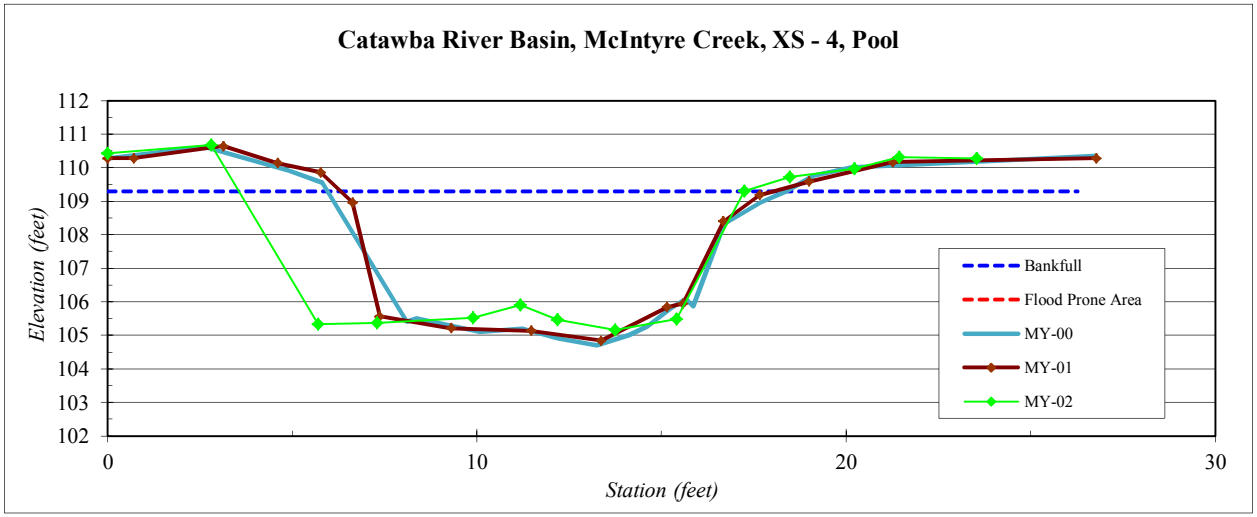


River Basin:	Catawba
Watershed:	McIntyre Creek
XS ID	XS - 4, Pool
Feature	Pool
Date:	10/28/2011
Field Crew:	Thomas, Perkinson

Station	Elevation
0.0	110.4
2.8	110.7
5.7	105.3
7.3	105.4
9.9	105.5
11.2	105.9
12.2	105.5
13.7	105.2
15.4	105.5
17.2	109.3
18.5	109.7
20.2	110.0
21.4	110.3
23.5	110.3
26.3	110.34

SUMMARY DATA	
Bankfull Elevation:	109.3
Bankfull Cross-Sectional Area:	45.2
Bankfull Width:	13.7
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	4.1
Mean Depth at Bankfull:	3.3
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

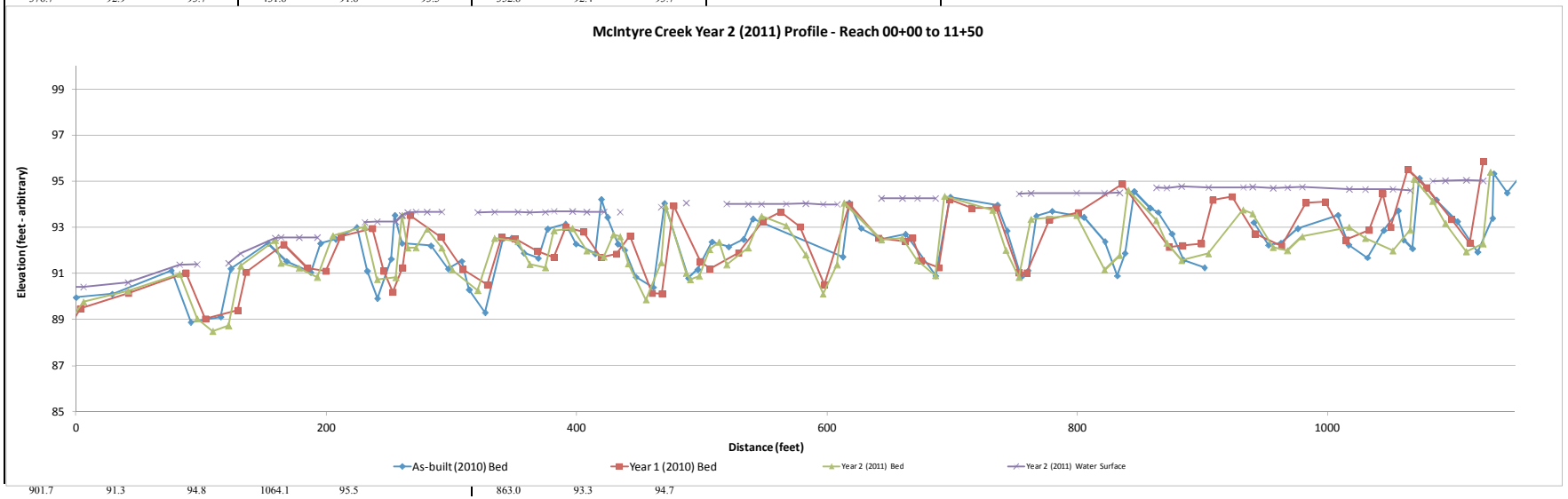
Stream Type	C/E



Project Name	McIntyre Creek - Year 2 (2011) Profile
Reach	Reach 1 (00+00 - 11+50)
Feature	Profile
Date	10/28/11
Crew	Thomas, Perkinson

2010 As-built Survey			2010 Year 1 Monitoring \Survey			2011 Year 2 Monitoring \Survey			2012 Year 3 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	90.0	90.4	-13.1	88.0	90.6	-23.8	88.0	90.4			
28.8	90.1	90.4	3.4	89.5	90.6	-17.1	88.0	90.4			
76.2	91.1	91.4	41.8	90.1	90.6	5.8	89.8	90.4			
91.6	88.9	91.3	87.6	91.0	91.4	41.5	90.2	90.6			
115.6	89.1	91.5	103.3	89.0	91.4	82.6	91.0	91.4			
123.7	91.2	91.6	129.2	89.4	91.4	96.7	89.0	91.4			
153.3	92.3	92.5	135.8	91.1	91.6	109.1	88.5				
168.2	91.5	92.6	165.9	92.3	92.5	121.6	88.7				
187.5	91.1	92.6	184.9	91.2	92.5	121.7	88.7	91.5			
195.2	92.3	92.7	199.3	91.1	92.5	131.5	91.3	91.9			
207.4	92.5	92.9	211.6	92.6	92.8	159.1	92.4	92.5			
224.3	93.0	93.3	236.6	93.0	93.2	163.6	91.5	92.6			
232.6	91.1	93.3	245.6	91.1	93.2	178.1	91.2	92.6			
240.7	89.9	93.4	253.0	90.2	93.1	192.7	90.8	92.6			
251.7	91.6	93.3	260.6	91.2	93.2	205.0	92.6				
254.7	93.5	93.7	266.9	93.5	93.6	230.6	93.0	93.2			
260.4	92.3	93.4	291.4	92.6	93.6	240.6	90.7	93.2			
283.4	92.2	93.6	308.8	91.2	93.6	255.5	90.8	93.2			
297.3	91.2	93.4	328.6	90.5	93.6	260.4	93.5	93.5			
308.1	91.5	93.5	340.0	92.6	93.6	265.0	92.1	93.6			
314.1	90.3		350.9	92.5	93.6	271.5	92.1	93.7			
326.8	89.3	93.6	368.3	92.0	93.6	280.4	92.9	93.7			
341.2	92.5	93.7	381.8	91.7	93.6	292.1	92.1	93.7			
347.8	92.5	93.7	391.3	93.0	93.6	300.6	91.2				
357.9	91.9	93.8	405.4	92.8	93.6	320.9	90.3	93.7			
369.2	91.7	93.7	419.6	91.7	93.6	334.3	92.5	93.7			
376.7	92.9	93.7	431.8	91.8	93.5	352.8	92.4	93.7			
901.7	91.3	94.8	1064.1	95.5		863.0	93.3	94.7			

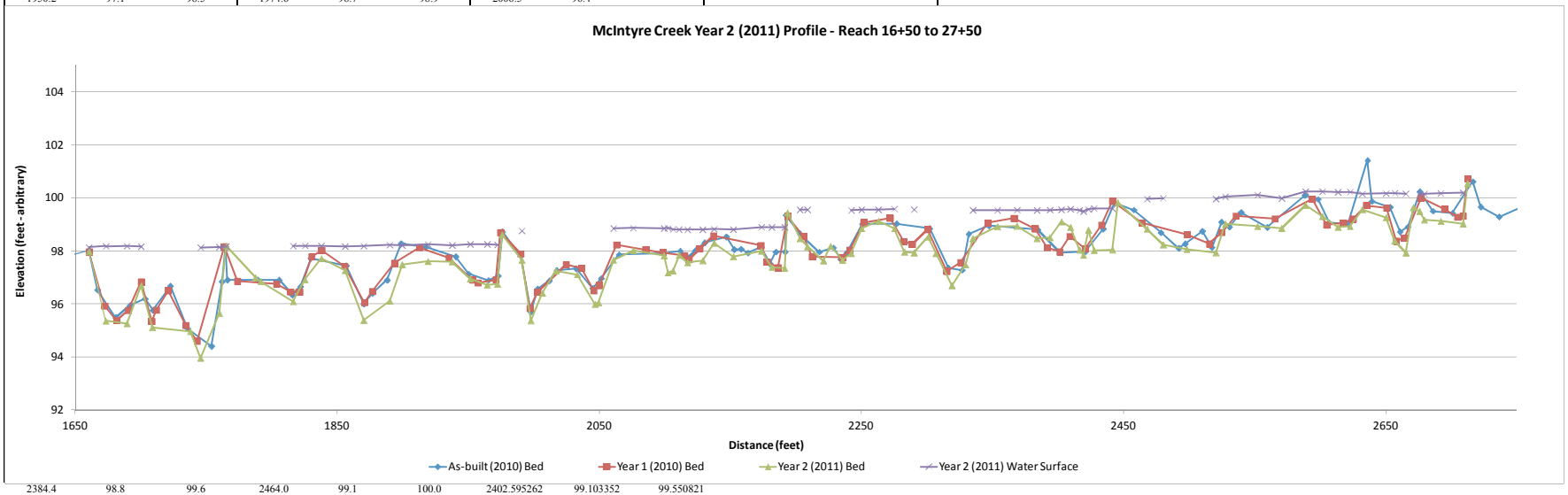
	As-built	2010	2011	2012
Avg. Water Surface Slope	0.0035	0.0042	0.0041	
Riffle Length	32	26	27	
Avg. Riffle Slope	0.0042	0.0047	0.0023	
Pool Length	16	19	20	
Avg. Pool Slope	76	76	0.0023	



Project Name	McIntyre Creek - Year 2 (2011) Profile
Reach	Reach 2 (16+50 - 27+50)
Feature	Profile
Date	10/28/11
Crew	Thomas, Perkinson

2010 As-built Survey			2010 Year 1 Monitoring \Survey			2011 Year 2 Monitoring \Survey			2012 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
1639.0	97.7	97.8	1660.7	98.0	98.2	1660.7	98.0	98.1			
1660.7	98.0	98.2	1672.6	95.9	98.2	1673.5	95.4	98.2			
1667.1	96.5	98.2	1681.9	95.4	98.2	1689.6	95.3	98.2			
1680.9	95.5		1690.5	95.8	98.2	1700.4	96.7	98.2			
1681.2	95.5	98.2	1700.6	96.8	98.2	1708.9	95.1				
1691.8	95.9	98.3	1708.4	95.3	98.2	1737.9	95.0				
1703.4	96.2	98.3	1712.0	95.8	98.1	1745.7	94.0	98.1			
1709.4	95.8	98.3	1720.9	96.5	98.2	1760.1	95.6	98.1			
1722.7	96.7	98.2	1734.4	95.2	98.2	1765.4	98.2	98.2			
1735.8	95.1	98.2	1743.2	94.6	98.2	1787.6	97.0				
1754.1	94.4	98.3	1763.9	98.2	98.3	1791.8	96.9				
1762.1	96.8	98.3	1773.9	96.9	98.2	1816.4	96.1	98.2			
1764.9	98.2	98.3	1803.7	96.8	98.2	1825.5	96.9	98.2			
1766.3	96.9	98.3	1814.3	96.5	98.2	1837.9	97.7	98.2			
1789.2	96.9	98.3	1821.3	96.5	98.2	1856.1	97.3	98.2			
1805.7	96.9	98.3	1830.5	97.8	98.3	1870.2	95.4	98.2			
1815.7	96.3	98.3	1838.1	98.0	98.2	1890.0	96.1	98.2			
1822.0	96.7	98.3	1855.6	97.4	98.2	1899.6	97.5	98.2			
1829.8	97.7	98.3	1870.8	96.1	98.3	1919.2	97.6	98.2			
1856.8	97.4	98.3	1876.9	96.5	98.3	1937.6	97.6	98.2			
1870.4	96.0	98.3	1893.7	97.5	98.3	1951.4	96.9	98.3			
1876.9	96.4	98.3	1912.5	98.1	98.3	1964.5	96.7	98.3			
1888.1	96.9	98.3	1935.1	97.7	98.4	1972.2	96.8	98.2			
1898.7	98.3	98.4	1953.4	96.9	98.4	1975.9	98.6				
1917.7	98.2	98.4	1957.4	96.8	98.4	1990.9	97.7	98.8			
1940.5	97.8	98.4	1971.0	96.9	98.4	1997.7	95.4				
1950.2	97.1	98.5	1974.6	98.7	98.9	2006.5	96.4				
2384.4	98.8	99.6	2464.0	99.1	100.0	2402.595262	99.103352	99.550821			

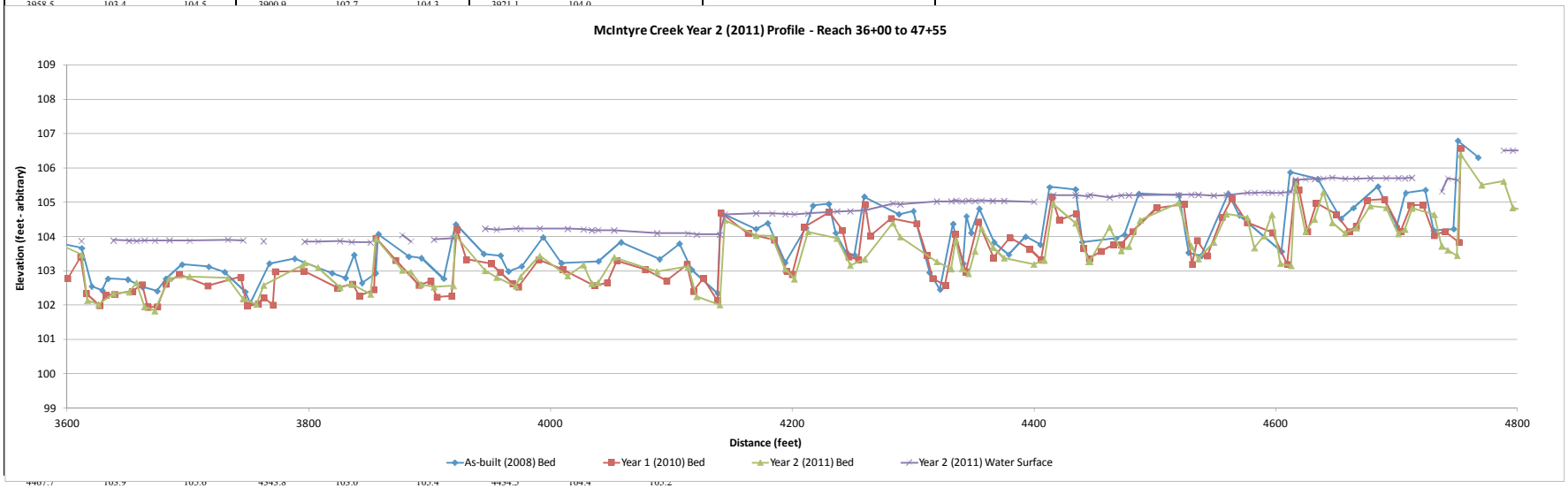
	As-built	2010	2011	2012
Avg. Water Surface Slope	0.0035	0.0022	0.0020	
Riffle Length	32	30	25	
Avg. Riffle Slope	0.0042	0.0010	0.0010	
Pool Length	16	15	10	
Avg. Pool Slope	76	76	0.0000	



Project Name	McIntyre Creek - Year 2 (2011) Profile
Reach	Reach 3 (36+00 - 47+55)
Feature	Profile
Date	10/28/11
Crew	Thomas, Perkinson

2010 As-built Survey			2010 Year 1 Monitoring \Survey			2011 Year 2 Monitoring \Survey			2012 Year 3 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
3595.8	103.8		3600.4	102.8	103.8	3594.1	103.8				
3612.0	103.7	104.0	3611.1	103.4	104.1	3611.8	103.5	103.9			
3620.2	102.5	103.9	3615.7	102.3	104.1	3616.8	102.1				
3629.0	102.4	103.9	3626.9	102.0	104.1	3625.8	102.0				
3633.6	102.8	103.9	3632.0	102.3	104.1	3638.2	102.3	103.9			
3650.1	102.7	103.9	3639.3	102.3	104.1	3651.1	102.4	103.9			
3662.4	102.5	104.0	3654.0	102.4	104.1	3657.4	102.7	103.9			
3674.4	102.4	104.0	3662.0	102.6	104.1	3663.9	102.0	103.9			
3681.7	102.8	104.0	3666.8	101.9	104.1	3672.5	101.8	103.9			
3695.1	103.2	104.0	3674.6	102.0	104.1	3684.6	102.8	103.9			
3717.0	103.1	104.0	3681.6	102.6	104.2	3701.3	102.8	103.9			
3730.2	103.0	103.9	3692.8	102.9	104.2	3733.0	102.8	103.9			
3747.3	102.4	103.9	3716.4	102.6	104.2	3745.5	102.2	103.9			
3751.6	102.1	104.0	3743.5	102.8	104.2	3756.5	102.0				
3767.3	103.2	103.9	3749.0	102.0	104.2	3762.5	102.6	103.9			
3788.1	103.4	103.9	3757.9	102.0	104.2	3794.4	103.2				
3819.3	102.9	104.0	3762.6	102.2	104.2	3796.5	103.2	103.9			
3830.3	102.8	104.0	3770.2	102.0	104.2	3807.6	103.1	103.9			
3837.4	103.5	103.9	3772.2	103.0	104.2	3825.6	102.5	103.9			
3844.1	102.6	104.0	3795.8	103.0	104.2	3835.2	102.6	103.8			
3855.3	102.9	103.9	3823.8	102.5	104.1	3851.0	102.3	103.8			
3857.4	104.1		3836.0	102.6	104.2	3855.4	103.9				
3882.6	103.4	104.2	3841.7	102.3	104.2	3877.3	103.0	104.0			
3893.1	103.4	104.2	3853.8	102.4	104.2	3884.3	103.0	103.9			
3911.6	102.8	104.1	3855.4	104.0	104.2	3892.8	102.6				
3921.5	104.4	104.4	3871.7	103.3	104.4	3903.4	102.5	103.9			
3944.6	103.5	104.4	3890.9	102.6	104.3	3919.5	102.6	104.0			

	As-built	**2010**	**2011**	**2012**
Avg. Water Surface Slope	0.0035	0.0020	0.0025	
Riffle Length	32	35	28	
Avg. Riffle Slope	0.0042	0.0027	0.0003	
Pool Length	16	12	16	
Pool to Pool Spacing	76	76	0.0005	

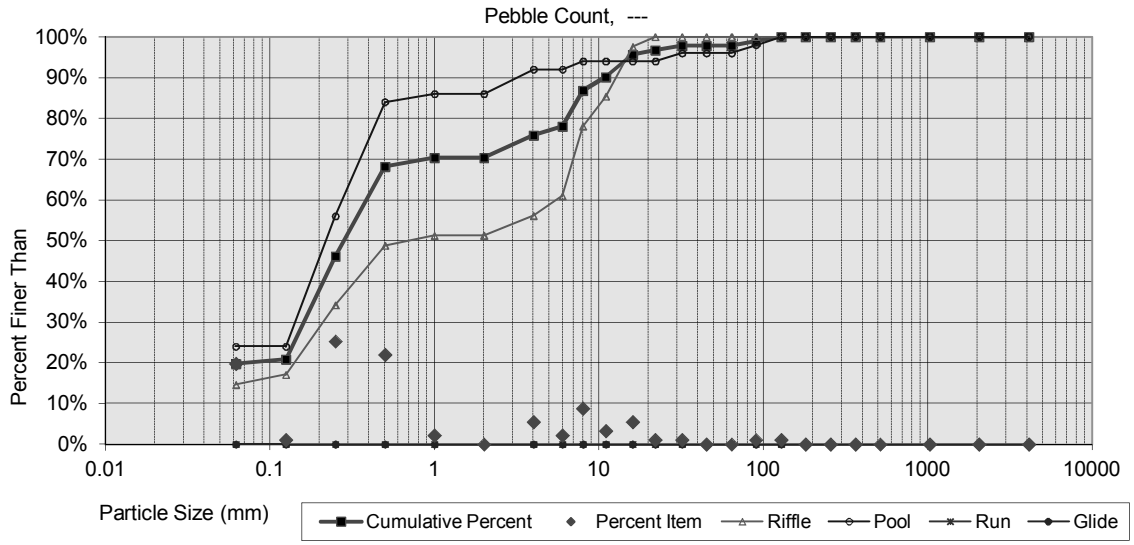


Weighted Pebble Count

Percent Riffle:	**50**	Percent Run:		Pebble Count,	
Percent Pool:	**50**	Percent Glide:			

Material	Size Range (mm)		Total #		
silt/clay	0	0.062	18.0	#	#
very fine sand	0.062	0.13	1.0	#	#
fine sand	0.13	0.25	23.0	#	#
medium sand	0.25	0.5	20.0	#	#
coarse sand	0.5	1	2.0	#	#
very coarse sand	1	2	0.0	#	#
very fine gravel	2	4	5.0	#	#
fine gravel	4	6	2.0	#	#
fine gravel	6	8	8.0	#	#
medium gravel	8	11	3.0	#	#
medium gravel	11	16	5.0	#	#
coarse gravel	16	22	1.0	#	#
coarse gravel	22	32	1.0	#	#
very coarse gravel	32	45	0.0	#	#
very coarse gravel	45	64	0.0	#	#
small cobble	64	90	1.0	#	#
medium cobble	90	128	1.0	#	#
large cobble	128	180	0.0	#	#
very large cobble	180	256	0.0	#	#
small boulder	256	362	0.0	#	#
small boulder	362	512	0.0	#	#
medium boulder	512	1024	0.0	#	#
large boulder	1024	2048	0.0	#	#
very large boulder	2048	4096	0.0	#	#
bedrock			9.0	#	
		Weighted Count:	100		
		True Total Particle Count:	100		

Note:	



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
#N/A	0.18	0.3	7	15	18%	46%	25%	2%	0%	9%

Table 10a. Baseline Stream Data Summary
McIntyre Creek at Hornets Nest Park (EEP 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 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
McIntyre Creek at Hornets Nest Park (EEP 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 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
McIntyre Creek at Hornets Nest Park (EEP 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	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	20.0	19.6	19.4					16.7	17.0	15.9					17.6	17.0	11.1					15.5	15.5	13.7				
Floodprone Width (ft) (approx)	NA	NA	NA					150.0	150.0	150.0					150.0	150.0	1501.0					NA	NA	NA				
BF Mean Depth (ft)	2.8	3.0	3.2					2.0	2.0	2.1					1.5	1.5	2.1					3.1	3.0	3.3				
BF Max Depth (ft)	5.0	5.3	6.1					3.2	3.0	3.2					2.9	2.8	2.6					5.3	5.2	4.1				
BF Cross Sectional Area (ft^2)	55.4	58.5	61.3					32.9	33.8	33.5					26.4	25.2	23.8					48.1	47.0	45.2				
Width/Depth Ratio	NA	NA	NA					8.5	8.6	7.5					11.7	11.4	5.2					NA	NA	NA				
Entrenchment Ratio	NA	NA	NA					9.0	8.8	9.4					8.5	8.8	13.5					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				
d50 (mm)	3.1	0.4	0.3					15.6	11.7	0.4					13.6	8.7	4.4					6.3	0.1	0.2				

Table 11b. Monitoring Data - Stream Reach Data Summary
McIntyre Creek at Hornets Nest Park (EEP Project Number 243)

Parameter	Baseline					MY-1					MY-2					MY-3					MY-4					MY-5				
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**
BF Width (ft)	16.7			17.6		17.0			17		11.1			15.9																
Floodprone Width (ft)	150			150		150			150		150			150																
BF Mean Depth (ft)	1.5			2.0		1.5			2.0		2.1			2.1																
BF Max Depth (ft)	2.9			3.2		2.8			3.0		2.6			3.2																
BF Cross Sectional Area (ft^2)	26.4			32.9		25.2			33.8		23.8			33.5																
Width/Depth Ratio	8.5			11.7		8.6			11.4		5.2			7.5																
Entrenchment Ratio	8.5			9.0		8.8			8.8		9.4			13.5																
Bank Height Ratio	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																
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																
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																
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1																
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																
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																
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																
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																
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1																
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																
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																
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																
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																
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1																
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																
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																			
Channel Thalweg Length (ft)	5178					5178					5178																			
Sinuosity	1.4					1.4					1.4																			
Water Surface Slope (Channel) (ft/ft)	0.0035					0.0020 - 0.0042					0.0002 - 0.0041																			
BF slope (ft/ft)	------					------					------																			
Ri%/RU%P%G%/S%	45	14	25	15		41	17	22	20		38	21	24	17																
SC%/SA%/G%/C%/B%BE%																														
d16/d35/d50/d84/d95											NA	0.18	0.3	7	15															
% of Reach with Eroding Banks																														
Channel Stability or Habitat Metric																														
Biological or Other																														

APPENDIX E

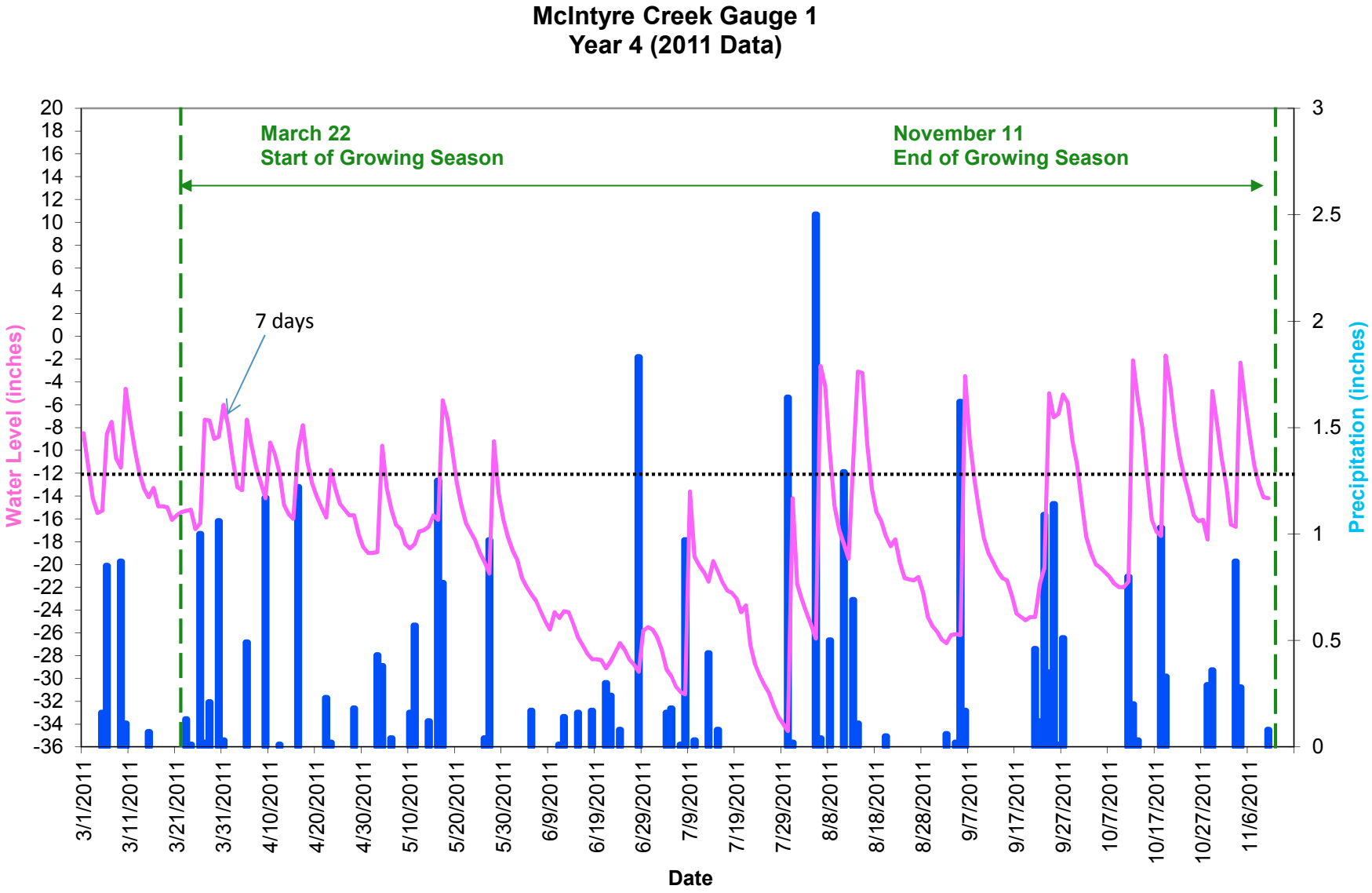
HYDROLOGY DATA

Table 12. Verification of Bankfull Events

2011 (Year 2) Groundwater Gauge Graphs

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

Table 13. Wetland Hydrology Criteria Attainment Summary


McIntyre Creek Gauge 1
Year 4 (2011 Data)
March 22
Start of Growing Season
November 11
End of Growing Season
7 days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
3
2.5
2
1.5
1
0.5
0
3/1/2011
3/11/2011
3/21/2011
3/31/2011
4/10/2011
4/20/2011
4/30/2011
5/10/2011
5/20/2011
5/30/2011
6/9/2011
6/19/2011
6/29/2011
7/9/2011
7/19/2011
7/29/2011
8/8/2011
8/18/2011
8/28/2011
9/7/2011
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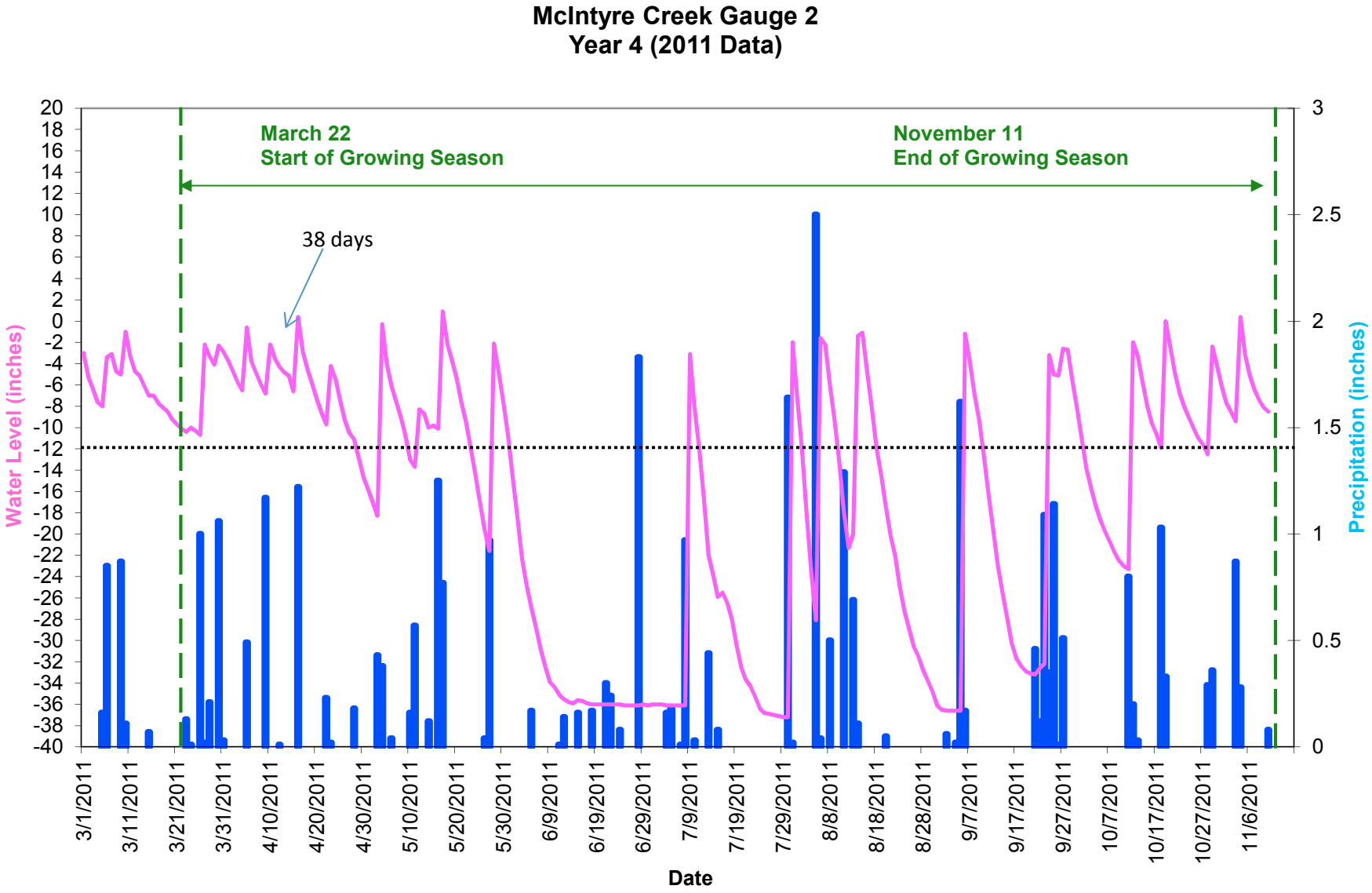
9/27/2011
10/7/2011
10/17/2011
10/27/2011
11/6/2011


McIntyre Creek Gauge 2
Year 4 (2011 Data)
March 22
Start of Growing Season
November 11
End of Growing Season
38 days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3
2.5
2
1.5
1
0.5
0
3/1/2011
3/11/2011
3/21/2011
3/31/2011
4/10/2011
4/20/2011
4/30/2011
5/10/2011
5/20/2011
5/30/2011
6/9/2011
6/19/2011
6/29/2011
7/9/2011
7/19/2011
7/29/2011
8/8/2011
8/18/2011
8/28/2011
9/7/2011
9/17/2011
9/27/2011
10/7/2011
10/17/2011
10/27/2011
11/6/2011

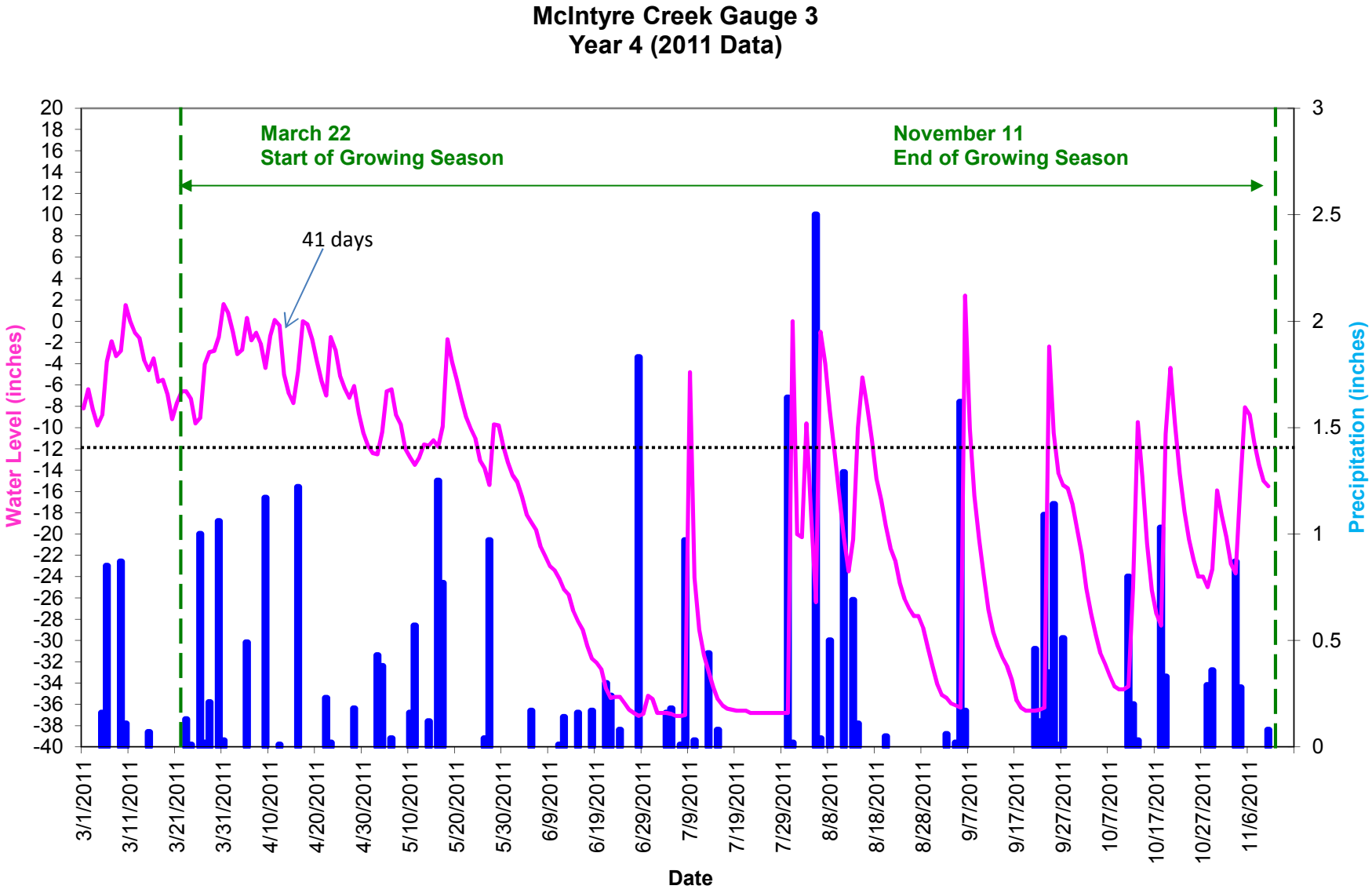

McIntyre Creek Gauge 3
Year 4 (2011 Data)
March 22
Start of Growing Season
November 11
End of Growing Season
41 days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3
2.5
2
1.5
1
0.5
0
3/1/2011
3/11/2011
3/21/2011
3/31/2011
4/10/2011
4/20/2011
4/30/2011
5/10/2011
5/20/2011
5/30/2011
6/9/2011
6/19/2011
6/29/2011
7/9/2011
7/19/2011
7/29/2011
8/8/2011
8/18/2011
8/28/2011
9/7/2011
9/17/2011
9/27/2011
10/7/2011
10/17/2011
10/27/2011
11/6/2011

Table 12. Verification of Bankfull Events

McInytre Creek Restoration Site (EEP 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	Total of 4.04 inches* of rain reported to fall over 6 days (September 25-30, 2010).	---
October 21, 2011	August 5, 2011	Total of 2.50 inches* of rain reported to fall on August 5, 2011.	4

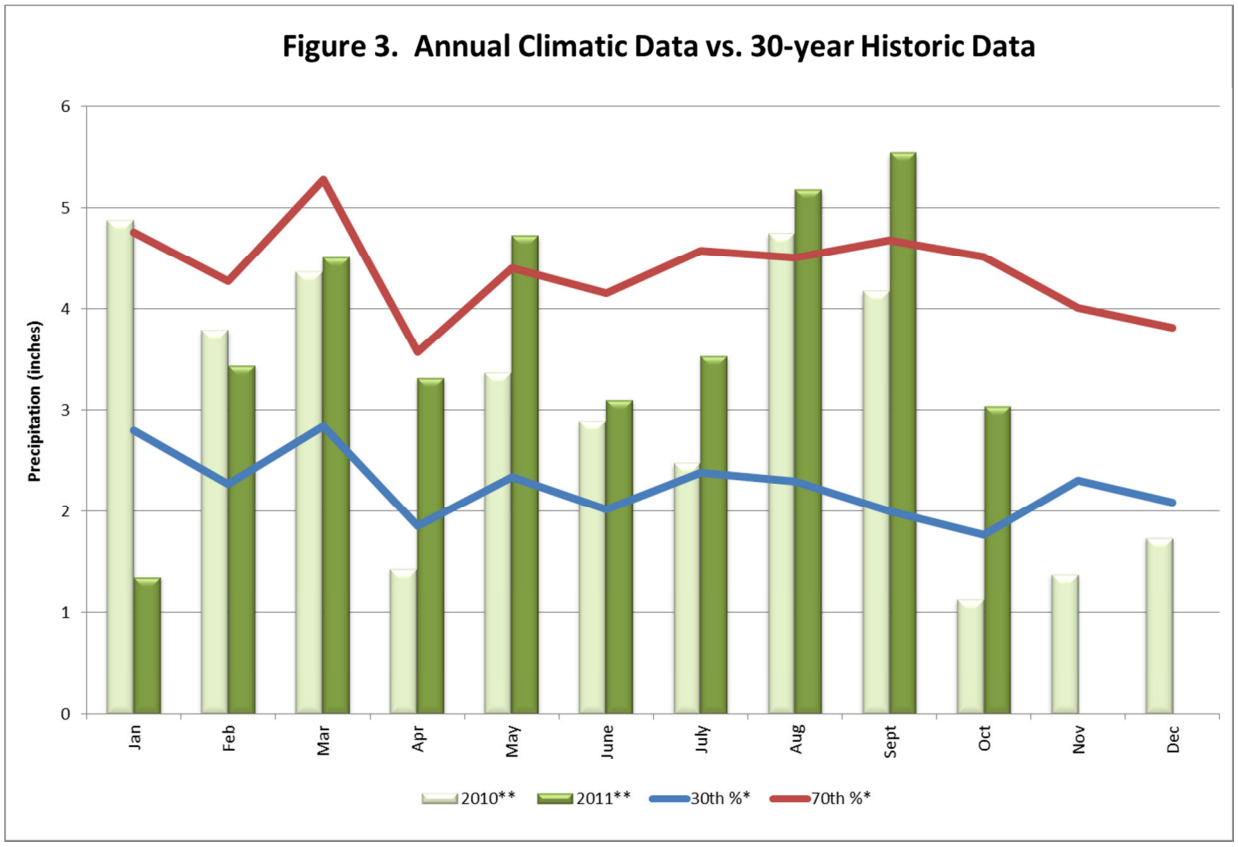
* Reported at KCLT Weather Station at the Charlotte Airport (Weatherunderground 2011).

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.

Month	30th %*	70th %*	2010**	2011**
Jan	2.79	4.76	4.88	1.36
Feb	2.27	4.28	3.79	3.44
Mar	2.84	5.28	4.37	4.52
Apr	1.85	3.57	1.44	3.32
May	2.34	4.41	3.37	4.73
June	2.02	4.16	2.89	3.1
July	2.38	4.58	2.48	3.53
Aug	2.29	4.51	4.75	5.18
Sept	2	4.68	4.18	5.55
Oct	1.77	4.52	1.13	3.04
Nov	2.3	4.01	1.38	
Dec	2.09	3.81	1.74	



*Charlotte Douglas International Airport 30-year historic data (NOAA 2004)
**Charlotte Douglas International Airport rainfall data (Weatherunderground 2011)

Table 13. Wetland Hydrology Criteria Attainment Summary
McInytre Creek Restoration Site (EEP 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 %)			
2	--	Yes/38 day (16.3 %)			
3	--	Yes/41 day (17.6 %)			