

YEAR 5 (2016)
ANNUAL MONITORING REPORT
SLIVER MOON NON-RIPARIAN WETLAND MITIGATION SITE

CRAVEN COUNTY, NORTH CAROLINA
DMS PROJECT ID: 95017



PREPARED FOR:

NC Department of Environment Quality
Department of Mitigation Services
Raleigh, North Carolina

PREPARED BY:

Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, NC 27604

November 2016

EXECUTIVE SUMMARY

Restoration Systems, LLC has established the Sliver Moon Non-Riparian Wetland Mitigation Site (Site) designed specifically to assist in fulfilling North Carolina Division of Mitigation Services wetland restoration goals. The Site is located approximately 4 miles east of Dover, North Carolina in the western portion of Craven County (Figure 1) and positioned within the Core Creek Targeted Local Watershed (TLW) 03020202080010 of the Neuse River Basin (8-digit HUC 03020202). Core Creek has been assigned a Best Usage Classification of C; NSW, Sw and is considered biologically impaired. This report serves as the Year 5 (2016) annual monitoring report.

The 17.1-acre project encompasses 14 acres of non-riparian wetland restoration, for a total for 14 non-riparian wetland mitigation units (WMUs). The restoration plan consisted of filling and plugging perimeter and interior ditches followed by planting the Site with native hardwood understory and canopy species.

The project goals aim to address stressors identified in the TLW and include the following:

- Remove non-point sources of pollution associated with vegetation maintenance including:
 - a. the cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to Site drainage ditches and
 - b. providing a vegetated wetland to aid in the treatment of runoff.
- Restore wetland hydroperiods that satisfy wetland jurisdictional requirements and approximate the Site's natural range and variation.
- Promote floodwater attenuation by filling ditches and enhancing groundwater storage capacity.
- Restore and reestablish natural community structure, habitat diversity, and functional continuity.
- Enhance and protect the Site's full potential of wetland functions and values in perpetuity.

In order to avert hydrologic trespassing issues within the property immediately to the west, a meandering shallow swale was constructed through the Site. The swale ultimately connects into the remaining southeastern ditch (Figure 2, Appendix B). The 6-inch corrugated pipe, found during construction activities, drained surface water originating from subsurface springs located within the adjacent western property. Elevations were taken of the pipe and throughout the Site to determine the path of least resistance. This approach was taken for two reasons 1) to minimize the possible draw down from the swale and 2) to maintain and enhance the Site's existing micro-topography, minimizing the amount of cut soil. Filling the western boundary ditch without allowing the surface hydrology to naturally flow through the Site would have undoubtedly inundated the neighbor's road and surrounding land. Ultimately, the additional surface hydrology is a bonus to the Site and will help further the success of the wetland restoration.

Fourteen vegetation plots (10-meters by 10-meters in size) were established and permanently monumented. These plots were surveyed in July 2016 for the Year 5 (2016) monitoring season following guidelines established in *CVS-DMS Protocol for Recording Vegetation, Version 4.2*

(Lee et al. 2008). Vegetation sampling across the Site was above the required average density with 506 planted stems per acre surviving. In addition, each individual plot was above success criteria with the exception of Plot 5; however, when including natural recruits of red maple (*Acer rubrum*) this plot was well-above success criteria.

Agricultural encroachment in the southern margins of the Site occurred in the spring of 2012, after site planting had occurred. Carolina Silvics replanted the encroached area in the winter of 2012/2013 with approximately 40-3 gallon containerized sweetbay magnolia (*Magnolia virginiana*), 200 bare-root black gums (*Nyssa sylvatica* var. *sylvatica*), 700 bare-root swamp chestnut oaks (*Quercus michauxii*), 200 bare-root water oaks (*Quercus nigra*), and 200 bare-root willow oaks (*Quercus phellos*). Additionally, the southern boundary was marked more visibly to alleviate further encroachment into the Site.



An approximately 0.25-acre area along the southern margins of the Site was mowed in the spring of 2014. The southern boundary was remarked with new t-posts, 10-foot pvc pipes, and DMS signs every 100 feet. In addition, this area was replanted in the winter of 2014/2015 with 150-3 gallon black gums (*Nyssa sylvatica* var. *sylvatica*) (see photo to left). The replanted trees appear vigorous during Year 5 (2015), and no further easement encroachment was observed.

Nine groundwater monitoring gauges were installed at the Site with an additional groundwater gauge installed in a reference wetland located immediately adjacent to the western boundary of the Site. All monitored gauges were inundated/saturated within 12 inches of the surface for greater than 7.5 percent of the year 5 (2016) growing season (18 days), which extends from March 18 to November 14 (242 days).

Site vegetation and wetland hydrology met success criteria for Year 5 (2016) monitoring. Additionally, the United States Army Corps of Engineers have approved a credit release for this project (Appendix E).

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
1.0 PROJECT BACKGROUND.....	1
1.1 Location and Setting	1
1.2 Project Objectives	1
1.3 Monitoring Plan View.....	2
2.0 ANNUAL MONITORING	2
2.1 Vegetation.....	2
2.1.1 Vegetation Success Criteria	2
2.1.2 Vegetation Monitoring Results	2
2.2 Hydrology	3
2.2.1 Hydrology Success Criteria	3
2.2.2 Hydrology Monitoring Results	4
3.0 CONCLUSIONS.....	5
4.0 REFERENCES	7

FIGURES

Figure 1. Site Location.....	Appendix A
Figure 2. Monitoring Plan View	Appendix B

APPENDICES

APPENDIX A. GENERAL TABLES AND FIGURES

- Figure 1. Site Location 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 & Attributes Table

APPENDIX B. VISUAL ASSESSMENT DATA

- Figure 2. Current Condition Plan View
- Table 5. Vegetation Condition Assessment

APPENDIX C. VEGETATION DATA

- Table 6. 2016 (Year 5) Planted and Total Stems/Acre
- Table 7. Vegetation Plot Criteria Attainment
- Table 8. CVS Vegetation Plot Metadata
- Vegetation Plot Photographs

APPENDIX D. HYDROLOGY DATA

- Table 9. Wetland Gauge Attainment Data
- 2016 Groundwater Gauge Graphs

APPENDIX E. CREDIT RELEASE DOCUMENTATION

- U.S. Army Corps of Engineers Credit Release Approval Letter

1.0 PROJECT BACKGROUND

1.1 Location and Setting

Located approximately 4 miles east of Dover, North Carolina in western Craven County, the Site is situated within the Carolina Flatwoods section of the Middle Atlantic Coastal Plain physiographic province of North Carolina, United States Geological Survey (USGS) HUC 03020202 (NC Division of Water Quality [NCDWQ] Subbasin Number 03-04-08) of the Neuse River Basin. The Site is situated within an interstream flat north of Core Creek, NCDWQ Stream Index Number 27-90.

Directions to the Site (Figure 1, Appendix A) from the City of Kinston:

- Travel southeast on US 70 Bypass for 7.2 miles
- Turn left at SR 1005/Dover Road
- Continue on Old US Highway 70 for 0.3 mile
- Continue onto West Kornegay Street for 1.3 Miles
- Continue onto Old US Highway 70 for 3.7 miles
- Turn left at Daisy Lane
- Point in center of Site: Latitude: 35.205882 °N, Longitude: -77.361332 °W

1.2 Project Objectives

Project goals include the following:

- Improving Water Quality
 - Removing non-point sources of pollution associated with agricultural activities, including a) eliminating the application of fertilizer, pesticides, and other agricultural materials into ditches that flow to adjacent streams and wetlands and b) providing a vegetated wetland to aid in the treatment of pollutants such as sediment and/or agricultural pollutants from the adjacent landscape.
 - Reducing sedimentation onsite and in adjacent ditches by a) reducing ditch erosion associated with tillage and b) planting a diverse woody vegetative to reduce runoff.
- Enhancing Flood Attenuation
 - Promoting floodwater attenuation by a) removing ditches to reduce the amount of runoff that occurs during high precipitation; b) restoring wetland hydroperiods that satisfy wetland jurisdictional requirements and approximate the Site's natural range of variation; c) restoring non-riparian wetlands, resulting in increased storage capacity during precipitation events within the Site; d) revegetating the Site to reduce sheet flow off the Site.
- Restoring Non-riparian Habitat
 - Restore and reestablish natural community structure, habitat diversity, and functional continuity.
- Enhance and protect the Site's full potential of wetland functions and values in perpetuity.

Project objectives include the following:

- Providing 14 non-riparian WMUs, as calculated in accordance with the requirements stipulated in RFP #16-003571. This will be accomplished by restoring 14 acres of non-riparian wetland by eliminating row crop production, filling agricultural ditches, restoring historic water table elevations, redirecting ditches located near the Site to avoid possible draw-down, and planting the Site with native non-riparian forest vegetation.
- Protecting the Site in perpetuity with a conservation easement.

1.3 Monitoring Plan View

Monitoring features (vegetation plots and groundwater gauges) are depicted in Figure 2 (Appendix B). Tables 1 through 3 summarize project components and mitigation credits, project activities and reporting history, and project contacts, respectively (Appendix A).

2.0 ANNUAL MONITORING

Monitoring of restoration efforts will be performed for a minimum of 7 years or until success criteria are fulfilled. The detailed monitoring plan is depicted in Figure 2 (Appendix B).

2.1 Vegetation

Monitoring of planted vegetation will follow guidelines outlined in the *Carolina Vegetation Survey (CVS) DMS Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) and will be conducted annually between June 1 and September 30 until vegetation success criteria are achieved. Fourteen, 10-meter by 10-meter vegetation plots have been placed within restored wetlands (Figure 2, Appendix B). Vegetation will receive a visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species.

Agricultural encroachment in the southern margins of the Site occurred in the spring of 2012, after site planting had occurred. Carolina Silvics replanted the encroached area in the winter of 2012/2013 with approximately 40-3 gallon containerized sweetbay magnolia (*Magnolia virginiana*), 200 bare-root black gums (*Nyssa sylvatica* var. *sylvatica*), 700 bare-root swamp chestnut oaks (*Quercus michauxii*), 200 bare-root water oaks (*Quercus nigra*), and 200 bare-root willow oaks (*Quercus phellos*). Additionally, the southern boundary was marked more visibly to alleviate further encroachment into the Site.

An approximately 0.25-acre area along the southern margins of the Site was mowed in the spring of 2014. The southern boundary was remarked with new t-posts, 10-foot pvc pipes, and DMS signs every 100 feet. In addition, this area was replanted in the winter of 2014/2015 with 150 3-gallon black gums (*Nyssa sylvatica* var. *sylvatica*).

2.1.1 Vegetation Success Criteria

Success criteria are dependent upon the density and growth of living, planted stems throughout the planted areas of the Site, all of which is characterized as Non-riverine Wet Hardwood Flat (Schafale and Weakley 1990). The presence of desirable volunteer species will be considered by the United States Army Corps of Engineers (USACE) and Interagency Review Team (IRT) in making a determination whether the Site has successfully met the stated goals and objectives. An average density of 320 stems per acre of living, planted stems must be surviving in the first three monitoring years. Subsequently, 260 living, planted stems-per-acre must be surviving in Year 5 and 210 living, planted stems-per-acre in Year 7.

2.1.2 Vegetation Monitoring Results

Fourteen vegetation plots (10-meter by 10-meter in size) were established and permanently monumented. These plots were surveyed in July 2016 for the Year 5 (2016) monitoring period. Vegetation sampled across the Site exceeded the required average density with 506 planted stems per acre surviving. In addition, each individual plot was above success criteria with the exception of Plot 5; however, when including natural recruits of red maple (*Acer rubrum*) this plot was well-above success criteria. The area surrounding Plot 5 is very wet, with standing water year-round, which likely contributed to planted stem mortality in this area.

Summary of Planted Vegetation Plot Results

Plot	Planted Stems/Acre Counting Towards Success Criteria						
	Year 1 (2012)	Year 2 (2013)	Year 3 (2014)	Year 4 (2015)	Year 5 (2016)	Year 6 (2017)	Year 7 (2018)
1	688	607	526	486	486		
2	648	648	647	607	567		
3	486	364	364	364	607		
4	567	526	364	324	324		
5	324	162	202	121	202		
6	567	486	324	324	324		
7	607	688	769	769	769		
8	405	364	404	324	324		
9	486	445	364	283	283		
10	607	607	607	526	607		
11	567	567	526	567	526		
12	648	728	728	728	728		
13	769	769	688	688	688		
14	648	688	647	607	647		
Average of All	572	546	511	480	506		

2.2 Hydrology

Measurements of wetland hydrology were performed in accordance with traditional methods as per the April 2003 *USACE Wilmington District Stream Mitigation Guidelines* (USACE et al. 2003). Nine continuously recording, groundwater monitoring gauges were installed within the 14-acre restoration area in accordance with specifications in *Installing Monitoring Wells/Piezometers in Wetlands* (NCWRP 1993); in addition, one reference gauge was installed adjacent to the Site and monitored. Year 5 (2016) groundwater data are presented by gauge in Appendix D.

2.2.1 Hydrology Success Criteria

Based on the Site's location and hydrology source, target hydrological characteristics include saturation or inundation for 7.5 percent of the growing season at a minimum of 12 inches below ground level during average rainfall conditions for a period of seven years. During growing seasons with atypical climatic conditions, groundwater gauges in reference wetlands may be used by the USACE/IRT to evaluate hydrology success.

The growing season will primarily be determined by the United States Department of Agriculture (USDA) *Soil Survey of Craven County, North Carolina* (USDA 1989) (March 18-November 14 [242 days]). In abnormally seasonable years the growing season may be based on USACE Regional Supplement (USACE 2010), which states the following:

The growing season has begun on a site in a given year when two or more different non-evergreen vascular plant species growing in the wetland or surrounding areas exhibit one or more of the following indicators of biological activity:

- a. Emergence of herbaceous plants from the ground

- b. Appearance of new growth from vegetative crowns (e.g., in graminoids, bulbs, and corms)
- c. Coleoptile/cotyledon emergence from seed
- d. Bud burst on woody plants (i.e., some green foliage is visible between spreading bud scales)
 - 1. Emergence or elongation of leaves of woody plants
 - f. Emergence or opening of flowers

The end of the growing season is indicated when woody deciduous species lose their leaves and/or the last herbaceous plants cease flowering and their leaves become dry or brown, generally in the fall due to cold temperatures or reduced moisture availability. Early plant senescence due to the initiation of the summer dry season in some areas does not necessarily indicate the end of the growing season and alternative procedures (e.g., soil temperature) should be used.

Summary of Hydrology Success Criteria by Year

Year	Soil Temperatures/Date Bud Burst Documented	Monitoring Period Used for Determining Success	7.5 Percent of Monitoring Period
2012 (Year 1)	--	March 18-November 14 (242 days)	18 days
2013 (Year 2)	Bud burst on red maple (<i>Acer rubrum</i>) and elderberry (<i>Sambucus canadensis</i>) and soil temperature of 48°F documented on February 7, 2013	February 7-November 14 (281 days)	21 days
2014 (Year 3)	--	March 18-November 14 (242 days)	18 days
2015 (Year 4)	--	March 18-November 14 (242 days)	18 days
2016 (Year 5)	--	March 18-November 14 (242 days)	18 days

2.2.2 Hydrology Monitoring Results

All monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 7.5 percent of the monitoring period used for 2016 (Year 5) (18 days), which extends from March 18 to November 14 (242 days). Several gauges were replaced or repaired during the growing season. There are data gaps due to failed batteries or faulty data loggers, in some cases data was unrecoverable.

No hydrology problem areas were identified within the Site during Year 5 (2016) monitoring.

Sliver Moon Wetland Restoration Site

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2012)* March 18 Growing Season Start	Year 2 (2013)** February 7 Growing Season Start	Year 3 (2014) March 18 Growing Season Start	Year 4 (2015) March 18 Growing Season Start	Year 5 (2016) March 18 Growing Season Start
1	Yes/25 days (10.3 percent)	Yes/43 days (15.3 percent)	Yes/51 Days (21 percent)	Yes/19 Days (7.8 percent)	Yes/28 Days (11.6 percent)
2	Yes/117 days (48.3 percent)	Yes/96 days (34.2 percent)	Yes/127 Days (52 percent)	Yes/59 Days (24 percent)	Yes/106 Days (43.8 percent)
3	Yes/117 days (48.3 percent)	Yes/95 days (33.8 percent)	Yes/ 56 Days (23 percent)	Yes/76 Days (31 percent)	Yes/106 Days (43.8 percent)
4	No/13 days (5.4 percent)	Yes/29 days (10.3 percent)	Yes/20 Days (8.3 percent)	Yes/18 Days (7.5 percent)	Yes/28 Days (11.6 percent)
5	Yes/76 days (31.4 percent)	Yes/92 days (32.7 percent)	Yes/54 Days (22 percent)	Yes/72 Days (29 percent)	Yes/86 Days (35.5 percent)
6	Yes/24 days (9.9 percent)	Yes/43 days (15.3 percent)	Yes/28 Days (11.6 percent)	Yes/42 Days (17 percent)	Yes/29 Days (12 percent)
7	Yes/40 Days (16.5 percent)	Yes/93 days (33.1 percent)	Yes/53 Days (22 percent)	Yes/46 Days (19 percent)	Yes/71 Days (29.3 percent)
8	Yes/97 days (40.1 percent)	Yes/93 days (33.1 percent)	Yes/55 Days (23 percent)	Yes/45 Days (18 percent)	Yes/74 Days (30.6 percent)
9	Yes/42 days (17.4 percent)	Yes/67 days (23.8 percent)	Yes/57 Days (24 percent)	Yes/56 Days (23 percent)	Yes/242 Days (100 percent)
Ref	Yes/102 days (42.1 percent)	Yes/91 days (32.4 percent)	Yes/ 57 Days (24 percent)	Yes/47 Days (19 percent)	Yes/106 Days (43.8 percent)

* Groundwater gauges were installed at the Site on March 24, six days after the published NRCS growing season start date (March 18). Therefore, Year 1 (2012) hydrology success criteria is proposed to use the USDA published growing season dates in place of the proposed biological and physical indicators of growing season as described for the Site.

**Based on biological and physical indicators for the site, February 7 was determined the start of the growing season for year 2 (2013) monitoring.

3.0 CONCLUSIONS

Vegetation sampling across the Site was above the required average density with 506 planted stems-per-acre surviving. In addition, each individual plot was above success criteria with the exception of Plot 5; however, when including natural recruits of red maple (*Acer rubrum*) this plot was well-above success criteria. The area surrounding plot five is very wet with standing water year-round, which likely contributed to planted stem mortality in this area. Areas disturbed by 2012 agricultural encroachment were planted with 40, 3-gallon containerized trees and 1300 bare-roots trees. These trees are doing well and are successfully vegetating disturbed areas with the exception of a 0.25 acre area of additional agricultural encroachment along the south portion of the Site that occurred during summer 2014. The southern boundary was remarked with new t-posts, 10-foot pvc pipes, and DMS signs every 100 feet. In addition, this area was replanted in winter 2014/2015 with 150 3-gallon black gums (*Nyssa sylvatica* var. *sylvatica*). This portion of the site has recovered, and the replanted trees are vigorous. No additional encroachment or vegetation problem areas were observed during Year 5 (2016) monitoring.



All nine monitored groundwater gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 7.5 percent of the monitoring period used for 2016 (Year 5) (18 days), which extends from March 18 to November 14 (242 days).

Site vegetation and wetland hydrology met success criteria for Year 5 (2016) monitoring.

4.0 REFERENCES

- Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. DMS Protocol for Recording Vegetation, Version 4.2. North Carolina Department of Environmental Quality, Department of Mitigation Services. Raleigh, North Carolina.
- NC Wetlands Restoration Program (NCWRP). 1993. Installing Monitoring Wells/Piezometers in Wetlands (WRP Technical Note HY-IA-3.1). Department of Environment, Health, and Natural Resources, Raleigh, North Carolina
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.
- US Army Corps of Engineers (USACE). 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0). U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, MS. ERDC/EL TR-10-20. 154 pp.
- US Army Corps of Engineers, US Environmental Protection Agency, NC Wildlife Resources Commission, NC Division of Water Quality (USACE et al.). 2003. Stream Mitigation Guidelines.
- US Department of Agriculture (USDA). 1989. Soil Survey of Craven County, North Carolina. Natural Resources Conservation Service.

Appendix A.
General Tables and Figures

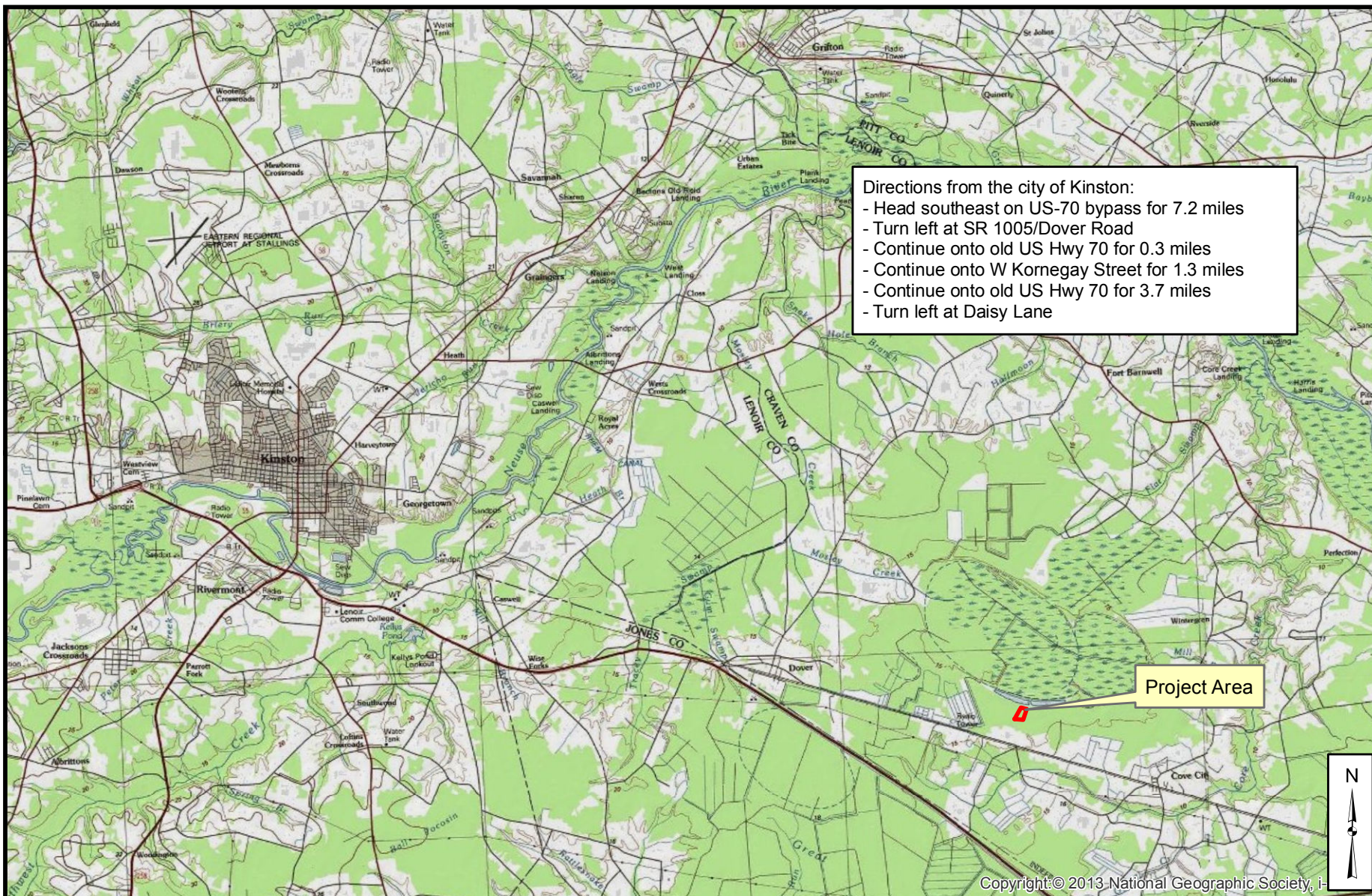
Figure 1. Site Location Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information & Attributes Table



Axiom Environmental
 218 Snow Ave
 Raleigh, NC 27603

Scale:
 1 inch = 10,000 feet

Date:
 Nov 2015

Project:
 Sliver Moon

**FIGURE 1:
 SITE LOCATION MAP**

This figure indicates where the Site is physically located along with directions to the Site.

**Sliver Moon Non-Riparian Wetland
 Mitigation Site**
 RFP # 16-003571 DMS Project ID # 95017
 Craven County, North Carolina

Imagery USGS Topographical Map
 Coordinate System: NAD 1983 NC FEET

Table 1. Project Components and Mitigation Credits

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

Mitigation Credits									
Type	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
	R	RE	R	RE	R	RE			
Totals					14				
Project Components									
Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage		Approach (PI,PII etc.)	Restoration – or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio		
Non-riparian restoration	NA	17.01		NA	Restoration	14	1:1		
Component Summation									
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)			
		Riverine	Non-Riverine						
Restoration	0	0	0	14	0	0			
Enhancement		0	0	0	0	0			
Enhancement I	0								
Enhancement II	0								
Creation		0	0	0					
Preservation	0	0	0	0		0			
High Quality Preservation	0	0	0	0		0			

Table 2. Project Activity and Reporting History

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

Activity or Report	Data Collection Complete	Completion or Delivery
CE Document	NA	October - 2011
Conservation Easement	NA	February - 2012
Mitigation Plan	NA	February - 2012
Construction	NA	March - 2012
Bare Root Planting	NA	March - 2012
Baseline Monitoring Document	April-2012	August 2012
Year 1 Monitoring	October 2012	November 2012
Supplemental Planting/Easement Marking		Winter 2012/2013
Year 2 Monitoring	November 2013	November 2013
Year 3 Monitoring	November 2014	November 2014
Year 4 Monitoring	November 2015	December 2015
Year 5 Monitoring	November 2016	November 2016
Year 6 Monitoring		
Year 7 Monitoring		

Table 3. Project Contacts Table

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

	Firm	POC & Address
Designer:	Restoration Systems, LLC with preliminary consulting by Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Ave. Raleigh, NC 27603
Construction Contractor:	Land Mechanics, Inc.	Lloyd Glover; 919.422.3392 780 Landmark Road Willow Spring, NC 27592-7756
Planting Contractor:	Carolina Silvics	Dwight McKinney 252.482.8491 908 Indian Trail Road Edenton, NC 27932
Seeding Contractor:	Land Mechanics, Inc.	Lloyd Glover; 919.422.3392 780 Landmark Road Willow Spring, NC 27592-7756
Nursery Stock Suppliers:	ArborGen	1.888.888.7158
Baseline Data Collection	Restoration Systems, LLC	Ray Holz; 919.604.9314 1101 Haynes St. Raleigh, NC 27604
Vegetation Monitoring:	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Avenue Raleigh, NC 27603
Wetland Monitoring:	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Avenue Raleigh, NC 27603

Table 4: Project Baseline Information & Attributes Table

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

Project Information			
Project Name	Sliver Moon		
County	Craven		
Project Area (acres)	17.01		
Project Coordinates (latitude and longitude)	35.204817, -77.360605 (NAD 83/WGS 84)		
Project Watershed Summary Information			
Physiographic Province	Carolina Flatwoods section of the Middle Atlantic Coastal Plain		
River Basin	Neuse		
USGS Hydrologic Unit 8-digit	03020202	USGS Hydrologic Unit 14-digit	03020202080010
DWQ Sub-basin	03-04-08		
Project Drainage Area, Total Outfall (acres)	+/- 130		
Groundwater Treated by Site (acres)	+/- 20		
Project Drainage Area Percentage of Impervious Area	< 1%		
CGIA Land Use Classification	Cropland and Pasture		
Wetland Summary Information			
Parameters		Wetland 1	
Size of Wetland (acres)	14.00		
Wetland Type (non-riparian, riparian riverine or riparian non riverine)	Non-riparian		
Mapped Soil Series	Torhunta & Pantego		
Drainage class	Poorly Drained		
Soil Hydric Status	Class A		
Source of Hydrology	Rain Events		
Hydrologic Impairment	Ditches		
Native vegetation community	Non-Riverine Wet Harwood Forest		
Percent composition of exotic invasive vegetation	0%		
Regulatory Considerations			
Regulation	Applicable?	Resolved?	
Waters of the United States – Section 404	Yes	Yes	
Waters of the United States – Section 401	Yes	Yes	
Endangered Species Act	No		
Historic Preservation Act	No		
Coastal Zone Management Act [CZMA/Coastal Area Management Act (CAMA)]	No		
FEMA Floodplain Compliance	No		
Essential Fisheries Habitat	No		
Sediment & Erosion Control Plan (S&EC)	Yes	Yes	

APPENDIX B
VISUAL ASSESSMENT DATA

Figure 2. Current Condition Plan View

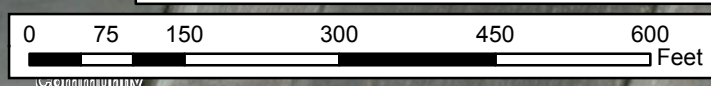
Table 5. Vegetation Condition Assessment



Legend

- Conservation Easement Boundary
- Wetland Restoration = 14ac
- Surface Water Swale
- Vegetation Monitoring Plot
- Ground Water Gauge
- 2014 Replanting Area
- 2012 Replanting Area

*The Reference Monitoring Well's position was re-referenced at the end of the 2012 monitoring season with a more accurate GPS device resulting in a new, more accurate location than what was reported on 'Sheet D: Monitoring Plan' of the Sliver Moon Baseline Monitoring Document and As-Built Report Dated July 2012.



Axiom Environmental
218 Snow Ave
Raleigh, NC 27603

Axiom Environmental, Inc.

CURRENT CONDITIONS PLAN VIEW
SLIVER MOON WETLAND RESTORATION SITE
Craven County, North Carolina

Dwn. by: KRJ
Date: Nov. 2016
Project: 10-001

FIGURE
2

Table 5: Vegetation Condition Assessment

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

Vegetation Category		Mapped Acreage	CCPV Symbol	Number of Polygons	% of planted Acreage
Planted Acreage – 17.01 acres (Entire Easement)					
Areas of Concern	No areas of concern were observed during year 5 (2016) monitoring.	NA	NA	NA	0%
Exotic Invasive Species	No invasive species observed at the Site during year 5 (2016) monitoring.	NA	NA	NA	0%

APPENDIX C
VEGETATION DATA

- Table 6. 2016 (Year 5) Planted and Total Stems/Acre
- Table 7. Vegetation Plot Criteria Attainment
- Table 8. CVS Vegetation Plot Metadata
- Vegetation Plot Photographs

Table 6. Total and Planted Stems by Plot and Species

CVS Project Code Sliver M. Project Name: Sliver Moon Non-riparian Wetland Mitigation Site

		Current Plot Data (MYS 2016)																														
Scientific Name	Common Name	Species Type	Sliver M-RS-0001			Sliver M-RS-0002			Sliver M-RS-0003			Sliver M-RS-0004			Sliver M-RS-0005			Sliver M-RS-0006			Sliver M-RS-0007			Sliver M-RS-0008			Sliver M-RS-0009			Sliver M-RS-0010		
			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 rubrum	red maple	Tree			6					10			24			17			8			5			9			1			3	
Baccharis halimifolia	eastern baccharis	Shrub			11			11					14			2			5			7			4			3			8	
Betula	birch	Tree																														
Betula nigra	river birch	Tree												1	1	1																
Carya	hickory	Tree				1	1	1																								
Liquidambar styraciflua	sweetgum	Tree																														
Liriodendron tulipifera	tuliptree	Tree	1	1	1	3	3	3											2	2	2	1	1	1					6	6	6	
Magnolia virginiana	sweetbay	Tree				1	1	1					1	1	1							4	4	4			1	1	1	2	2	2
Morella	bayberry	shrub																														
Morella cerifera	wax myrtle	shrub											2	2	3	1	1	1							1	1	1	2	2	2		
Nyssa	tupelo	Tree																														
Nyssa sylvatica	blackgum	Tree	3	3	3	1	1	1	3	3	3	2	2	2	2	2	2												7	7	7	
Persea	bay	Tree																														
Persea palustris	swamp bay	tree				3	3	3	3	3	3																					
Pinus taeda	loblolly pine	Tree																														
Quercus	oak	Tree																				2	2	2								
Quercus laurifolia	laurel oak	Tree	1	1	1	1	1	1	1	1	1							4	4	4	7	7	7	3	3	3	1	1	1			
Quercus michauxii	swamp chestnut oak	Tree										1	1	1							4	4	4	1	1	1	3	3	3			
Quercus nigra	water oak	Tree	5	5	5				1	1	1											1										
Quercus pagoda	cherrybark oak	Tree	2	2	2	1	1	1	1	1	1	1	1	1								1	1	1	3	3	3					
Quercus phellos	willow oak	Tree				3	3	3				1	1	1				2	2	2												
Rhus copallinum	flameleaf sumac	shrub																														
Salix nigra	black willow	Tree																								1			1			
Taxodium distichum	bald cypress	Tree							6	6	6				1	1	1															
Ulmus americana	American elm	Tree																														
Stem count			12	12	29	14	14	25	15	15	26	8	8	48	5	5	24	8	8	22	19	19	31	8	8	22	7	7	12	15	15	26
size (ares)			1			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	7	8	8	9	6	6	8	6	6	9	4	4	6	3	3	6	6	6	8	4	4	7	4	4	7	3	3	5
Stems per ACRE			485.6	485.6	1174	566.6	566.6	1012	607	607	1052	323.7	323.7	1942	202.3	202.3	971.2	323.7	323.7	890.3	768.9	768.9	1255	323.7	323.7	890.3	283.3	283.3	485.6	607	607	1052

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 excluding livestakes
- P-all = Planting including livestakes
- T = All planted and natural recruits including livestakes
- T includes natural recruits

Table 6. Total and Planted Stems by Plot and Species (continued)

CVS Project Code Sliver M. Project Name: Sliver Moon Non-riparian Wetland Mitigation Site

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2016)												Annual Means																			
			Sliver M-RS-0011			Sliver M-RS-0012			Sliver M-RS-0013			Sliver M-RS-0014			MY5 (2016)			MY4 (2015)			MY3 (2014)			MY2 (2013)			MY1 (2012)			MY0 (2012)				
			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 rubrum	red maple	Tree										6			2			91			495			259			177			6				
Baccharis halimifolia	eastern baccharis	Shrub			14			9			7			6			101			318			53			28			4					
Betula	birch	Tree																						1	1	1	1	1	1					
Betula nigra	river birch	Tree					3	3	3		6	6	6				10	10	10	9	9	9	10	10	10	9	9	9	1	1	1			
Carya	hickory	Tree														1	1	1	1	1	1	1	1	1	1	1	1	1	1					
Liquidambar styraciflua	sweetgum	Tree			2			5							2			9			12			3			9							
Liriodendron tulipifera	tuliptree	Tree					2	2	2		2	2	2	6	6	6	23	23	23	21	21	21	25	25	25	26	26	26	28	28	30			
Magnolia virginiana	sweetbay	Tree	1	1	1		3	3	3				2	2	2	15	15	15	15	15	15	18	18	18	16	16	21	17	17	17				
Morella	bayberry	shrub																6	6	6	6	6	6	6	9	9	9	9	9	9				
Morella cerifera	wax myrtle	shrub	3	3	3							2	2	2	2	2	2	13	13	14	7	7	9	8	8	8	7	7	7	1	1	1		
Nyssa	tupelo	Tree																																
Nyssa sylvatica	blackgum	Tree	5	5	5							1	1	1				24	24	24	7	7	8	6	6	6	7	7	7	11	11	11		
Persea	bay	Tree																																
Persea palustris	swamp bay	tree														6	6	6	6	6	6	5	5	9	5	5	5	10	10	10	9	9	9	
Pinus taeda	loblolly pine	Tree																																
Quercus	oak	Tree																																
Quercus laurifolia	laurel oak	Tree											4	4	4	22	22	22	22	22	22	21	21	21	24	24	24	18	18	18	32	32	32	
Quercus michauxii	swamp chestnut oak	Tree																																
Quercus nigra	water oak	Tree	2	2	2		2	2	2		4	4	4	2	2	3	16	16	18	17	17	17	18	18	19	16	16	16	20	20	20	28	28	28
Quercus pagoda	cherrybark oak	Tree	1	1	1		1	1	1																									
Quercus phellos	willow oak	Tree	1	1	1		7	7	7		2	2	2																					
Rhus copallinum	flameleaf sumac	shrub																																
Salix nigra	black willow	Tree																																
Taxodium distichum	bald cypress	Tree																																
Ulmus americana	American elm	Tree																																
Stem count			13	13	29	18	18	34	17	17	30	16	16	27	175	175	385	166	166	995	177	177	498	189	189	413	198	198	212	223	223	223		
size (ares)			1			1			1			1			14			14			14			14			14			14				
size (ACRES)			0.02			0.02			0.02			0.02			0.35			0.35			0.35			0.35			0.35			0.35				
Species count			6	6	8	6	6	9	6	6	8	5	5	8	14	14	19	15	15	19	15	15	19	16	16	22	16	16	19	9	9	9		
Stems per ACRE			526.1	526.1	1174	728.4	728.4	1376	688	688	1214	647.5	647.5	1093	505.9	505.9	1113	479.8	479.8	2876	511.6	511.6	1440	546.3	546.3	1194	572.3	572.3	612.8	644.6	644.6	644.6		

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 excluding livestakes
- P-all = Planting including livestakes
- T = All planted and natural recruits including livestakes
- T includes natural recruits

Table 7. Vegetation Plot Criteria Attainment based on Planted Stems

Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	93%
2	Yes	
3	Yes	
4	Yes	
5	No*	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	
11	Yes	
12	Yes	
13	Yes	
14	Yes	

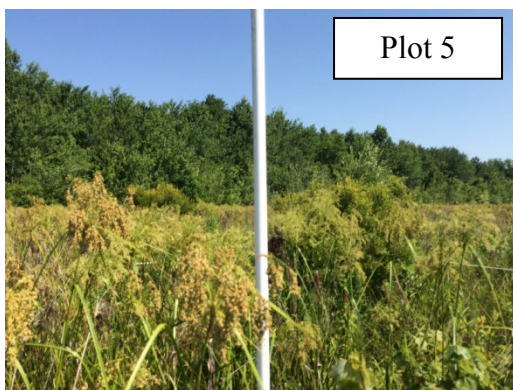
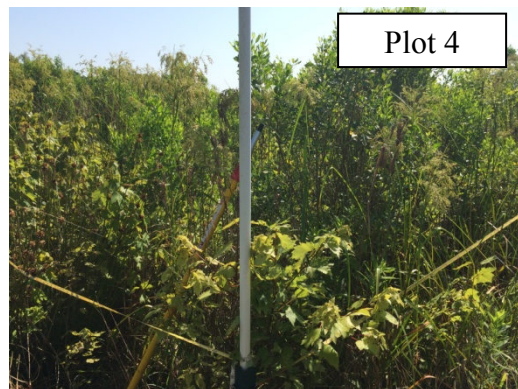
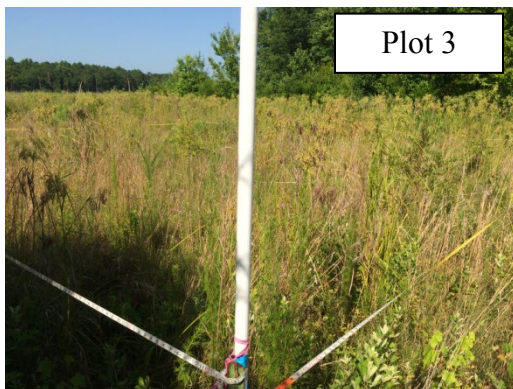
*This plot didn't meet success criteria based on planted stems alone; however, when including naturally recruited stems of red maple (*Acer rubrum*) this plot was well-above success criteria.

Table 8. CVS Vegetation Plot Metadata

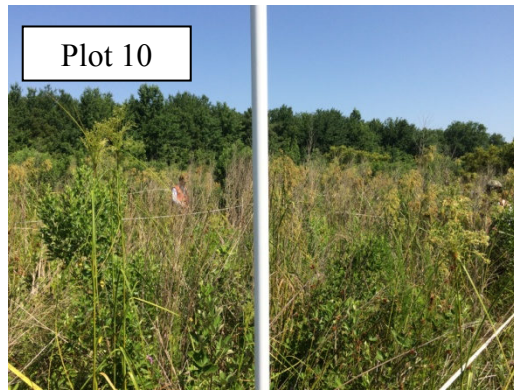
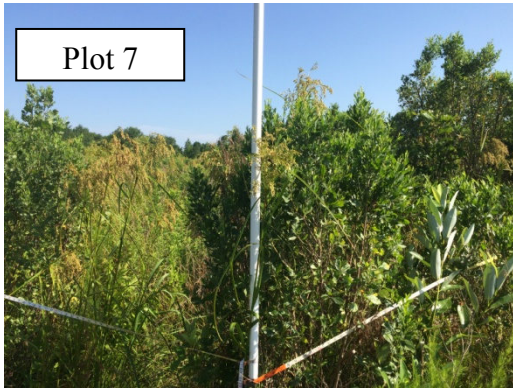
Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

Report Prepared By	Corri Faquin
Date Prepared	7/18/2016 17:05
database name	RS-SliverMoon-2016-A-v2.3.1.mdb
database location	S:\Business\Projects\10\10-001 RS 10 Monitoring\Sliver Moon\2016 Year 5\CVS
computer name	KEENAN-PC
file size	46919680
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.
Planted 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.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	Sliver M
project Name	Sliver Moon Non-riparian Wetland Mitigation Site
Description	14 ac. Non-riparian wetland Mitigation Site in the Neuse 01 River Basin
River Basin	Neuse
length(ft)	730
stream-to-edge width (ft)	1100
area (sq m)	56000
Required Plots (calculated)	13
Sampled Plots	14

**Sliver Moon
2016 (Year 5) Vegetation Monitoring Photographs
Taken July 2016**



**Sliver Moon
2016 (Year 5) Vegetation Monitoring Photographs
Taken July 2016
(continued)**



APPENDIX D
HYDROLOGY DATA

Table 9. Wetland Gauge Attainment Data
2016 Groundwater Gauge Graphs

Table 9. Wetland Gauge Attainment Data

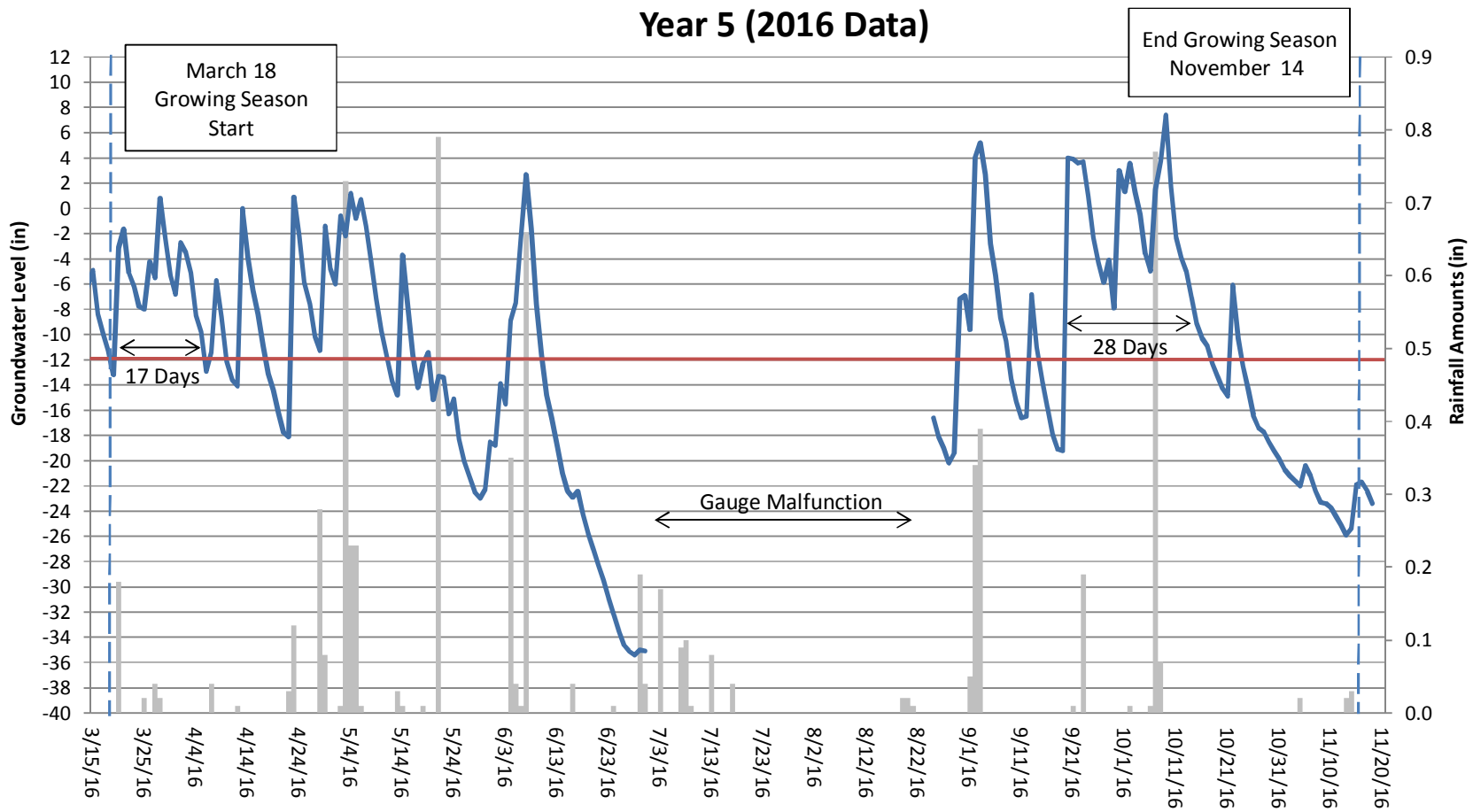
Sliver Moon Non-Riparian Wetland Mitigation Site, Craven County, DMS Project ID: 95017

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2012)* March 18 Growing Season Start	Year 2 (2013)** February 7 Growing Season Start	Year 3 (2014) March 18 Growing Season Start	Year 4 (2015) March 18 Growing Season Start	Year 5 (2016) March 18 Growing Season Start
1	Yes/25 days (10.3 percent)	Yes/43 days (15.3 percent)	Yes/51 Days (21 percent)	Yes/19 Days (7.8 percent)	Yes/28 Days (11.6 percent)
2	Yes/117 days (48.3 percent)	Yes/96 days (34.2 percent)	Yes/127 Days (52 percent)	Yes/59 Days (24 percent)	Yes/106 Days (43.8 percent)
3	Yes/117 days (48.3 percent)	Yes/95 days (33.8 percent)	Yes/ 56 Days (23 percent)	Yes/76 Days (31 percent)	Yes/106 Days (43.8 percent)
4	No/13 days (5.4 percent)	Yes/29 days (10.3 percent)	Yes/20 Days (8.3 percent)	Yes/18 Days (7.5 percent)	Yes/28 Days (11.6 percent)
5	Yes/76 days (31.4 percent)	Yes/92 days (32.7 percent)	Yes/54 Days (22 percent)	Yes/72 Days (29 percent)	Yes/86 Days (35.5 percent)
6	Yes/24 days (9.9 percent)	Yes/43 days (15.3 percent)	Yes/28 Days (11.6 percent)	Yes/42 Days (17 percent)	Yes/29 Days (12 percent)
7	Yes/40 Days (16.5 percent)	Yes/93 days (33.1 percent)	Yes/53 Days (22 percent)	Yes/46 Days (19 percent)	Yes/71 Days (29.3 percent)
8	Yes/97 days (40.1 percent)	Yes/93 days (33.1 percent)	Yes/55 Days (23 percent)	Yes/45 Days (18 percent)	Yes/74 Days (30.6 percent)
9	Yes/42 days (17.4 percent)	Yes/67 days (23.8 percent)	Yes/57 Days (24 percent)	Yes/56 Days (23 percent)	Yes/242 Days (100 percent)
Ref	Yes/102 days (42.1 percent)	Yes/91 days (32.4 percent)	Yes/ 57 Days (24 percent)	Yes/47 Days (19 percent)	Yes/106 Days (43.8 percent)

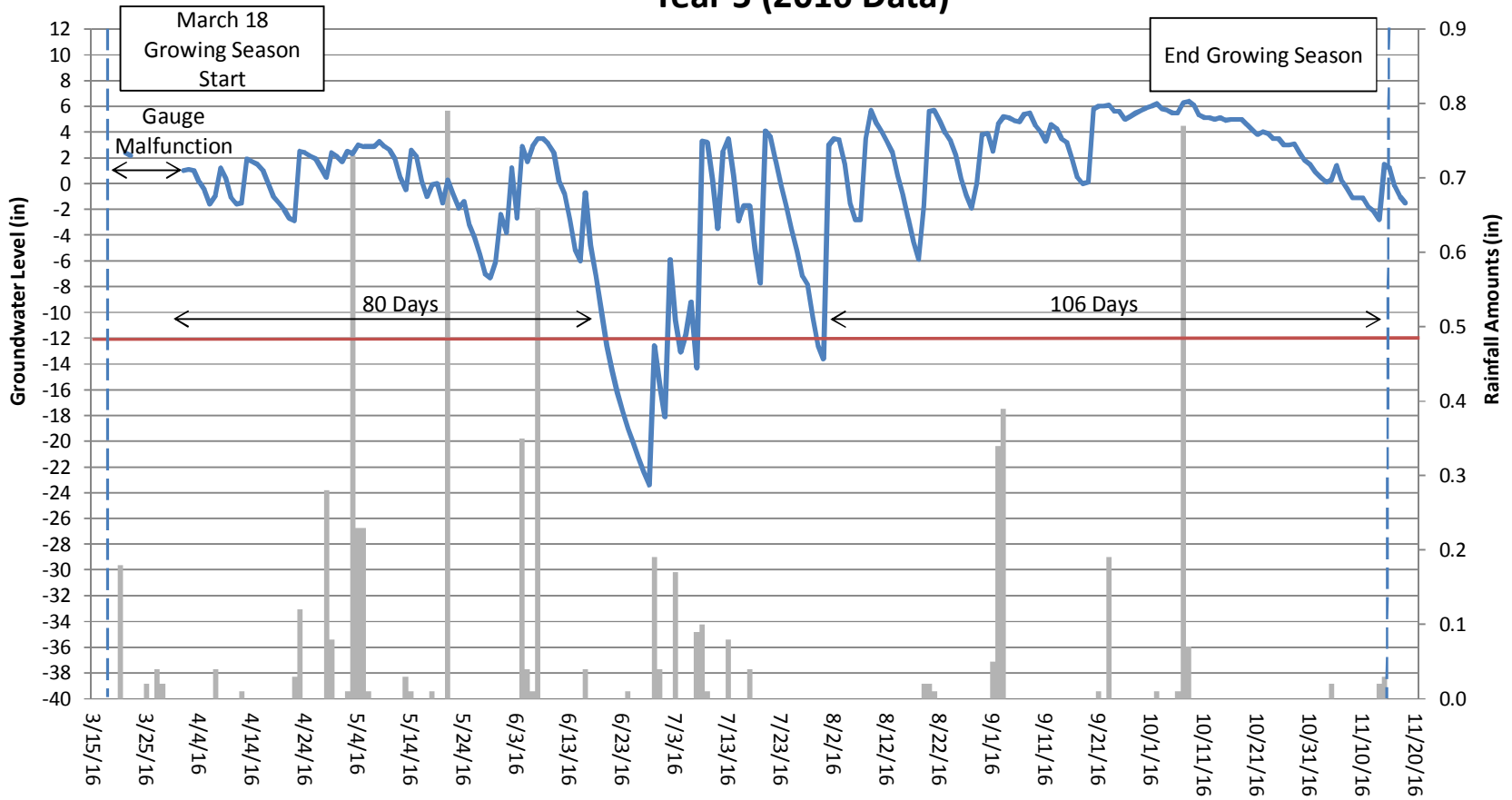
* Groundwater gauges were installed at the Site on March 24, six days after the published NRCS growing season start date (March 18). Therefore, Year 1 (2012) hydrology success criteria is proposed to use the USDA published growing season dates in place of the proposed biological and physical indicators of growing season as described for the Site.

**Based on biological and physical indicators for the site, February 7 was determined the start of the growing season for year 2 (2013) monitoring.

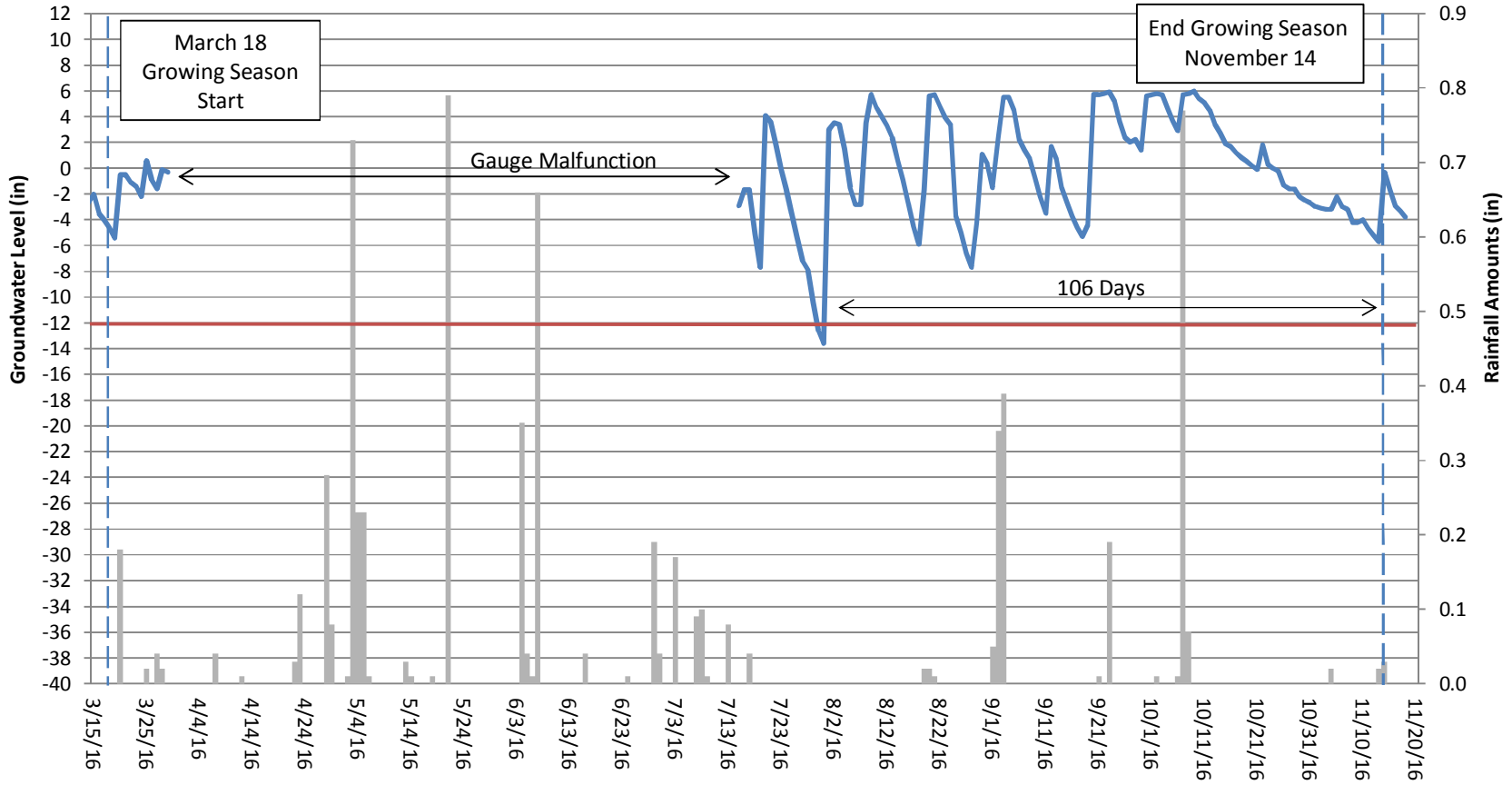
Sliver Moon Groundwater Gauge 1 Year 5 (2016 Data)



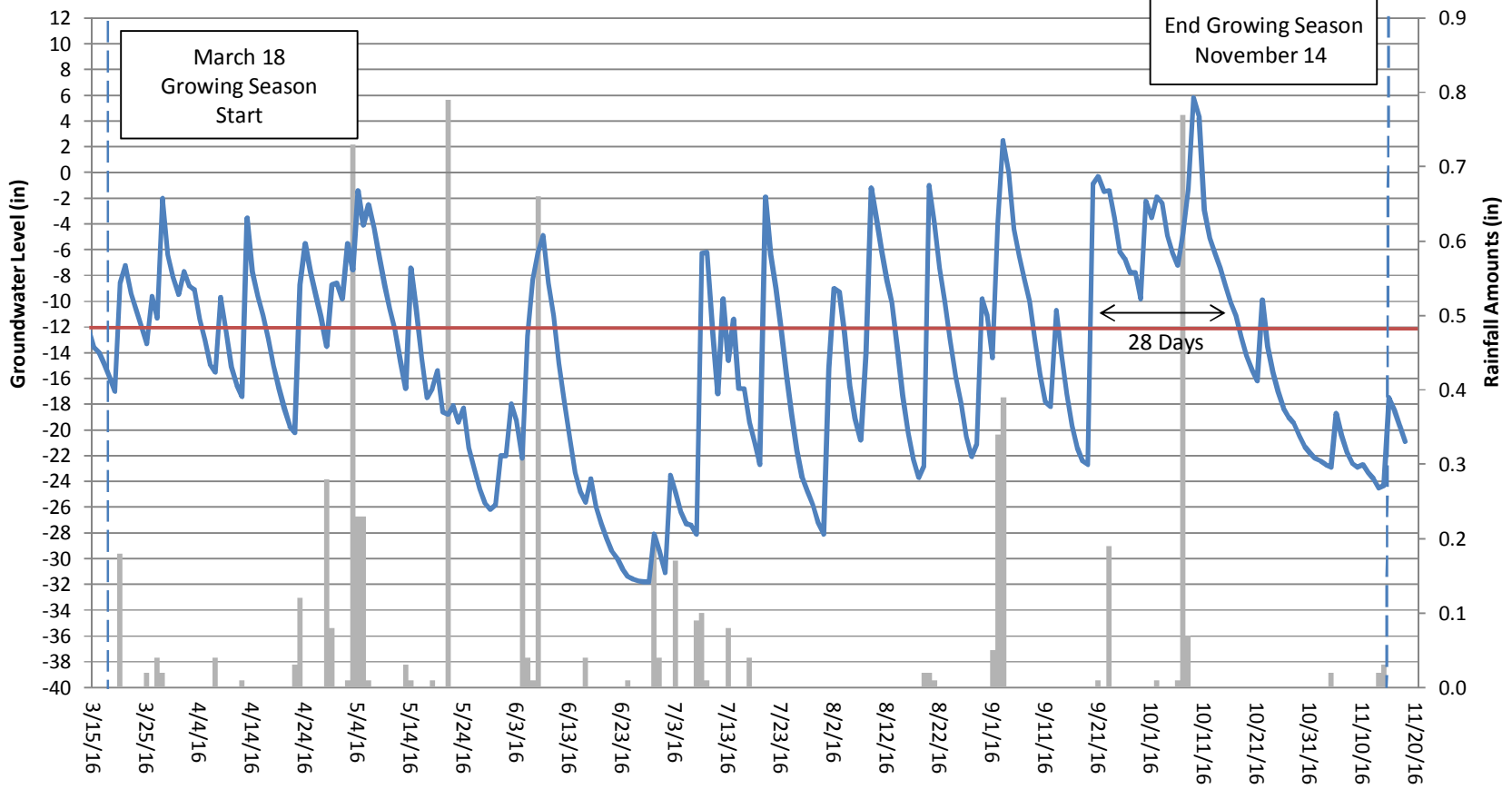
Sliver Moon Groundwater Gauge 2 Year 5 (2016 Data)



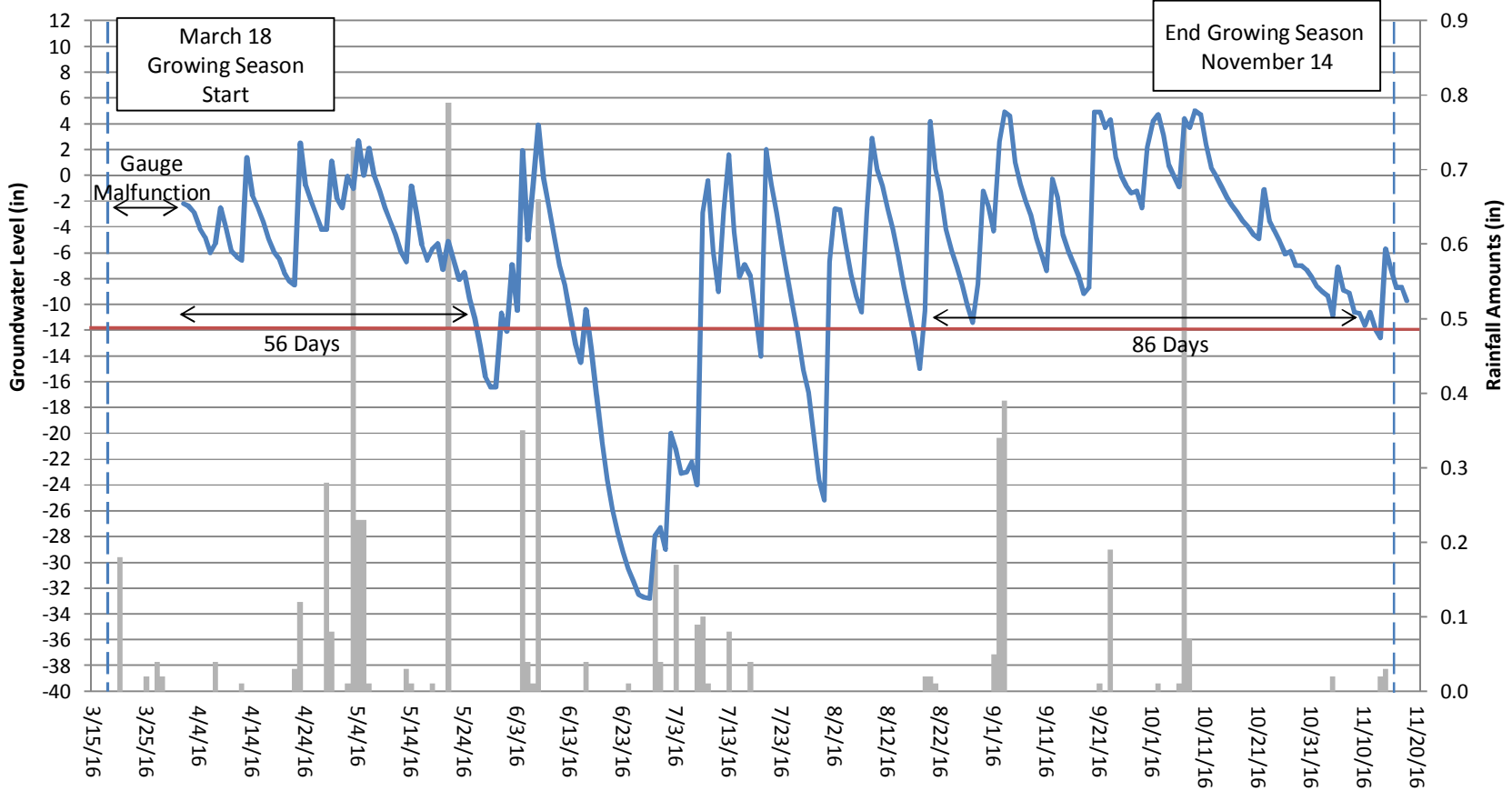
Sliver Moon Groundwater Gauge 3 Year 5 (2016 Data)



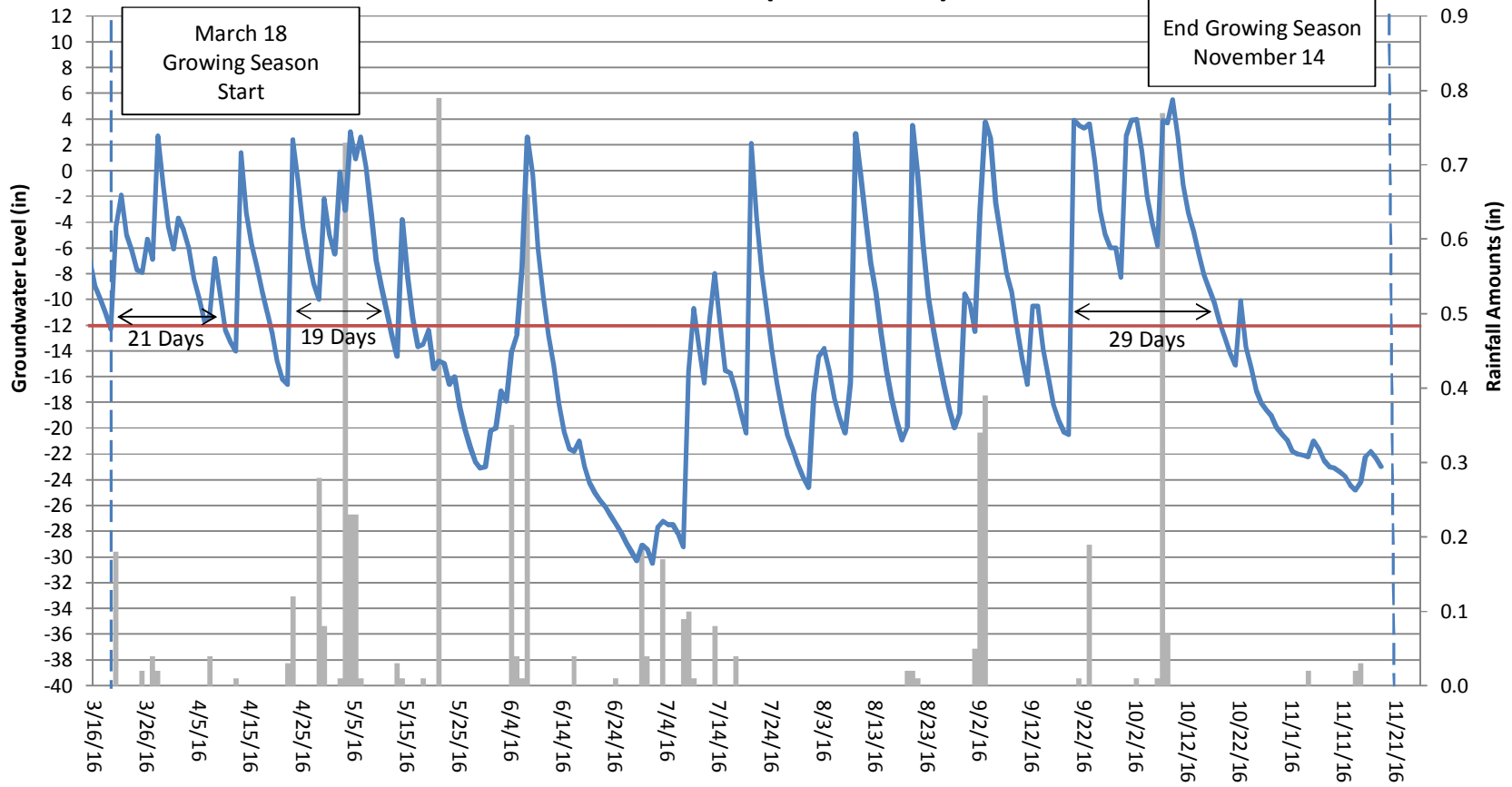
Sliver Moon Groundwater Gauge 4 Year 5 (2016 Data)



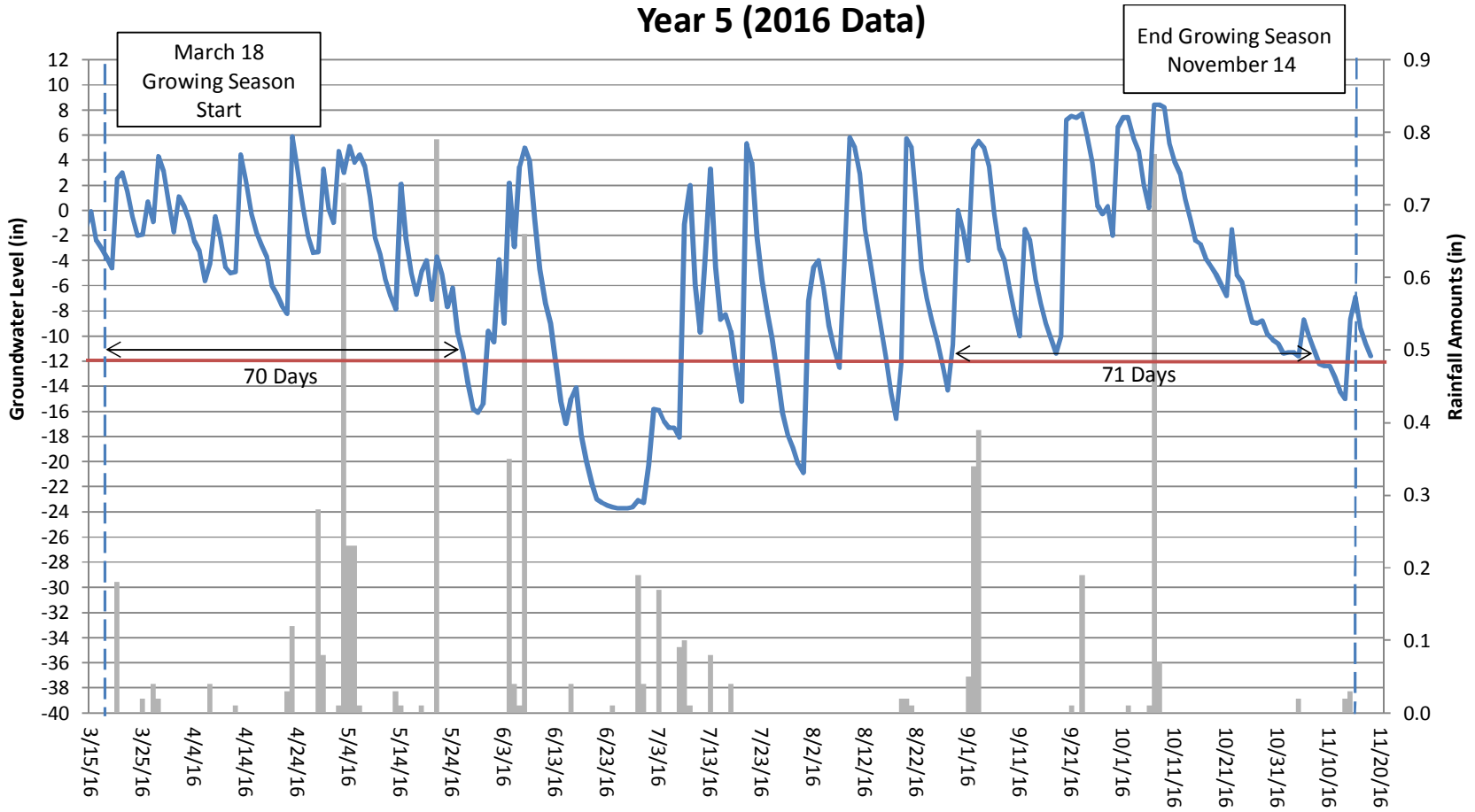
Sliver Moon Groundwater Gauge 5 Year 5 (2016 Data)



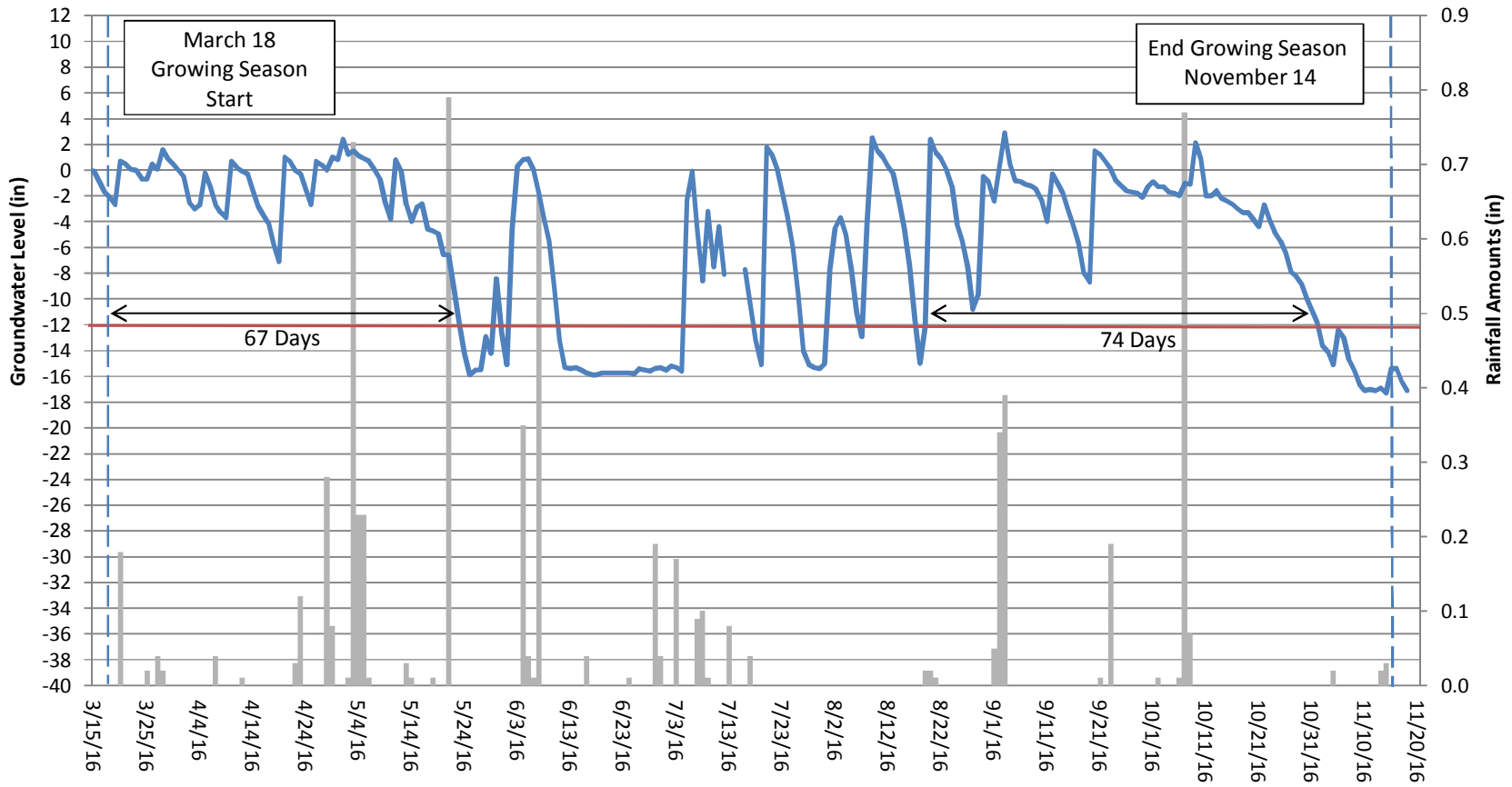
Sliver Moon Groundwater Gauge 6 Year 5 (2016 Data)



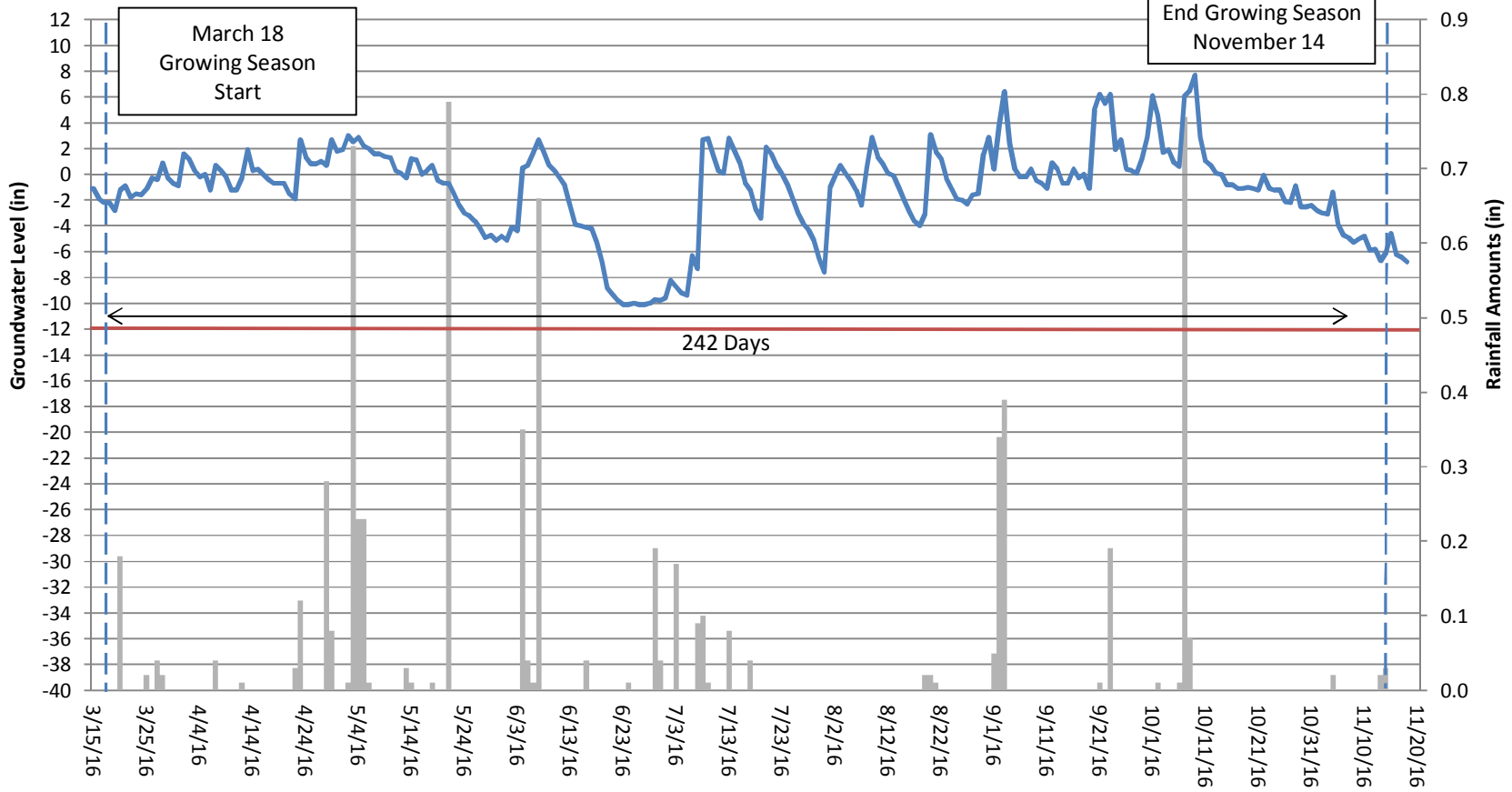
Sliver Moon Groundwater Gauge 7 Year 5 (2016 Data)



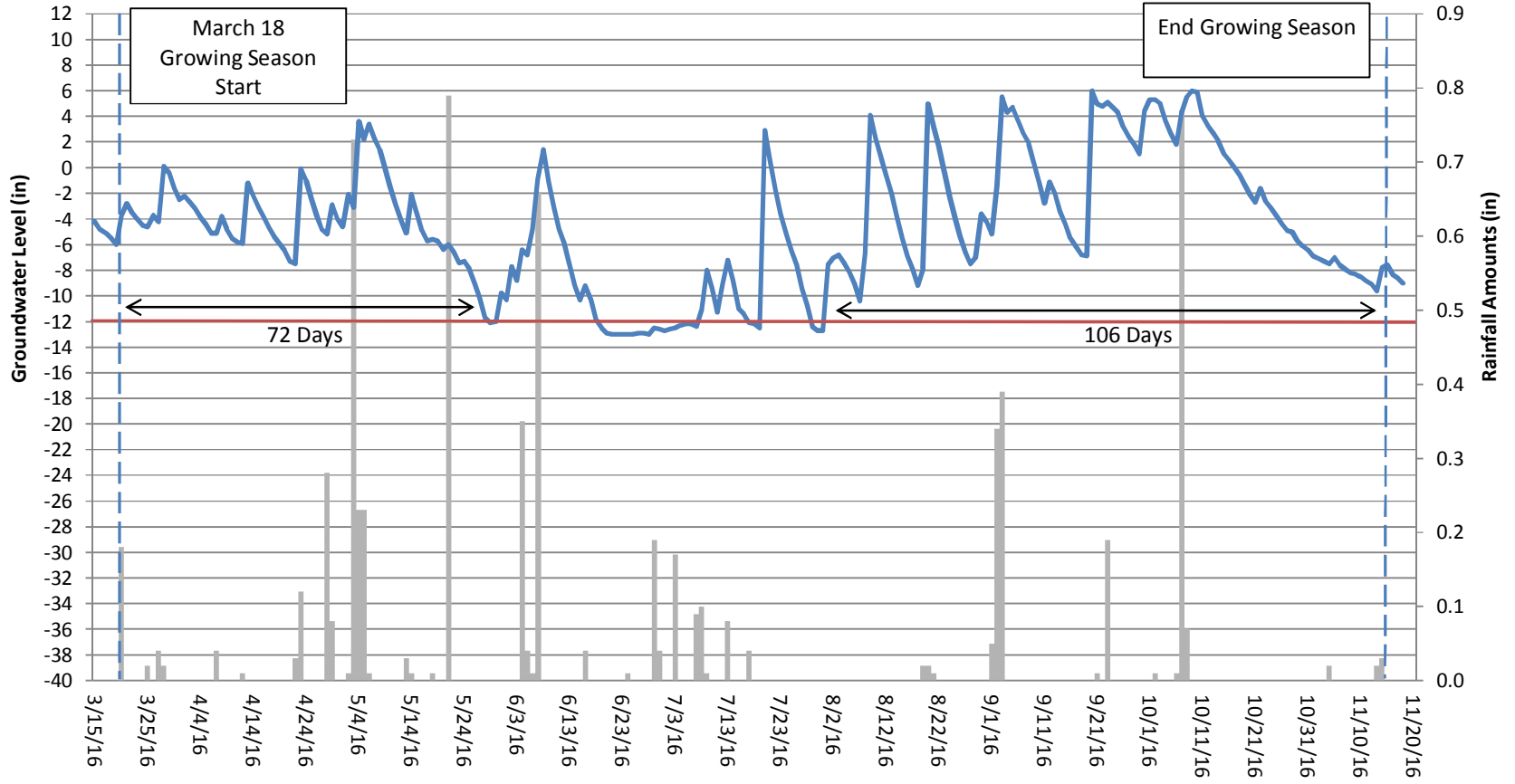
Sliver Moon Groundwater Gauge 8 Year 5 (2016 Data)



Sliver Moon Groundwater Gauge 9 Year 5 (2016 Data)



Sliver Moon Groundwater Gauge Reference Year 5 (2016 Data)



APPENDIX E
CREDIT RELEASE DOCUMENTATION

U.S. Army Corps of Engineers Credit Release Approval Letter