Bowl Basin Restoration Site
Monitoring Report MY05
DMS Project # 95721
DMS Contract # 005012

Onslow County, NC
CU# 03020106
DWR# 2013-0864
SAW# 2013-00393

Submitted to:

NCDMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Construction Completed: February 2015
Data Collection: 2019
Submitted: December 2019

Mitigation Project Name	**Bowl Basin**	**County**	**Onslow**	**USACE Action ID**	**2013-00393**
DMS ID	**95721**	**Date Project Instituted**	**11/30/2012**	**NCDWR Permit No**	**2013-0864**
River Basin	**White Oak**	**Date Prepared**	**6/13/2019**		
Cataloging Unit	**03020106**				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)										**11.700**				
Potential Credits (As-Built Survey)										**11.700**				
1 (Site Establishment)	**N/A**				N/A	N/A	**N/A**				**N/A**		N/A	N/A
2 (Year 0 / As-Built)	**30%**				N/A	N/A	**30%**			3.510	**30%**		2015	9/29/2015
3 (Year 1 Monitoring)	**10%**				N/A	N/A	**10%**			1.170	**10%**		2016	4/25/2016
4 (Year 2 Monitoring)	**10%**				N/A	N/A	**10%**			1.170	**15%**		2017	4/3/2017
5 (Year 3 Monitoring)	**10%**				N/A	N/A	**15%**			1.755	**20%**		2018	4/25/2018
6 (Year 4 Monitoring)	**5%**				N/A	N/A	**5%**			0.585	**10%**		2019	4/26/2019
7 (Year 5 Monitoring)	**10%**				N/A	N/A	**15%**				**15%**		2020	
8 (Year 6 Monitoring)	**5%**				N/A	N/A	**5%**				**N/A**		2021	
9 (Year 7 Monitoring)	**10%**				N/A	N/A	**10%**				**N/A**		2022	
Stream Bankfull Standard	**10%**				N/A	N/A	**N/A**				**N/A**			
Total Credits Released to Date										**8.190**				

NOTES:
1/16/2019: During the review of the Year 4 monitoring report, DMS discovered that the schedule of credit release was incorrect from what was in the final mitigation plan. The credit release schedule has been adjusted for the unreleased credits after 8/8/2018.

Contingencies (if any): None

Signature of Wilmington District Official Approving Credit Release

27 Sept 2019

Date

1 - For NCDMS, no credits are released during the first milestone
2 - For NCDMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCDMS Portal, provided the following criteria have been met:
1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Reciept of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met

Information from EEP Debit Ledger dated 09/09/2015

DEBITS (released credits only)

	Ratios	1	1.5	2.5	5	1	3	2	5	1	3	2	5	1	3	2	5
		Stream Restoration	Stream Enhancment I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)										**11.700**							
As-Built Amounts (mitigation credits)										**11.700**							
Percentage Released										**70%**							
Released Amounts (feet / acres)										**8.190**							
Released Amounts (credits)										**8.190**							
NCDWR Permit	USACE Action ID	Project Name															
Remaining Amounts (feet / acres)										**8.190**							
Remaining Amounts (credits)										**8.190**							

Information from EEP Debit Ledger dated 09/09/2015

Monitoring and Design Firm

4505 Falls of Neuse Road
Suite 400
Raleigh, NC 27609
Phone: (919) 278-2514
Fax: (919) 783-9266

Project Manager: Tim Morris
Email: tim.morris@kci.com
KCI Project No: 20122265

KCI ASSOCIATES OF NORTH CAROLINA, PA

ENGINEERS • SCIENTISTS • SURVEYORS • CONSTRUCTION MANAGERS

4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 (919) 783-9214 (919) 783-9266 Fax

MEMORANDUM

Date: February 6, 2020
To: Lindsay Crocker, DMS Project Manager
From: Adam Spiller, Project Manager
KCI Associates of North Carolina, PA
Subject: MY-05 Monitoring Report Comments
Bowl Basin DMS#95721, Contract 005012
White Oak River Basin CU 03030001
Onslow County, North Carolina

Please find below our responses in italics to the MY-05 Monitoring Report comments from NCDMS received on January 17, 2020, for the Bowl Basin Wetland Restoration Site.

1. Provide information about how the sweetgums were treated (i.e. mechanical or chemical). If available, insert a picture of the area of concern for sweetgum.
KCI Response: Sweetgum was treated by first cutting the sweetgum and then spraying the stumps with herbicide. A note explaining this has been added to the report as well as pictures taken of the treated area.

2. There is a 10' height requirement in the mitigation plan for this project. The report states that average tree heights are ~6.25'. If KCI does not think trees will be tall enough at MY7 it may be prudent to mention this in the narrative.
KCI Response: 53% of the planted stems on the site are over 5 ft tall while 30% are over 7.5 ft tall and 20% are over 9 ft tall. Based on these numbers and conditions at the site, KCI believes that the average tree height at the site will be greater than 10 ft after two more growing seasons.

3. Rainfall data presented in the table does not match the monitoring results narrative.
KCI Response: After double checking the rainfall data presented in the narrative, the 30/70 graph and the wetland hydrographs, no mismatch between data could be found.

4. Because some gauges are not meeting success criteria, it is recommended that KCI put a narrative explaining why this occurred and that explanation match the rainfall data. It may be prudent to look at all antecedent rainfall for October 2018-February 2019 because this typically drives hydrology. Also recommend determining if this is the closest rain gauge to the site.
KCI Response: The rainfall data presented is from the Albert J. Ellis Airport (KOAJ), which is located approximately 17.5 miles from the site. The closest rain station is the New River Marine Corps Air Station (MCAS), which is located approximately 16.5 miles from the site. The yearly rainfall total based on the KOAJ data was drier than any of the years recorded in the county WETS table (1945-2000) and the rainfall total based on the MCAS data would have qualified as the fourth driest year on record. This extremely low amount of rain is responsible for the low rates of success achieved this year.

5. The Mitigation Plan has a March 18-November 16 growing season, but the report shows growing season beginning on April 8. Check and update this as it may significantly influence results of this report.
   The growing season was erroneously reported as beginning April 8. This issue has been corrected.

Please contact me if you have any questions or would like clarification concerning these responses.

Sincerely,

Adam Spiller
Project Manager

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Bowl Basin Restoration Site (BBRS) is a full-delivery project that was developed for the North Carolina Division of Mitigation Services (DMS). Construction was completed in February 2015. The site is within the 03020106 Watershed Cataloging Unit (8-digit HUC) and the Local Watershed Unit (14-digit HUC) 03020106010010. In DMS' most recent publication of excluded and Targeted Local Watersheds/Hydrologic Units, the 03020106010010 14-digit HUC has been identified as a Targeted Local Watershed.

The project goals and objectives are listed below.

Project Goals

- Protect and improve water quality by reducing sediment and nutrient inputs
- The protection of a watershed draining into shellfish harvesting waters
- Provide habitat for aquatic flora and fauna by improving physical structure and vegetative composition
- Increase the local hydroperiod by encouraging both surface and subsurface storage and retention
- Restore and establish a functional and diverse wetland community

Project Objectives

- Fill field ditches to restore surface flow retention and elevate local groundwater levels.
- Redevelop longer wetland flow patterns to increase surface flow retention time.
- Restore a diverse wetland vegetation community through maintenance and germination of existing wetland seed stores, planting of wetland trees and shrubs, and incorporation of a custom wetland seed mix

The project site, which is protected by an 11.7-acre permanent conservation easement held by the State of North Carolina, is situated in Onslow County in the Carolina Flatwoods ecoregion of the Coastal Plains physiographic province. The site is located on a single parcel located off of White Oak River Road approximately 13.5 miles north of Jacksonville, North Carolina.

The BBRS provided mitigation for wetland impacts within Hydrologic Unit 03020106 by restoring 11.7 acres of wetland, generating 11.7 non-riparian wetland mitigation units (WMU's).

The BBRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. In the restoration areas, the wetland site will be deemed successful once hydrology is established and vegetation success criteria are met. The site will be monitored for at least seven years or until the success criteria are achieved.

2.0 MONITORING RESULTS

2.1 VEGETATION MONITORING

The success criteria for the planted species in the mitigation area will be based on the vegetative density estimated as woody stems/acre based on monitoring plot data. The site will demonstrate the re-establishment of targeted vegetative communities through the survival and growth of planted species and volunteer colonization, with an average stem density of 320 stems/acre after three years, 288 stems/acre after four years, 260 stems/acre after five years, and 210 stems/acre after seven years to be considered successful. To determine the success of the planted mitigation area, ten permanent vegetation monitoring plots (10 by 10 meters) have been established in the wetland restoration area at a density that represents the total mitigation acreage. The average density of these plots will determine whether the site meets the success criterion.

The fifth-year vegetation monitoring was based on the Level 2 CVS-EEP vegetation monitoring protocol. The site's average density for this monitoring period was 765 planted stems/acre. All ten plots had greater than 288 planted stems/acre. Including volunteers, the site averaged 4,019 total stems/acre. In general the site is well vegetated, with widespread herbaceous coverage and many tall, healthy, planted stems. Two of the ten plots (Plots 5 and 6) had greater than 100 sweetgum stems (*Liquidambar styraciflua*) growing in them and an additional five plots (Plots 1, 2, 4, 7, and 8) had between 35 and 75 sweetgum stems. With the exception of Plot 2, at least half of the sweetgums in each of these plots are less than 137 cm tall. The average height of the planted woody stems on the site is 192 cm, meaning that the sweetgums in these plots tend to be at least half a meter shorter than the planted stems, and in many cases are much shorter than the planted stems. In Plot 2, where most of the sweetgums are over 137 cm tall, there are 22 planted stems (890 stems/acre), with an average height of 268 cm. Since the majority of the sweetgum on the site are much smaller than the planted stems and do not seem to be negatively impacting the planted vegetation, they are not viewed as a threat to the site's success. Areas of the site that do contain dense areas of tall sweetgum were treated in the spring of 2017 and again during the spring of 2019. This treatment consisted of cutting the sweetgum and then spraying the stumps with an herbicide. This treatment will be repeated as necessary to ensure the sweetgum does not out-compete the planted stems.

2.2 HYDROLOGY MONITORING

Wetland hydrology will be monitored with a series of automatic gauges that record water table depth. The site must present continuous saturated or inundated hydrologic conditions for at least 9% of the growing season with a 50% probability of reoccurrence during normal weather conditions. A "normal" year is based on NRCS climatological data for Onslow County using the 30th to 70th percentile thresholds as the range of normal as documented in the USACE Technical Report "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology, April 2000." The growing season for Onslow County is considered to extend from March 18 to November 16 (244 days). The water table of the restored wetlands must be within 12" of the soil surface continuously for at least 9% (22 days) of the 244-day growing season. Wetland hydrology will be monitored with eight automatic gauges that record water table depth.

The wetland gauges will be checked and/or downloaded every other month. Daily data will be collected from the automatic gauges over the 7-year monitoring period.

The daily rainfall data was obtained from a local weather station in Jacksonville, NC; provided by the NC State Climate Office. For the 2019 year, the months of April, September, October, and November experienced average rainfall, while January, February, March, May, June, July, and August experienced

below average rainfall. No months experienced above average rainfall in 2019. Overall, the area experienced well below average rainfall during the 2019 growing season.

During the site's fifth growing season, only 3 of the 8 gauges had continuous saturation within 12 inches of the ground surface for 9% (22 days) of the 243 day growing season (March 18 to November 16). Overall the gauges on site averaged 19 days (7.8%) of continuous saturation. The low amount of gauges achieving success can be attributed to the extremely low rainfall amount that the site received in 2019.

3.0 METHODOLOGY

The CVS-EEP protocol, Level 2 (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data from the site. The vegetation monitoring was completed on July 15, 2019.

4.0 REFERENCES

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

USACE. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

Appendix A

Project Vicinity Map and Background Tables

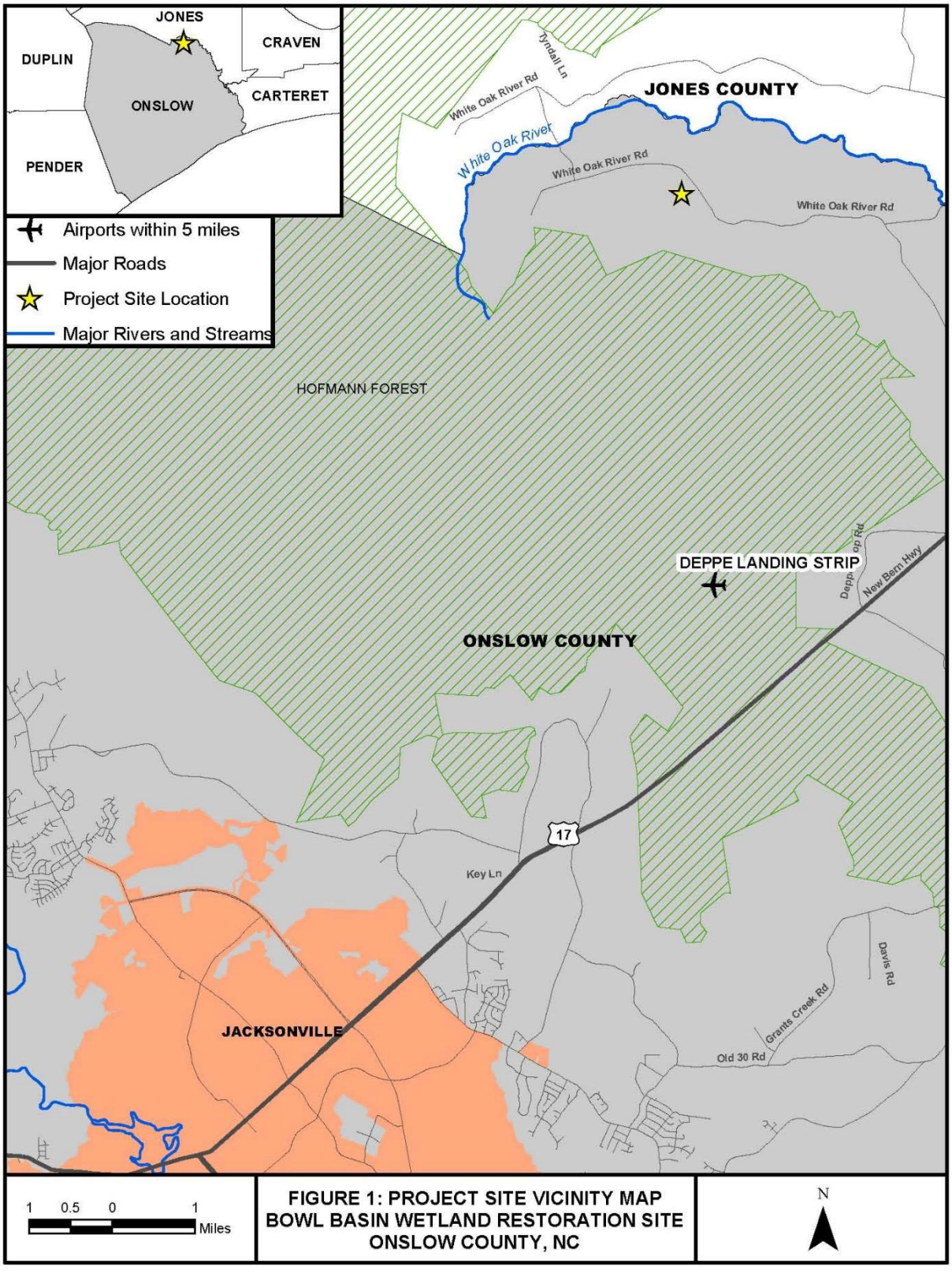

JONES
CRAVEN
DUPLIN
ONSLOW
CARTERET
PENDER
Airports within 5 miles
Major Roads
Project Site Location
Major Rivers and Streams
Tyndall Ln
White Oak River Rd
JONES COUNTY
White Oak River
White Oak River Rd
White Oak River Rd
HOFMANN FOREST
DEPPE LANDING STRIP
New Bern Hwy
ONSLOW COUNTY
17
Key Ln
Davis Rd
Grants Creek Rd
JACKSONVILLE
Old 30 Rd
1 0.5 0 1
Miles
FIGURE 1: PROJECT SITE VICINITY MAP
BOWL BASIN WETLAND RESTORATION SITE
ONSLOW COUNTY, NC
N

FIGURE 2: PROJECT SITE MITIGATION PLAN VIEW
BOWL BASIN WETLAND RESTORATION SITE
ONSLOW COUNTY, NC

Image Source: NC 2010 Statewide Orthoimagery.

Table 1. Project Components
Project Number and Name: 95721 – Bowl Basin Restoration Site

Mitigation Credits									
	Stream		**Riparian Wetland**		**Non-riparian Wetland**		**Buffer**	**Nitrogen Nutrient Offset**	**Phosphorous Nutrient Offset**
Type	R	RE	R	RE	R	RE			
Acres	-	-	-	-	11.7	-	-	-	-
Credits	-	-	-	-	11.7	-	-	-	-
TOTAL CREDITS	-		-		11.7		-	-	-

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**
Wetland Area	-	11.7 acres	-	Restoration	11.7 acres	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				11.7 acres		
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						
TOTAL	-	-	-	11.7 acres	-	-

Table 2. Project Activity & Reporting History Project Number and Name: 95721 - Bowl Basin Restoration Site		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Oct 2014
Final Design - Construction Plans		Dec 2014
Construction		March 2015
Planting		March 2015
Baseline Monitoring/Report	April 2015	May 2015
Vegetation Monitoring	May 20, 2015	
Photo Points	May 26, 2015	
Year 1 Monitoring	Nov 2015	Jan 2016
Vegetation Monitoring	Oct 16, 2015	
Photo Points	Oct 16, 2015	
Gauge Downloads	Nov 25, 2015	
Year 2 Monitoring	Nov 2016	Dec 2016
Vegetation Monitoring	June 30, 2016	
Photo Points	Aug 23, 2016	
Gauge Downloads	Nov 22, 2016	
Sweetgum Treatment	May 2017	
Year 3 Monitoring	Dec 2017	Jan 2018
Vegetation Monitoring	June 26, 2017	
Photo Points	Nov 30, 2017	
Gauge Downloads	Dec 1, 2017	
Year 4 Monitoring	Nov 2018	Dec 2018
Vegetation Monitoring	N/A	
Photo Points	Nov 13, 2018	
Gauge Downloads	Nov 13, 2018	
Sweetgum Treatment	May 2019	
Year 5 Monitoring	Nov 2019	Dec 2019
Vegetation Monitoring	July 15, 2019	
Photo Points	Nov 20, 2019	
Gauge Downloads	Nov 20, 2019	

Table 3. Project Contacts Project Number and Name: 95721 - Bowl Basin Restoration Site	
Design Firm	KCI Associates of North Carolina, PC 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	KCI Environmental Technologies and Construction, Inc. 4505 Falls of Neuse Road Suite 400. Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Planting Contractor	Bruton Nurseries and Landscapes PO Box 1197 Freemont, NC 27830 Contact: Mr. Charlie Bruton Phone: (919) 242-6555
Monitoring Performers	
MY00-MY05	KCI Associates of North Carolina, PC 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table Project Number and Name: 95721 – Bowl Basin Restoration Site			
County	Onslow County		
Project Area (acres)	11.7 acres		
Project Coordinates (lat. and long.)	34.925365 N , -77.607461 W		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	White Oak		
USGS Hydrologic Unit 8-digit	03020106	**USGS Hydrologic Unit 14-digit**	03020106010010
DWQ Sub-basin	03-05-01b		
Project Drainage Area (acres)	76.0 acres		
Project Drainage Area Percentage of Impervious Area	1%		
CGIA Land Use Classification	94% Cultivated, 4% Forest, and 2% Low-Intensity Development		
Wetland Summary Information			
Parameters	**Wetland Area**		
Size of Wetland (acres)	11.7 acres		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian		
Mapped Soil Series	Pantego loam by detailed soil investigation		
Drainage class	Poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Groundwater / Precipitation		
Hydrologic Impairment	Ditching and Crops		
Native vegetation community	Crops		
Percent composition of exotic invasive vegetation	0%		

Appendix B

Visual Assessment Data

LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- VEG PLOT TOTAL / PLANTED STEM DENSITY ····· 4019/765
- WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION
- WETLAND GAUGE BELOW HYDROLOGIC CRITERION
- PHOTO POINT (PP)
- FILLED DITCHES
- CONSERVATION EASEMENT =
  NONRIPARIAN WETLAND RESTORATION = 11.7 ACRES
- SWEETGUM TREATMENT (2017 & 2019)

IMAGE SOURCE: NC 2016 ORTHOIMAGERY

VEG PLOT #1 4816/769
PP1
GAUGE#1
VEG PLOT #2 3459/890
GAUGE#2
VEG PLOT #3 1619/728
PP2
GAUGE#3
VEG PLOT #4 4087/850
VEG PLOT #5 9227/890
GAUGE#4
PP3
VEG PLOT #10 1983/850
GAUGE#5
VEG PLOT #9 1983/526
GAUGE#8
PP6
VEG PLOT #8 3197/648
PP5
VEG PLOT #7 4006/607
GAUGE#7
GAUGE#6
VEG PLOT #6 5968/890
PP4
CORNWALLIS ROAD

NC GRID NAD 1983

–60′ –30′ 0′ 60′ 120′
GRAPHIC SCALE

REVISIONS

DESCRIPTION	DATE
SYM.	

NCDEQ DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD
RALEIGH, NORTH CAROLINA 27609

BOWL BASIN
RESTORATION SITE
DMS PROJECT #95721
ONSLOW COUNTY, NORTH CAROLINA
MONITORING YEAR 05

DATE: DEC 2019
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 1
FIGURE 3

Table 5. Vegetation Condition Assessment

Project Number and Name: 95721 – Bowl Basin Restoration Site

Planted Acreage 11.7 **Easement Acreage 11.7**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Area of Dense Sweetgum	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	1	1.54	13.2%
6. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo Reference Points

PP1 – MY-00 – 5/20/15

PP1 – MY-05 – 11/20/19

PP2 – MY-00 – 5/20/15

PP2 – MY-05 – 11/20/19

PP3 – MY-00 – 5/20/15

PP3 – MY-05 – 11/20/19

PP4 – MY-00 – 5/20/15

PP4 – MY-05 – 11/20/19

PP5 – MY-00 – 5/20/15

PP5 – MY-05 – 11/20/19

PP6 – MY-00 – 5/20/15

PP6 – MY-05 – 11/20/19

Vegetation Monitoring Plot Photos

Vegetation Plot 1 – MY-05 – 7/15/19

Vegetation Plot 2 – MY-05 – 7/15/19

Vegetation Plot 3 – MY-05 – 7/15/19

Vegetation Plot 4 – MY-05 – 7/15/19

Vegetation Plot 5 – MY-05 – 7/15/19

Vegetation Plot 6 – MY-05 – 7/15/19

Vegetation Plot 7 – MY-05 – 7/15/19

Vegetation Plot 8 – MY-05 – 7/15/19

Vegetation Plot 9 – MY-05 – 7/15/19

Vegetation Plot 10 – MY-05 – 7/15/19

Sweetgum Treatment Area Photos

Sweetgum treatment area, just after treatment – 5/9/19

Sweetgum treatment area, just after treatment – 5/9/19

Appendix C
Vegetation Plot Data

Table 6. Vegetation Plot Criteria Attainment Project Number and Name: 95721 - Bowl Basin Restoration Site			
Vegetation Plot ID	**Vegetation Survival Threshold Met? (288 planted stems/acre)**	**Monitoring Year 05 Planted Stem Density (stems/acre)**	**Monitoring Year 05 Total Stem Density (stems/acre)**
1	Yes	769	4,816
2	Yes	890	3,359
3	Yes	728	1,619
4	Yes	950	4,087
5	Yes	980	9,227
6	Yes	980	5,908
7	Yes	607	4,006
8	Yes	648	3,197
9	Yes	526	1,983
10	Yes	850	1,983

Table 7. CVS Vegetation Plot Metadata Project Number and Name: 95721 - Bowl Basin Wetland Restoration Site	
Report Prepared By	Angela Guiterrez
Date Prepared	8/3/2019 14:38
database name	KCI-2015-95721_Bowl Basin.mdb
database location	M:\2012\20122939 Bowl Basin FDP\Monitoring\Veg Database
computer name	12-3ZV4FP1
file size	62558208
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	
project Name	Bowl Basin Wetland Restoration Site
Description	Wetland Restoration Site
River Basin	White Oak
Sampled Plots	

Table 8. CVS Stem Count Total and Planted by Plot and Speceies

DMS Project Code 95721. Project Name: Bowl Basin

			Current Plot Data (MY5 2019)																												
			95721-01-0001			95721-01-0002			95721-01-0003			95721-01-0004			95721-01-0005			95721-01-0006			95721-01-0007			95721-01-0008			95721-01-0009			95721-01-0010		
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**
Acer negundo	boxelder	Tree																													
Acer rubrum	red maple	Tree			1												2								1			1			
Baccharis	baccharis	Shrub																													
Baccharis halimifolia	eastern baccharis	Shrub			5									1						2			8			9			3			
Betula nigra	river birch	Tree				1	1	1	1	1	1	6	6	6	1	1	1							7	7	7				9	9	9
Celtis occidentalis	common hackberry	Tree																													
Cephalanthus occidentalis	common buttonbush	Shrub																			4	4	5	2	2	4	4	4	5			
Diospyros virginiana	common persimmon	Tree									1																				
Fraxinus pennsylvanica	green ash	Tree	5	5	5	6	6	6	10	10	10	9	9	9	11	11	11	3	3	3	4	4	5				1	1	1	7	7	7
Juglans nigra	black walnut	Tree						5									1														
Liquidambar styraciflua	sweetgum	Tree			37			45			9			74			188			110			59			35			11			10
Magnolia virginiana	sweetbay	Tree	2	2	2	2	2	2																1	1	1	1	1	1			
Morella cerifera	wax myrtle	shrub			1																					2			1			
Myrica	sweetgale	shrub																													
Nyssa aquatica	water tupelo	Tree													5	5	5	1	1	3							1	1	1			
Nyssa biflora	swamp tupelo	Tree	2	2	2																									3	3	3
Pinus taeda	loblolly pine	Tree			55			10			11			5			12			10			10			10			11			18
Quercus michauxii	swamp chestnut oak	Tree				6	6	6	2	2	2																3	3	3	1	1	1
Quercus nigra	water oak	Tree			1																											
Quercus pagoda	cherrybark oak	Tree				1	1	1	2	2	2	2	2	2	2	2	2													1	1	1
Quercus phellos	willow oak	Tree				6	6	6				4	4	4	1	1	1															
Quercus shumardii	Shumard's oak	Tree																													
Salix	willow	Shrub or Tree																													
Salix alba	white willow	Exotic																													
Salix nigra	black willow	Tree						1			1						3						5			4			8			
Taxodium distichum	bald cypress	Tree	10	10	10				3	3	3				2	2	2	18	18	18	7	7	7	6	6	6	3	3	3			
		Stem count	19	19	119	22	22	83	18	18	40	21	21	101	22	22	228	22	22	146	15	15	99	16	16	79	13	13	49	21	21	49
		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	4	4	10	6	6	10	5	5	9	4	4	7	6	6	11	3	3	6	3	3	7	4	4	10	6	6	12	5	5	7
		Stems per ACRE	769	769	4816	890	890	3359	728	728	1619	850	850	4087	890	890	9227	890	890	5908	607	607	4006	647	647	3197	526	526	1983	850	850	1983

Table 8. CVS Stem Count Total and Planted by Plot and Speceies

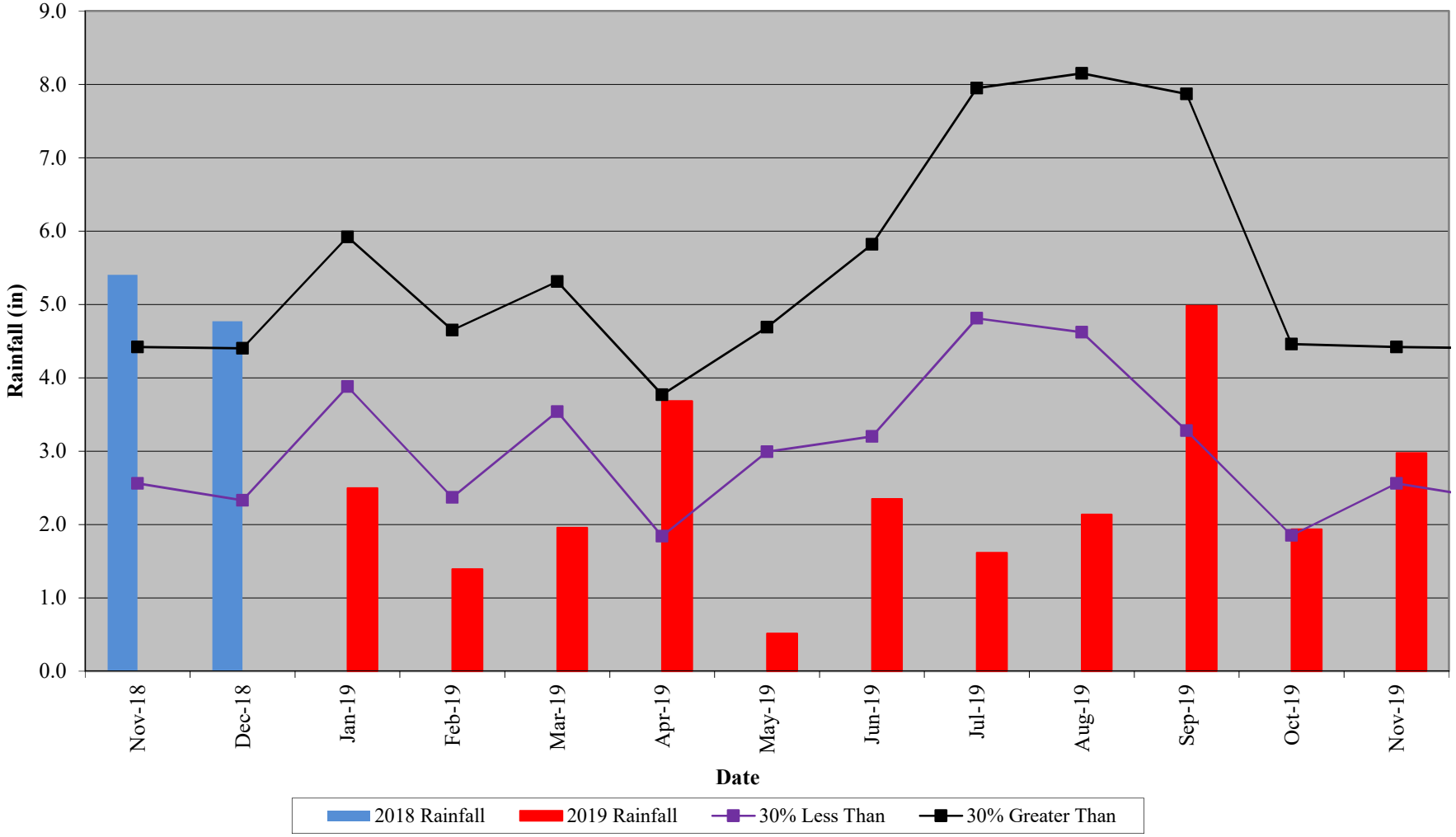
DMS Project Code 95721. Project Name: Bowl Basin

			Annual Means													
			MY5 (2019)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
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**
Acer negundo	boxelder	Tree									1						
Acer rubrum	red maple	Tree			5			2			2			1			
Baccharis	baccharis	Shrub									7						
Baccharis halimifolia	eastern baccharis	Shrub			28			12									
Betula nigra	river birch	Tree	25	25	25	26	26	26	27	27	27	27	27	27	22	22	22
Celtis occidentalis	common hackberry	Tree									1						
Cephalanthus occidentalis	common buttonbush	Shrub	10	10	14	10	10	10	10	10	10	12	12	12	11	11	11
Diospyros virginiana	common persimmon	Tree			1			1			1						
Fraxinus pennsylvanica	green ash	Tree	56	56	57	55	55	56	57	57	57	55	55	59	51	51	51
Juglans nigra	black walnut	Tree			6			4			5			2			
Liquidambar styraciflua	sweetgum	Tree			578			437			417			280			
Magnolia virginiana	sweetbay	Tree	6	6	6	6	6	6	5	5	5	4	4	4	4	4	4
Morella cerifera	wax myrtle	shrub			4			3									
Myrica	sweetgale	shrub									2						
Nyssa aquatica	water tupelo	Tree	7	7	9	8	8	8	8	8	8	7	7	7	7	7	7
Nyssa biflora	swamp tupelo	Tree	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3
Pinus taeda	loblolly pine	Tree			152			100			25						
Quercus michauxii	swamp chestnut oak	Tree	12	12	12	12	12	12	13	13	13	12	12	12	15	15	15
Quercus nigra	water oak	Tree			1												
Quercus pagoda	cherrybark oak	Tree	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7
Quercus phellos	willow oak	Tree	11	11	11	12	12	12	11	11	11	9	9	11	9	9	9
Quercus shumardii	Shumard's oak	Tree							1	1	1	1	1	1	2	2	2
Salix	willow	Shrub or Tree									1						
Salix alba	white willow	Exotic									1						
Salix nigra	black willow	Tree			22			8			1	1	1	2			
Taxodium distichum	bald cypress	Tree	49	49	49	49	49	49	47	47	48	48	48	48	45	45	45
		Stem count	189	189	993	191	191	759	191	191	656	188	188	478	176	176	176
		size (ares)	10			10			10			10			10		
		size (ACRES)	0.25			0.25			0.25			0.25			0.25		
		Species count	10	10	19	10	10	18	11	11	23	12	12	15	11	11	11
		Stems per ACRE	765	765	4019	773	773	3072	773	773	2655	761	761	1934	712	712	712

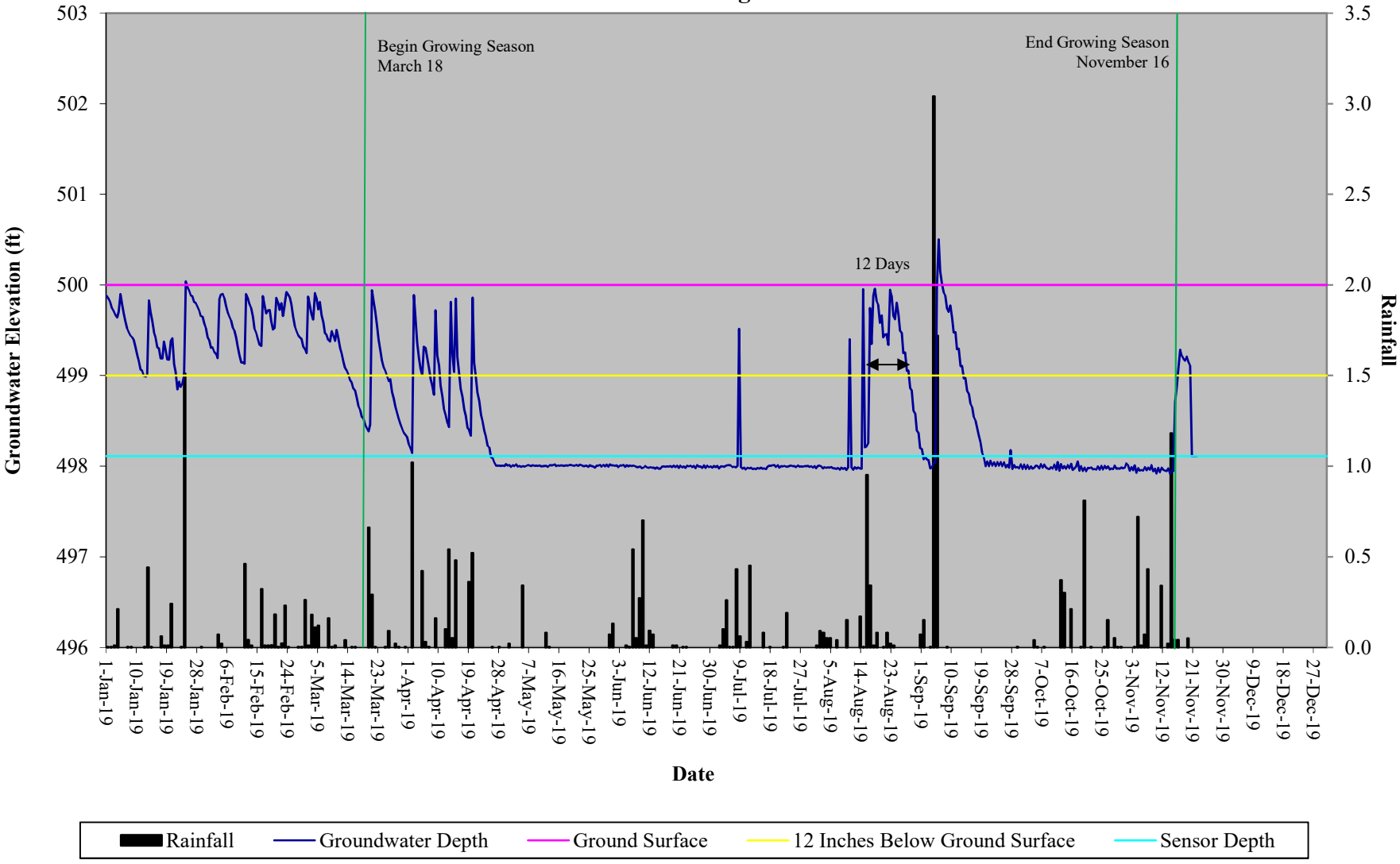
Appendix D

Hydrologic Data

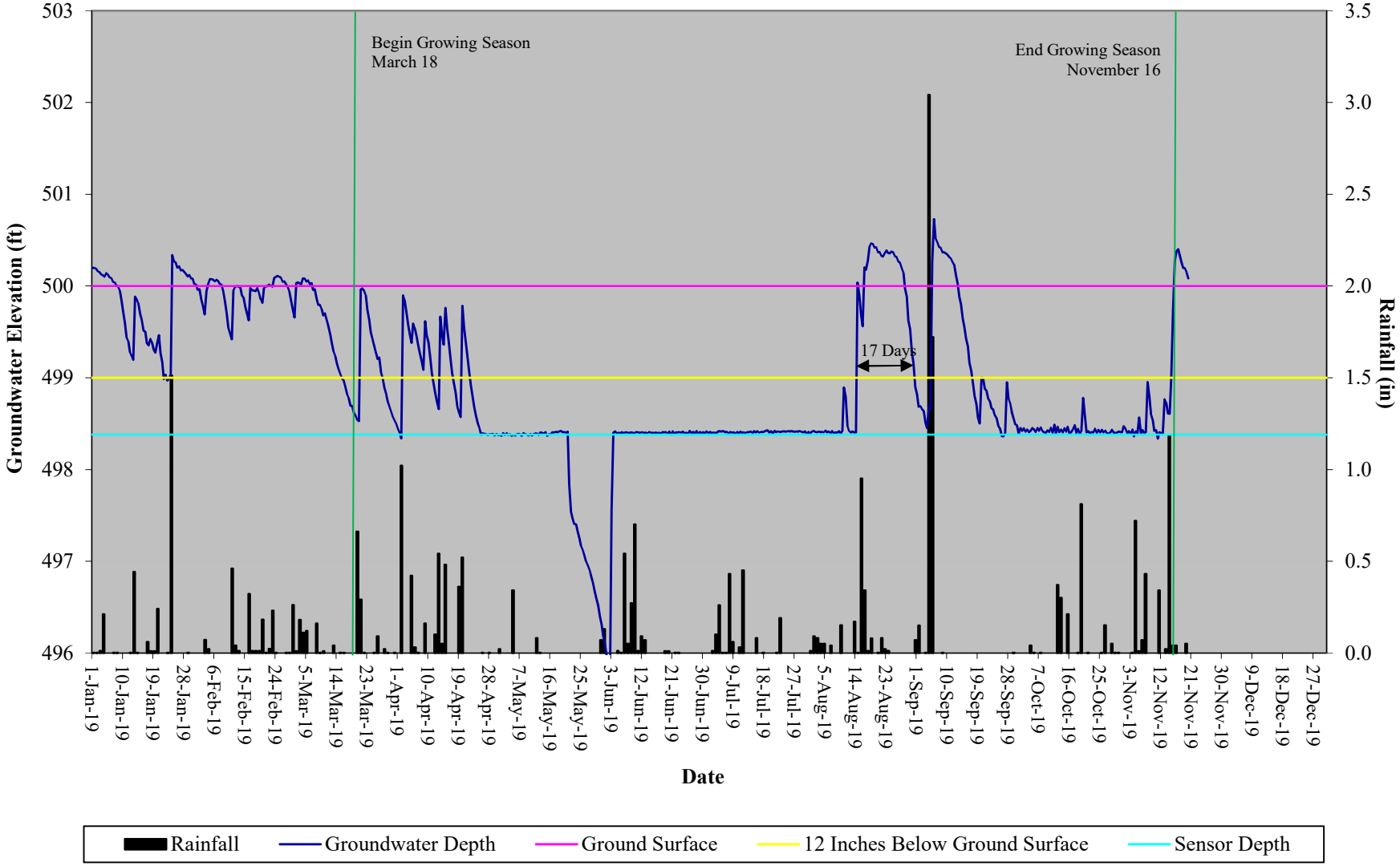
Bowl Basin Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Maysville, NC

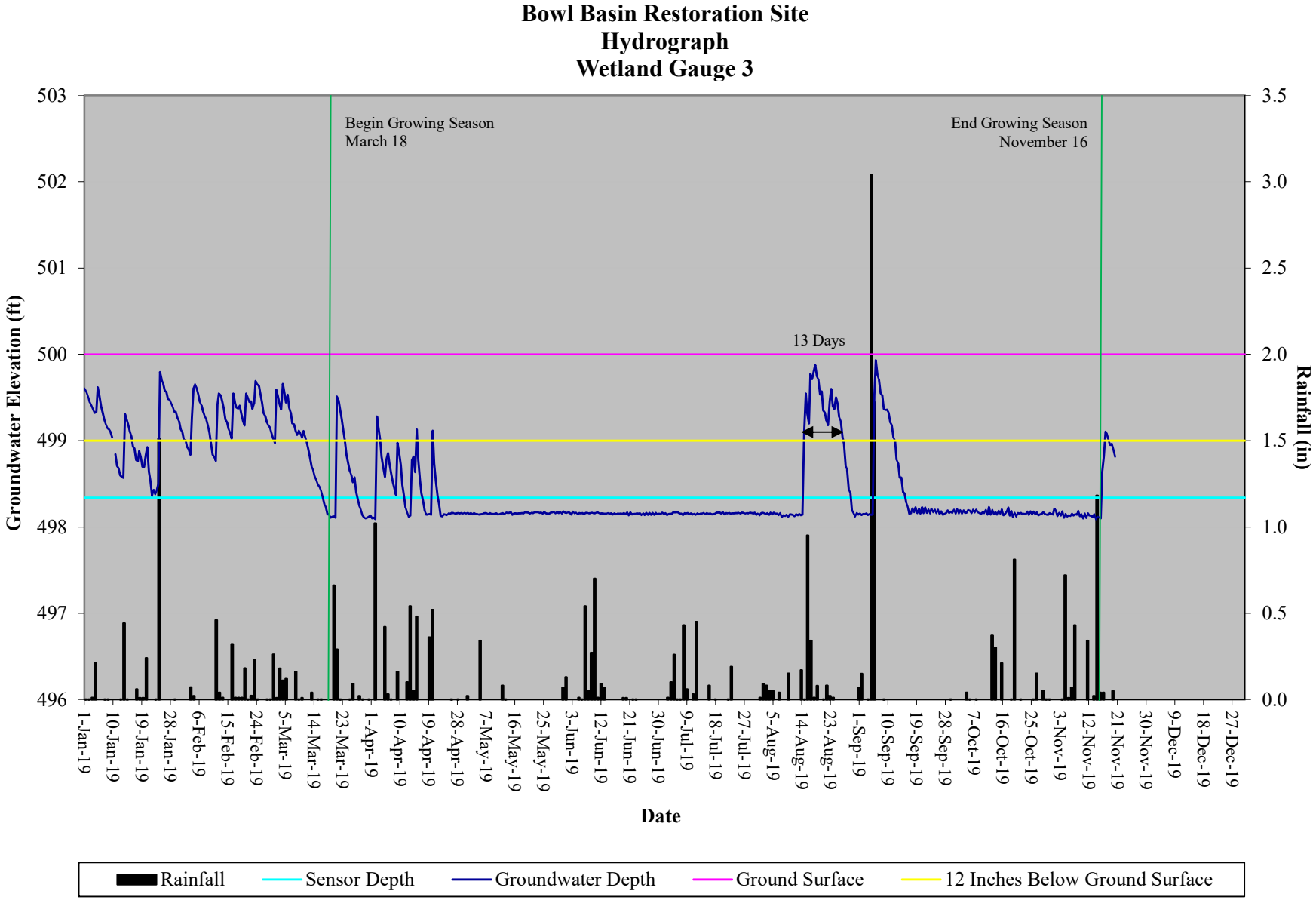


Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 1

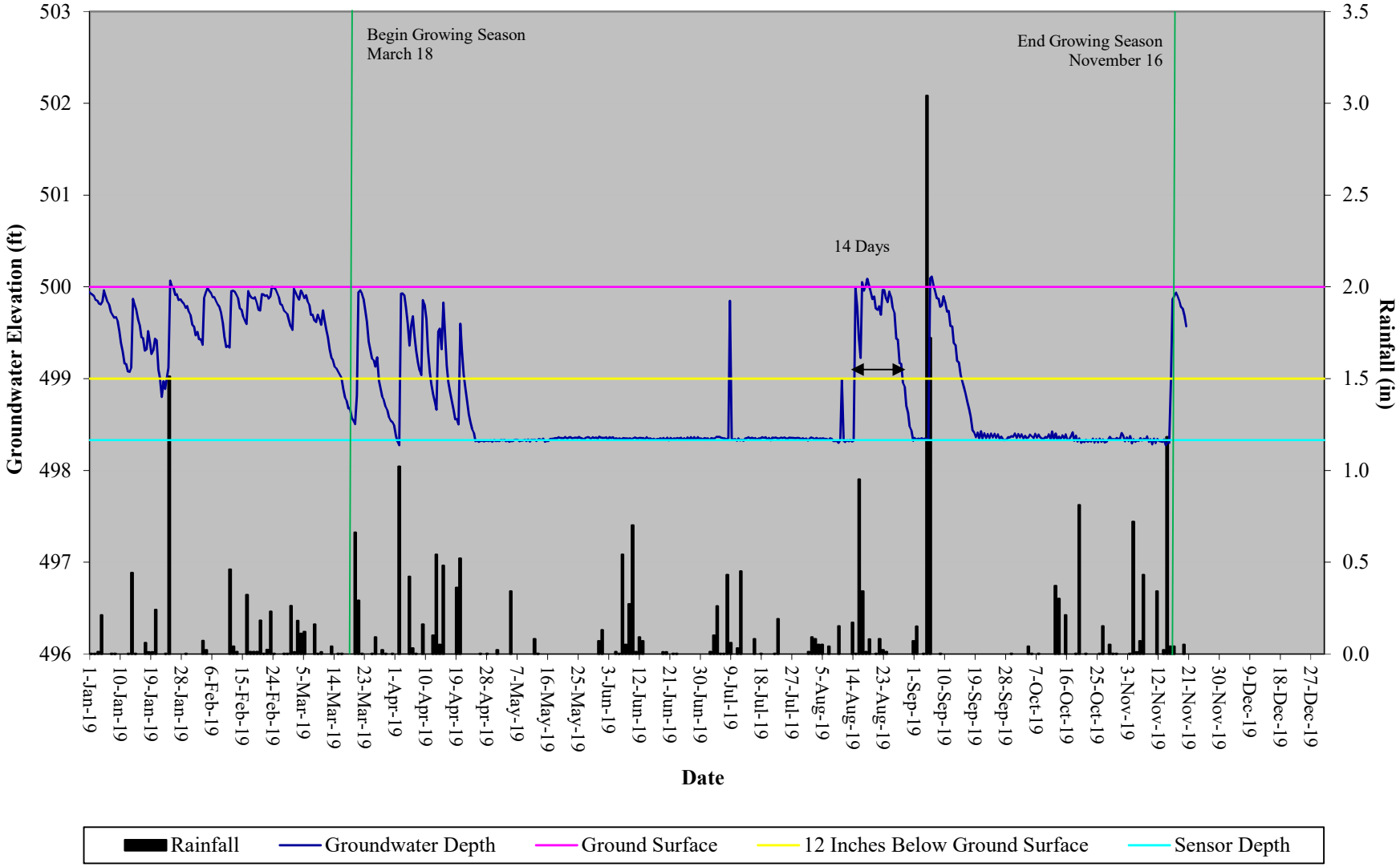


Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 2

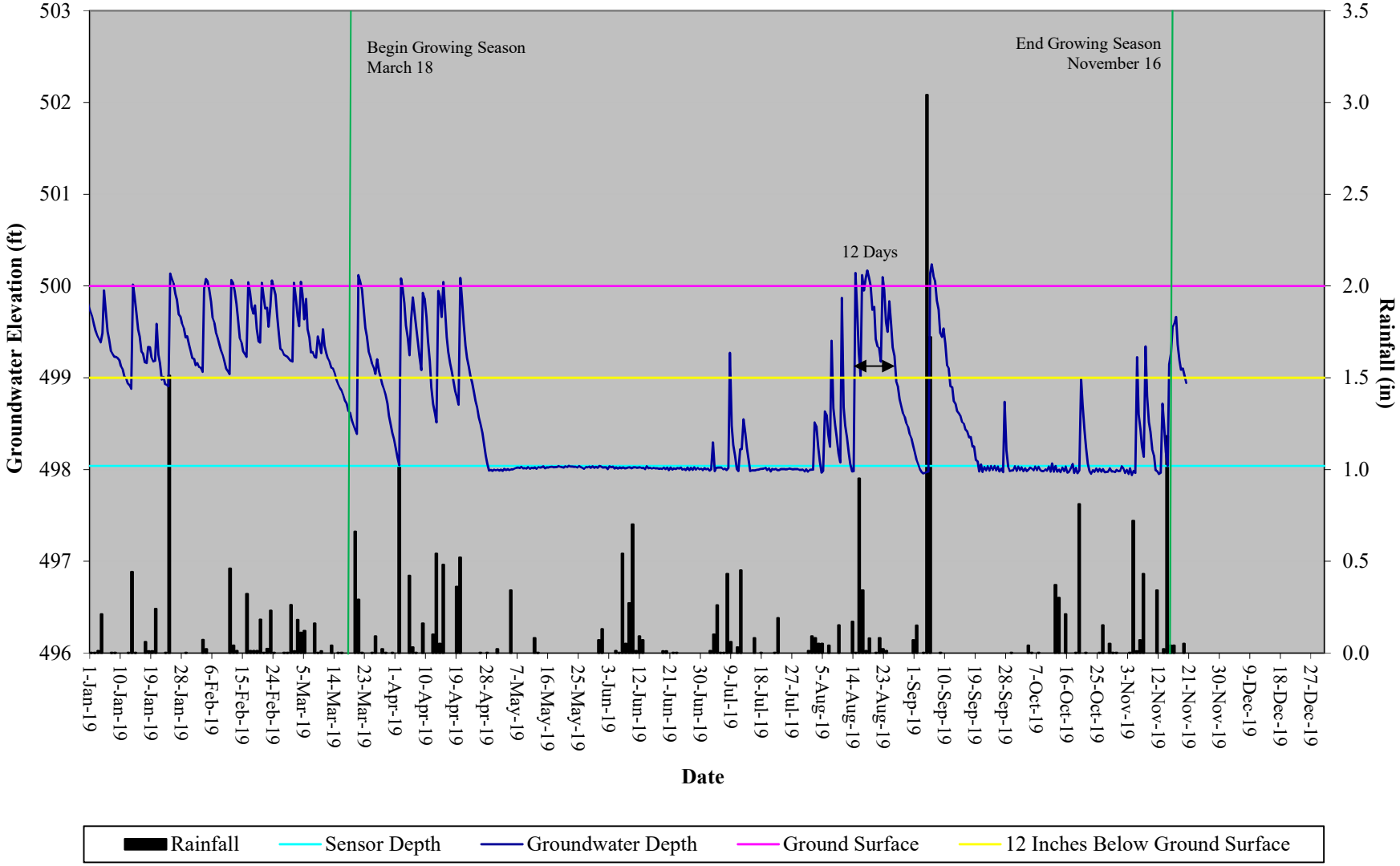



Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 3
Begin Growing Season
March 18
End Growing Season
November 16
13 Days
Groundwater Elevation (ft)
Rainfall (in)
Date
503
502
501
500
499
498
497
496
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1-Jan-19
10-Jan-19
19-Jan-19
28-Jan-19
6-Feb-19
15-Feb-19
24-Feb-19
5-Mar-19
14-Mar-19
23-Mar-19
1-Apr-19
10-Apr-19
19-Apr-19
28-Apr-19
7-May-19
16-May-19
25-May-19
3-Jun-19
12-Jun-19
21-Jun-19
30-Jun-19
9-Jul-19
18-Jul-19
27-Jul-19
5-Aug-19
14-Aug-19
23-Aug-19
1-Sep-19
10-Sep-19
19-Sep-19
28-Sep-19
7-Oct-19
16-Oct-19
25-Oct-19
3-Nov-19
12-Nov-19
21-Nov-19
30-Nov-19
9-Dec-19
18-Dec-19
27-Dec-19
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

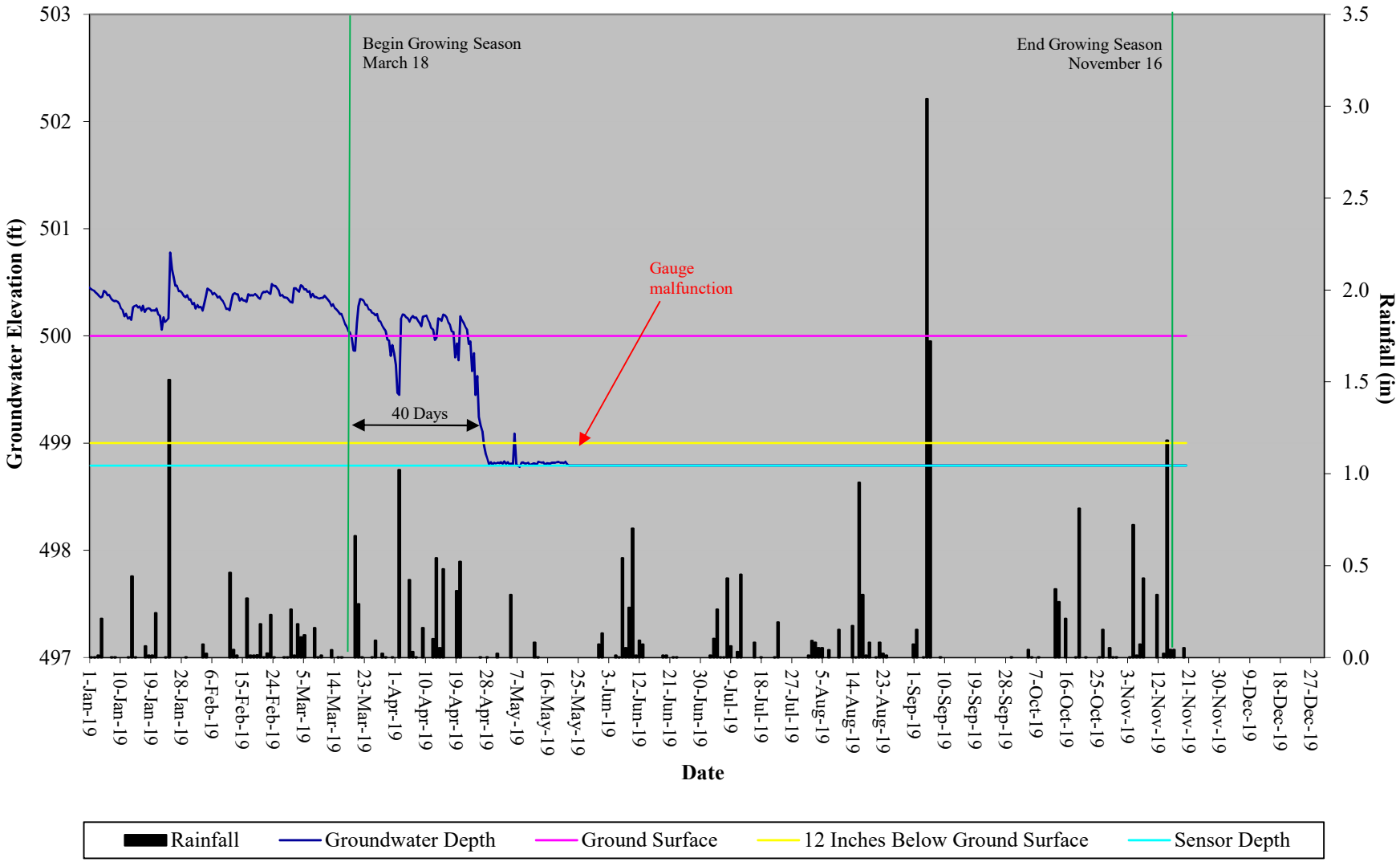
Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 4



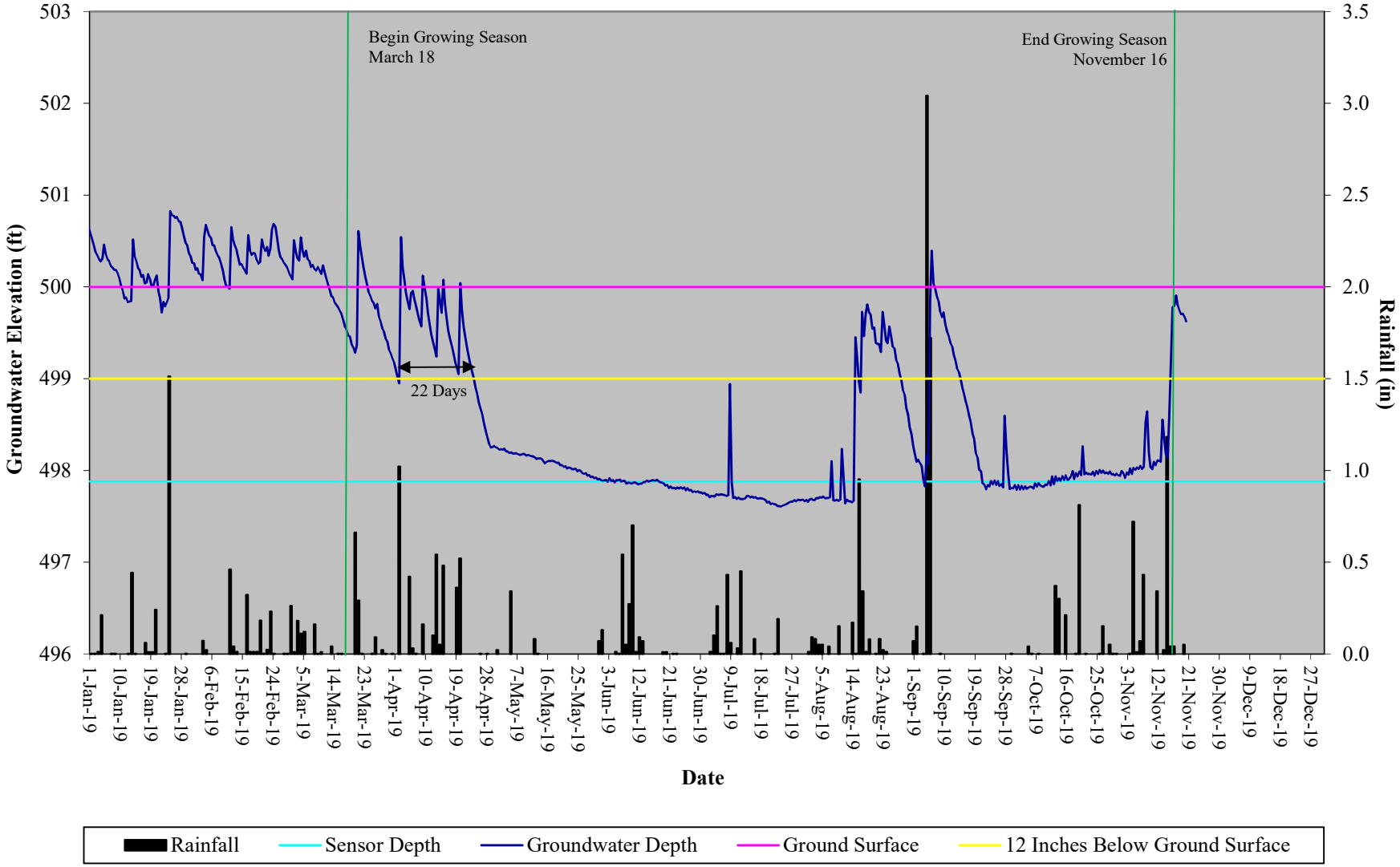
Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 5



Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 6



Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 7



Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 8

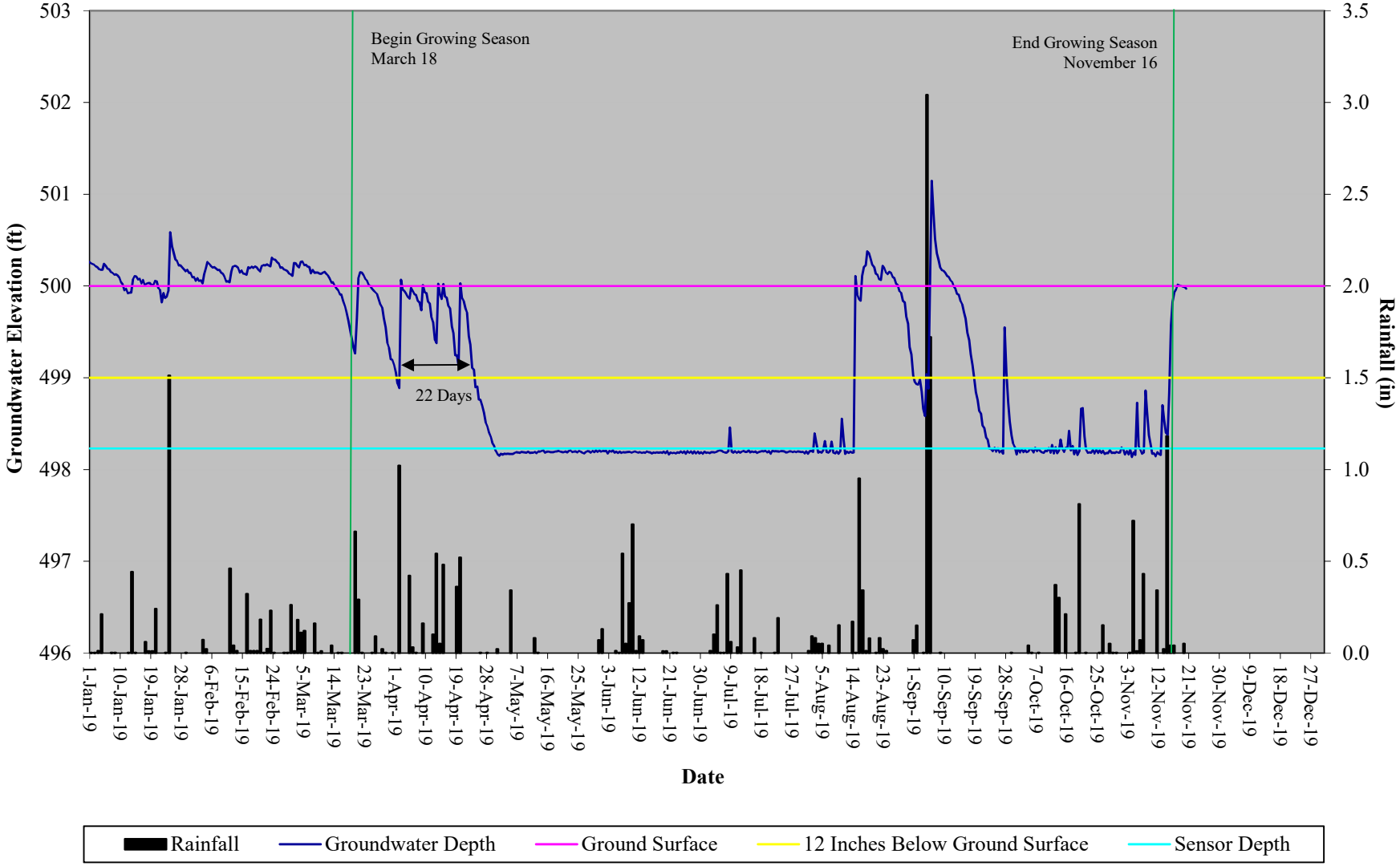


Table 9. Wetland Hydrology Criteria Attainment Table Project Number and Name: 95721 - Bowl Basin Restoration Site							
	Success Criteria Achieved / Max Consecutive Days During Growing Season (Percentage)						
Non-Riparian Gauges Success Criteria (22 Days) (9%)	**MY-01 2015**	**MY-02 2016**	**MY-03 2017**	**MY-04 2018**	**MY-05 2019**	**MY-06**	**MY-07**
Gauge 1	Yes/37 (15.2%)	Yes/29 (11.9%)	Yes/24 (9.8%)	Yes/35 (14.3%)	No/12 (4.9%)		
Gauge 2	Yes/69 (28.3%)	Yes/49 (20.1%)	Yes/32 (13.1%)	Yes/37 (15.2%)	No/17 (7.0%)		
Gauge 3	No/20 (8.2%)	Yes/27 (11.1%)	No/13 (5.3%)	Yes/27 (11.1%)	No/13 (5.3%)		
Gauge 4	Yes/29 (11.9%)	Yes/41 (16.8%)	Yes/26 (10.7%)	Yes/32 (13.1%)	No/14 (5.7%)		
Gauge 5	Yes/24 (9.8%)	Yes/52 (21.3%)	Yes/50 (20.5%)	Yes/36 (14.8%)	No/12 (4.9%)		
Gauge 6	Yes/79 (32.4%)	Yes/60 (24.6%)	Yes/62 (25.4%)	Yes/58 (23.8%)	Yes/40 (16.4%)		
Gauge 7	Yes/25 (10.2%)	Yes/38 (15.6%)	No/12 (4.9%)	Yes/31 (12.7%)	Yes/22 (9.0%)		
Gauge 8	Yes/37 (15.2%)	Yes/51 (20.9%)	Yes/49 (20.1%)	Yes/40 (16.4%)	Yes/22 (9.0%)		