Bear Basin Restoration Site
Monitoring Report MY06
DMS Project # 95362
DMS Contract # 004741

Onslow County, NC
CU# 03030001
DWR# 2013-0456
SAW# 2012-01391

Submitted to:

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

Construction Completed: February 2015
Data Collection: 2020
Submitted: December 2020

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: 20122266

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 2, 2021
To: Lindsay Crocker, DMS Project Manager
From: Tim Morris, Project Manager
KCI Associates of North Carolina, PA
Subject: MY-06 Monitoring Report Comments
Bear Basin DMS#95362, Contract 004741
White Oak River Basin CU 03030001
Onslow County, North Carolina

Please find below our responses in italics to the MY-06 Monitoring Report comments from NCDMS received on January 19, 2021, for the Bear Basin Wetland Restoration Site.

1. The report describes the rainfall as "average" in the text, but the data shows it is erratic (dry, normal, above average). DMS suggests revising wording, especially the dry antecedent conditions.
   KCI Response: A discussion contextualizing the rainfall this year has been added to the report.

2. The text in the report states 12 of the 21 gauges achieved success, but the report indicates that this is the number that did not achieve success. Revise as needed.
   KCI Response: The report has been correct to say that 12 of the 21 gauges did NOT achieve success.

3. The gauges that are not meeting presents concerning data for MY6 and indicates credit risk. It is important that KCI retrieve any data from these three non-meeting gauges by working with the manufacturer. DMS also suggests that KCI evaluate these areas in the field to determine if there is a difference in the soil development or some explanation. A suggestion may be to evaluate the data using a more modern growing season.
   KCI Response: 8 of the 21 gauges have not met the success criteria in at least 50% of the years they have been installed. 4 of these 8 gauges were installed in 2018 and all achieved that year, but did not achieve in 2019 or 2020. 2019 was a historically dry year for the site and does not represent normal conditions and KCI believes that at least two of these gauges would have achieved the success criteria under normal conditions. We recognize that these low performing gauges represent credits at risk and are taking steps to determine the extent of the low hydrology area.

4. Explain why planted vegetation increased between MY1, MY2, and MY3 without any re-planting shown in the report.
   KCI Response: No replanting has occurred on the site. The increase in stems is likely the result of stems that were overlooked in the earlier monitoring years being counted in later years. Several of the species that show increase can be fairly inconspicuous when small (Magnolia virginiana, Cephalanthus occidentalis, Quercus phellos) especially when there is a thick herbaceous layer as

there is on this site.

5. Please submit the photo point features included in the CCPV.
   Please include the feature displaying the bare area in the CCPV.
   Please submit a shapefile containing all the groundwater gauges.
   KCI Response: These shapefiles have been submitted with the digital deliverables.

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

Sincerely,

Tim Morris
Project Manager

TABLE OF CONTENTS

Appendix A – Project Vicinity Map and Background Tables

Appendix B – Visual Assessment Data

Appendix C – Vegetation Plot Data

Appendix D – Hydrologic Data

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Bear 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 03030001 Watershed Cataloging Unit (8-digit HUC) and the Local Watershed Unit (14-digit HUC) 03030001010010. In DMS' most recent publication of excluded and Targeted Local Watersheds/Hydrologic Units, the 03030001010010 14-digit HUC has been identified as a Targeted Local Watershed.

The project site, which is protected by an 11.9-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 Jesse Williams Road approximately five miles west of Richlands, North Carolina.

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 BBRS provided mitigation for wetland impacts within Hydrologic Unit 03030001 by restoring 8.6 acres of wetland and preserving 1.9 acres of upland, generating 8.6 non-riparian wetland mitigation units (WMU's). The wetland site 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.

As designed, the western and southernmost ditches, located adjacent to the project easement were left open and not filled during construction. It is anticipated that leaving these ditches open will have minimal impacts to the overall hydrologic performance of the site. The hydrologic influence of these ditches was modeled using Lateral Effect, a software program that determines the lateral effect of a drainage ditch or borrow pit on adjacent wetland hydrology (NCSU BAE, 2011). This analysis determined that the potential horizontal drainage influence averages 85'. Due to the fact that these ditches cannot be filled because of the potential for hydrologic trespass, the area immediately adjacent to the ditch will not be a credit generating part of the site. It is assumed that with the onsite modifications, such as filling field ditches and surface roughening, the entire site will have more surface and groundwater storage, which may decrease the effect of the open ditches. For this reason, the non-credit generating portion of the site is assumed to be half of the zone of influence for the ditch.

2.0 MONITORING RESULTS

2.1 VEGETATION MONITORING

The success criteria for the planted species in the mitigation area will be based on survival. 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, seven 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.

During the sixth monitoring year, vegetation monitoring did not occur, as stipulated in the mitigation plan. In general the site is well vegetated, with widespread herbaceous coverage and healthy planted stems. There is an area of open water that does not have significant vegetation. Over the course of the year, this area expands and shrinks with the seasons so that it reaches its fullest extent in the winter and its lowest during the summer. This results in areas around the edge that, while inundated during the winter, support vegetation during the summer. Species such as *Juncus effuses, Scirpus cyperinus, Scirpus atrovirens, Carex comosa, Carex vulpinodea,* and *Schoenoplectus tabernaemontani* are abundant in these areas. In December 2018, KCI used GPS to map the extent of the area that is inundated to the point of excluding vegetation year round and found it to be 0.87 acres. See Appendix B – Visual Assessment Data for more information.

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 8% 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 8% (20 days) of the 244-day growing season. Wetland hydrology will be monitored with twenty automatic gauges that record water table depth.

To monitor the effect of the unfilled ditches described in Section 1.0, four sets of coupled gauges were installed perpendicular to the unfilled ditches. Each set includes a gauge that is 50’ from the open ditch and another that is 80’ from the ditch. An additional four gauges were installed between the coupled gauges to monitor hydrology less than 42.5’ from the open ditch in the non-credit bearing zone.

The daily rainfall data was obtained from a local weather station in Jacksonville, NC; provided by the NC State Climate Office. For the 2020 year, the months of March, April, August, September, and October experienced average rainfall, while January, and July experienced below average rainfall. February, May, June, and November recorded above average rainfall for the site. Although the overall rainfall total for the site was average for the year. After receiving a total of 6 inches of rain during the first 2 months of the growing season (3/18-5/16), the site then received 5.7 inches of rain in 5 days (5/17-5/21). This was followed by approximately three weeks with only 0.5 inches of rain (5/22-6/11) and then another 5.7 inches of rain in 5 days (6/12-6/16). This pattern continued throughout the growing season with long periods of relatively little rain followed by short periods of heavy rain. This inconsistent rain fall caused many of the gauges to have short dry periods during what would normally be jurisdictional hydrology.

During the site's sixth growing season, 12 of the 21 credit bearing gauges achieved the success criteria. Collectively the credit bearing gauges averaged 10.0% (24 days) continuous saturation during the growing season. Additionally, one of the four non-credit bearing gauges achieved the success criteria. Six of the nine non-achieving gauges are located near the unfilled ditch along the western boundary of the property. One of the three non-achieving gauges that is not located along this ditch missed achieving the success criteria by only one day.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm)

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

Sprecher, S. W. and Warne, A. G. 2000. "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology," ERDC/EL TR-WRAP-00-01, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Appendix A

Project Vicinity Map and Background Tables

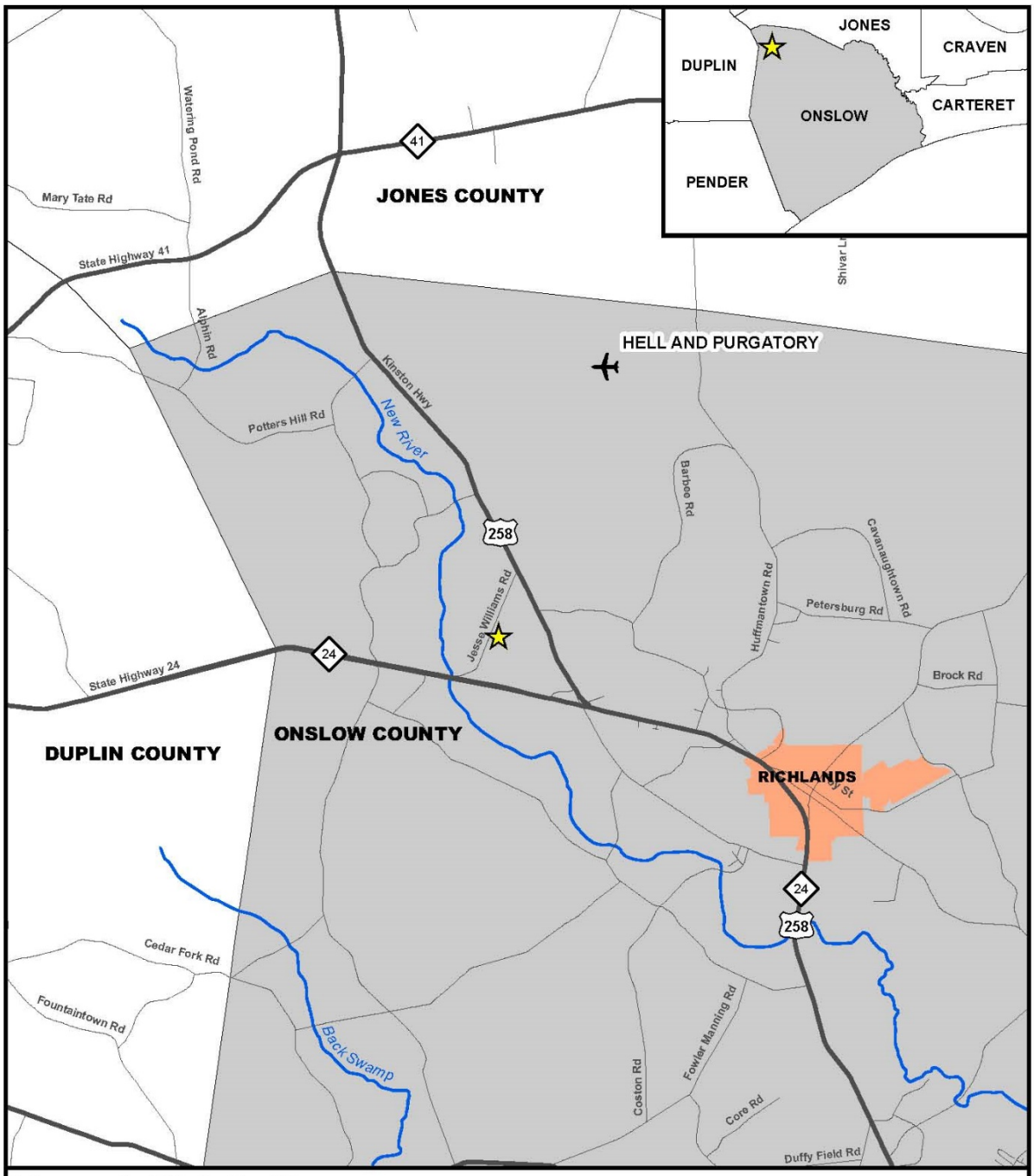


Figure 1. Vicinity Map

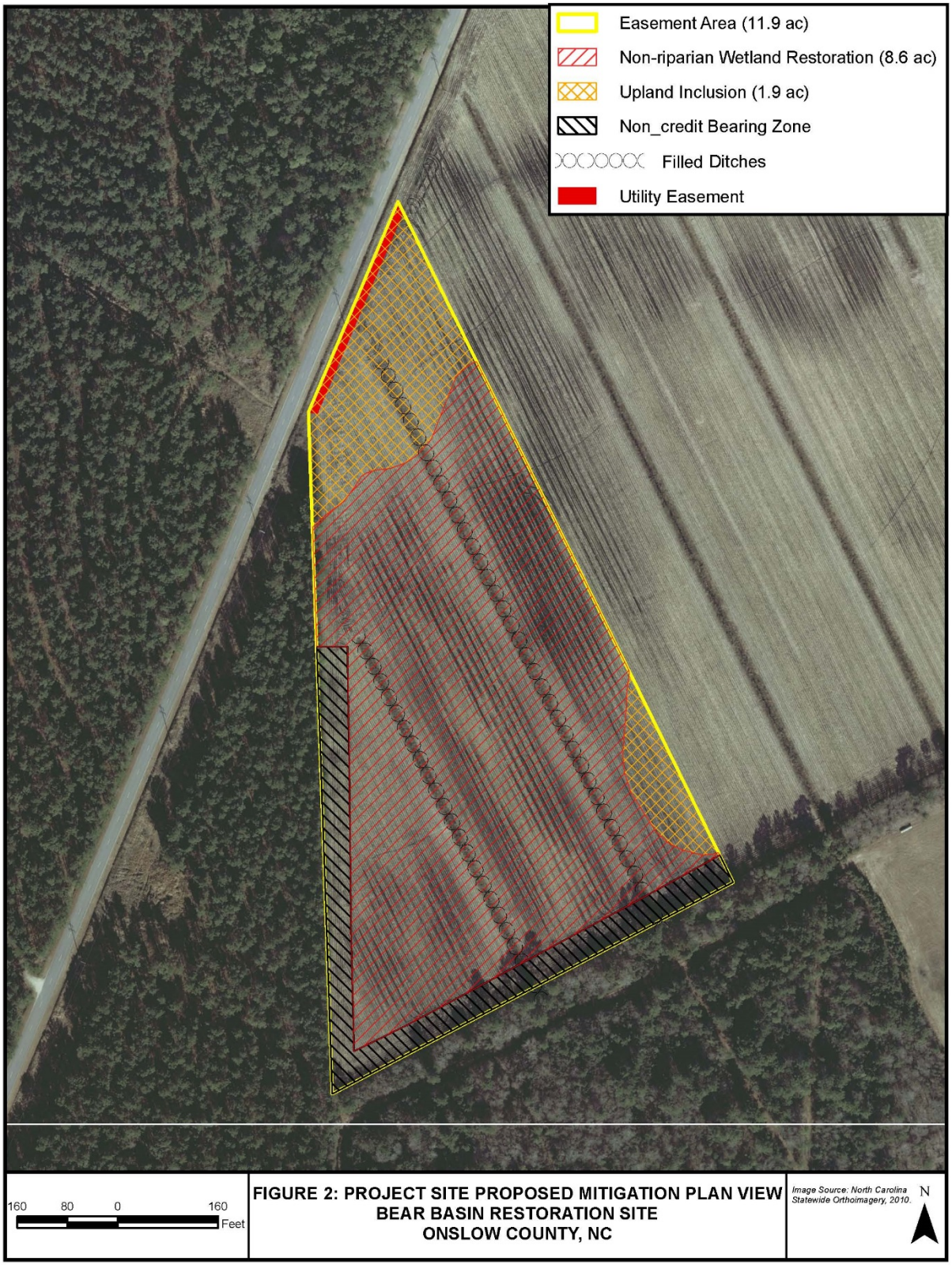


FIGURE 2: PROJECT SITE PROPOSED MITIGATION PLAN VIEW
BEAR BASIN RESTORATION SITE
ONSLOW COUNTY, NC

Table 1. Project Components
Project Number and Name: 95362 – Bear 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	-	-	-	-	8.6	-	-	-	-
Credits	-	-	-	-	8.6	-	-	-	-
TOTAL CREDITS	-		-		8.6		-	-	-

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	-	8.6 acres	-	Restoration	8.6 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	-	-	-	8.6 acres	-	-
Enhancement		-	-	-	-	-
Enhancement I	-					
Enhancement II	-					
Creation		-	-	-		-
Preservation	-	-	-	-		1.9 acres
High Quality Preservation	-	-	-	-		-
TOTAL	-	-	-	8.6 acres		1.9 acres

Table 2. Project Activity & Reporting History		
Bear Basin Wetland Restoration Site, DMS Project# 95362		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		July 2014
Final Design – Construction Plans		July 2014
Construction		Dec 2014
Planting		March 2015
Baseline Monitoring/Report	May 2015	June 2015
Vegetation Monitoring	May 19, 2015	
Photo Points	May 26, 2015	
Year 1 Monitoring	Nov 2015	Jan 2015
Vegetation Monitoring	Oct 13, 2015	
Photo Points	Oct 13, 2015	
Gauge Downloads	Nov 25, 2015	
Year 2 Monitoring	Dec 2016	Dec 2016
Vegetation Monitoring	July 5, 2016	
Photo Points	Aug 16, 2016	
Gauge Downloads	Dec 14, 2016	
Year 3 Monitoring	Nov 2017	Jan 2018
Vegetation Monitoring	July 5, 2017	
Photo Points	Nov 30, 2017	
Gauge Downloads	Nov 30, 2017	
Year 4 Monitoring	Nov 2018	Jan 2018
Vegetation Monitoring	N/A	
Photo Points	Nov 13, 2018	
Gauge Downloads	Nov 13, 2018	
Year 5 Monitoring	Nov 2019	Dec 2019
Vegetation Monitoring	July 25, 2019	
Photo Points	Nov 20, 2019	
Gauge Downloads	Nov 20, 2019	
Year 6 Monitoring	Nov 2020	Dec 2020
Vegetation Monitoring	N/A	
Photo Points	Nov 20, 2020	
Gauge Downloads	Nov 20, 2020	

Table 3. Project Contacts **Project Number and Name: 95362 - Bear Basin Restoration Site**	
Design Firm	KCI Associates of North Carolina, PC 4505 Falls of Neuse Rd. 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 Rd. 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	
	KCI Associates of North Carolina, PC 4505 Falls of Neuse Rd. 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: 95362 – Bear Basin Restoration Site**			
County	Onslow County		
Project Area (acres)	11.9 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	03030001	**USGS Hydrologic Unit 14-digit**	03030001010010
DWQ Sub-basin	03-05-02b		
Project Drainage Area (acres)	32.7 acres		
Project Drainage Area Percentage of Impervious Area	2%		
CGIA Land Use Classification	44% Cultivated, 4% Managed Herbaceous Cover, 50% Southern Yellow Pine, and 2% High-Intensity Developed		
Wetland Summary Information			
Parameters	**Wetland Area**		
Size of Wetland (acres)	8.6 acres		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian		
Mapped Soil Series	Rains and Stallings (Pantego and Lynchburg by detailed soil investigation)		
Drainage class	Poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	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 - 1451/757
- WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION
- WETLAND GAUGE BELOW HYDROLOGIC CRITERION
- PHOTO POINT (PP)
- FILLED DITCHES
- NONRIPARIAN WETLAND RESTORATION = 8.6 ACRES
- CONSERVATION EASEMENT
- BARE AREA / OPEN WATER

**VEG MONITORING FROM MY05 (2019)*
IMAGE SOURCE: NC 2019 GOOGLE EARTH

NC GRID NAD 83

-60′ -30′ 0′ 60′ 120′
GRAPHIC SCALE

VEG PLOT #1 1943/648
VEG PLOT #2 1457/567
VEG PLOT #3 1416/1052
VEG PLOT #4 1295/1133
VEG PLOT #5 769/607
VEG PLOT #6 1576/607
VEG PLOT #7 1700/648

GA1 GA2 GA3 GA4 GA5 GA6 GA7 GA8 GA9 GA10 GA11 GA12 GA13 GA14 GA15 GA16 GA17 GA18 GA19 GA20 GA21 GA22 GA23 GA24 GA25

PP1 PP2 PP3 PP4 PP5 PP6

NON-CREDIT BEARING ZONE

CORNWALLIS ROAD

REVISIONS

SYM.	DESCRIPTION	DATE

NCDEQ DIVISION OF MITIGATION SERVICES

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

BEAR BASIN RESTORATION SITE
DMS PROJECT #95362
RICHLANDS, ONSLOW COUNTY, NORTH CAROLINA
MONITORING YEAR 05

DATE: DEC 2020
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 1

FIGURE 3

Table 5. Vegetation Condition Assessment

Project Number and Name: 95362 – Bear Basin Restoration Site

Planted Acreage 11.9 **Easement Acreage 8.6**

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	1	0.87	7.3%
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	1	0.87	7.3%
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	1	0.87	7.3%
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. 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 – 5/26/15

PP1 – MY-06 – 11/20/20

PP2 – MY-00 – 5/26/15

PP2 – MY-06 – 11/20/20

PP3 – MY-00 – 5/26/15

PP3 – MY-06 – 11/20/20

PP4 – MY-00 – 5/26/15

PP4 – MY-06 – 11/20/20

PP5 – MY-00 – 5/26/15

PP5 – MY-06 – 11/20/20

PP6 – MY-00 – 5/26/15

PP6 – MY-06 – 11/20/20

Appendix C

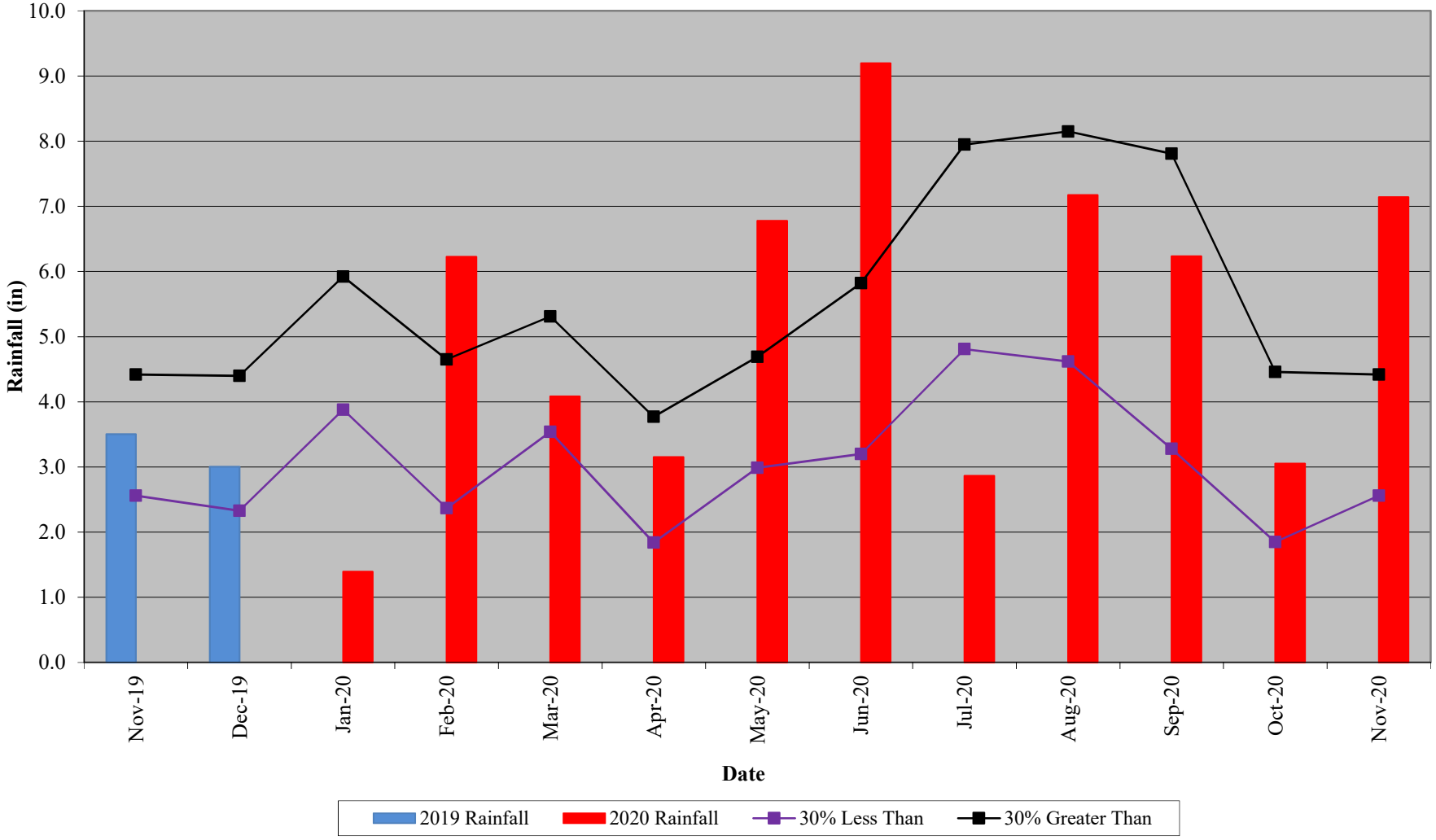
Vegetation Plot Data

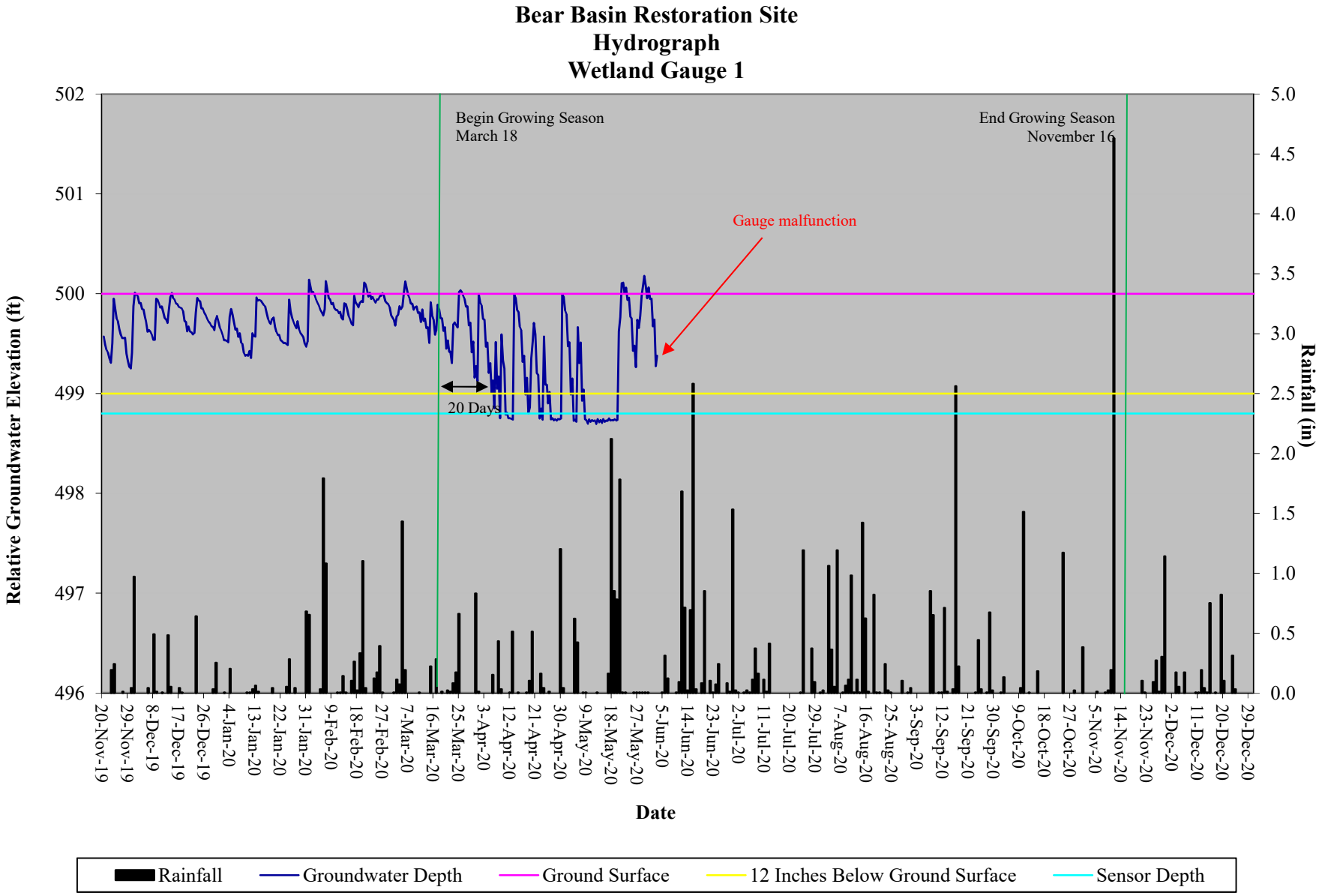
Table 6. CVS Stem Count by Plot and Species																	
DMS Project Code 95362. Project Name: Bear Basin			Annual Means														
			MY5 (2019)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			10			2									
Aronia arbutifolia	red chokeberry	Shrub	3	3	3	4	4	4	3	3	3	4	4	4	4	4	4
Baccharis halimifolia	eastern baccharis	Shrub			3			1			2						
Betula nigra	river birch	Tree	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Celtis occidentalis	common hackberry	Tree							1	1	1						
Cephalanthus occidentalis	common buttonbush	Shrub	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1
Diospyros virginiana	common persimmon	Tree	5	5	5	5	5	5	5	5	5	6	6	7	7	7	7
Fraxinus pennsylvanica	green ash	Tree	8	8	8	8	8	8	8	8	8	7	7	7	8	8	8
Juglans nigra	black walnut	Tree			4			1									
Liquidambar styraciflua	sweetgum	Tree			17			9			5			8			
Liriodendron tulipifera	tuliptree	Tree	7	7	7	13	13	13	9	9	10	10	10	10	15	15	15
Magnolia virginiana	sweetbay	Tree	8	8	8	8	8	8	7	7	7	6	6	6	5	5	5
Morella cerifera	wax myrtle	shrub			2												
Nyssa biflora	swamp tupelo	Tree	4	4	4	4	4	4	4	4	4						
Pinus taeda	loblolly pine	Tree			81			13									
Quercus	oak	Tree				1	1	1	1	1	6	3	3	4	2	2	2
Quercus laurifolia	laurel oak	Tree	5	5	5												
Quercus nigra	water oak	Tree													1	1	1
Quercus pagoda	cherrybark oak	Tree	65	65	66	66	66	66	66	66	66	64	64	68	67	67	67
Quercus phellos	willow oak	Tree	13	13	14	18	18	18	16	16	16	15	15	15	16	16	16
Salix nigra	black willow	Tree			1												
Taxodium distichum	bald cypress	Tree	3	3	3	3	3	3	3	3	3	1	1	1			
Vaccinium corymbosum	highbush blueberry	Shrub	2	2	2	3	3	3	3	3	3	2	2	2	2	2	2
		Stem count	131	131	251	141	141	167	133	133	146	125	125	139	134	134	134
		size (ares)	7			7			7			7			7		
		size (ACRES)	0.17			0.17			0.17			0.17			0.17		
		Species count	13	13	20	13	13	18	14	14	16	12	12	13	12	12	12
		Stems per ACRE	757	757	1451	815	815	965	769	769	844	723	723	804	775	775	775

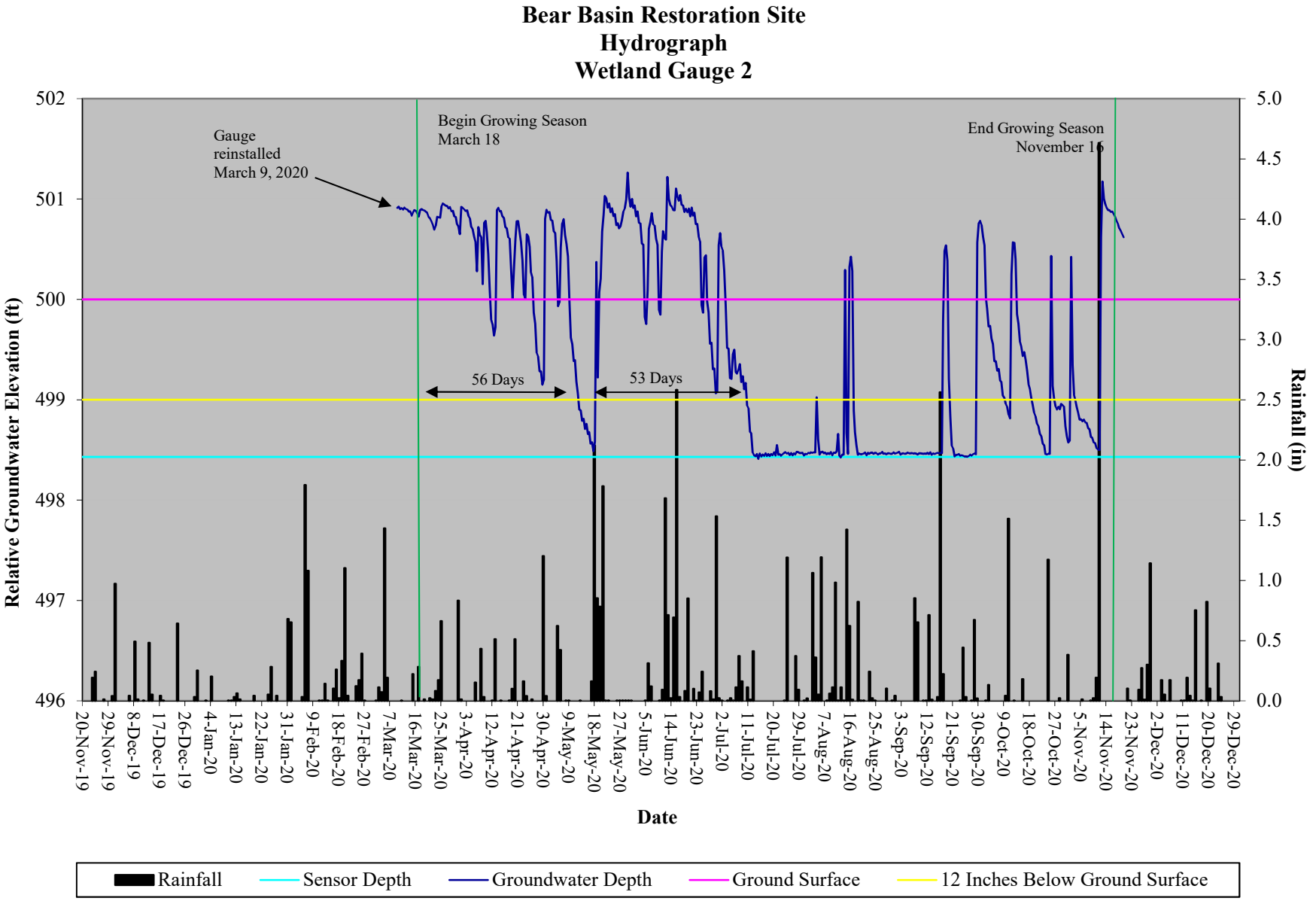
Appendix D

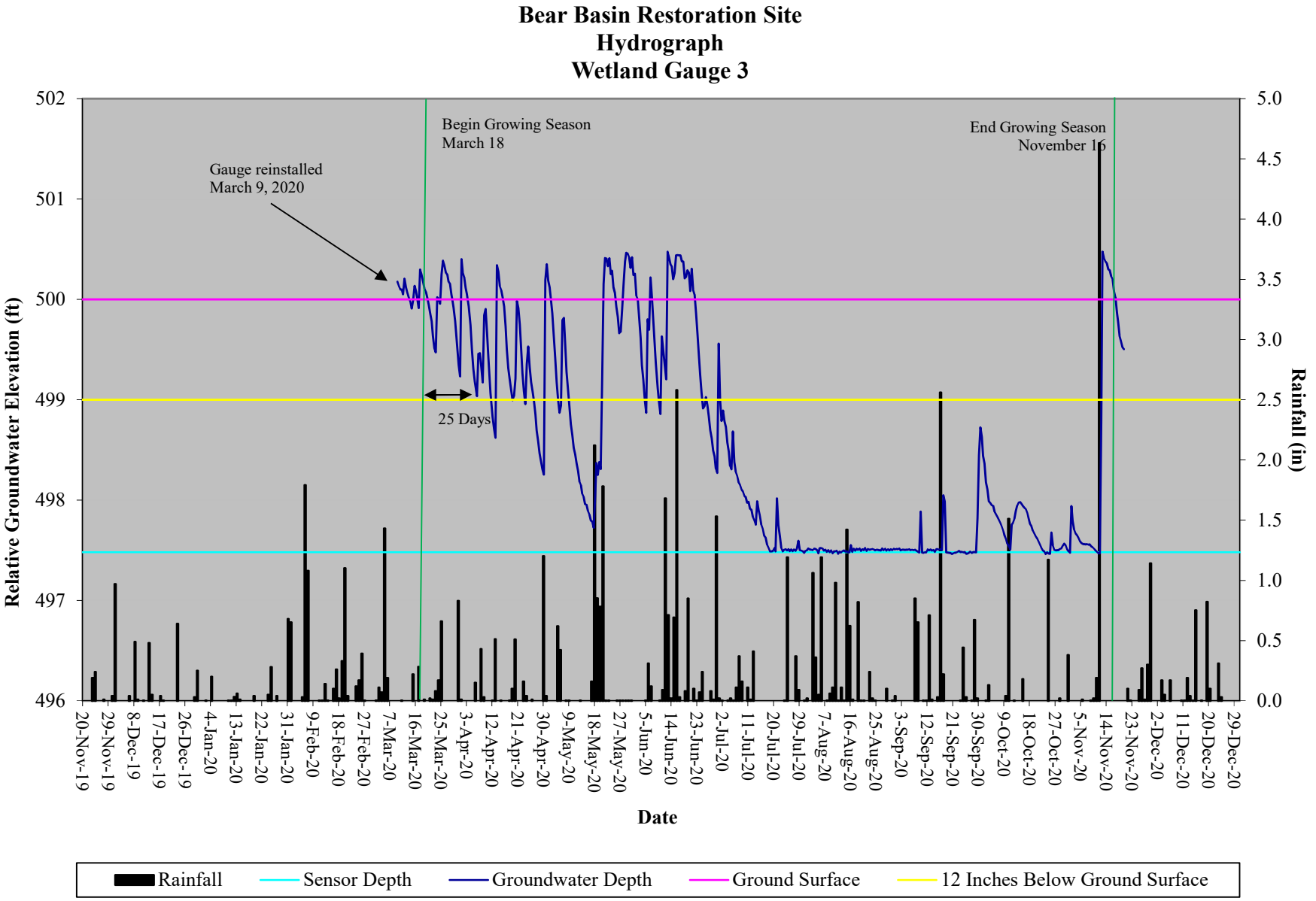
Hydrologic Data

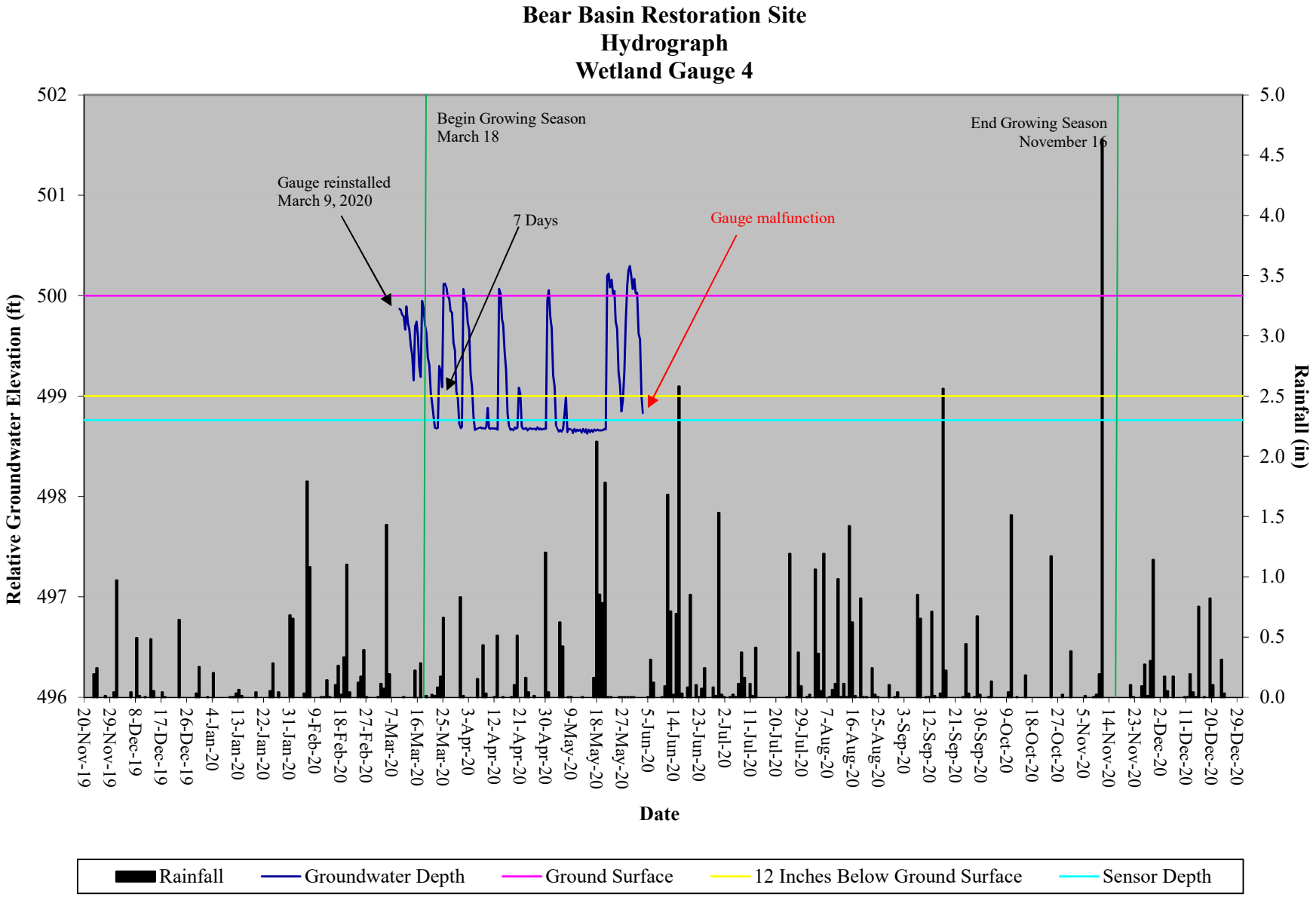
Bear Basin Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Maysville, NC

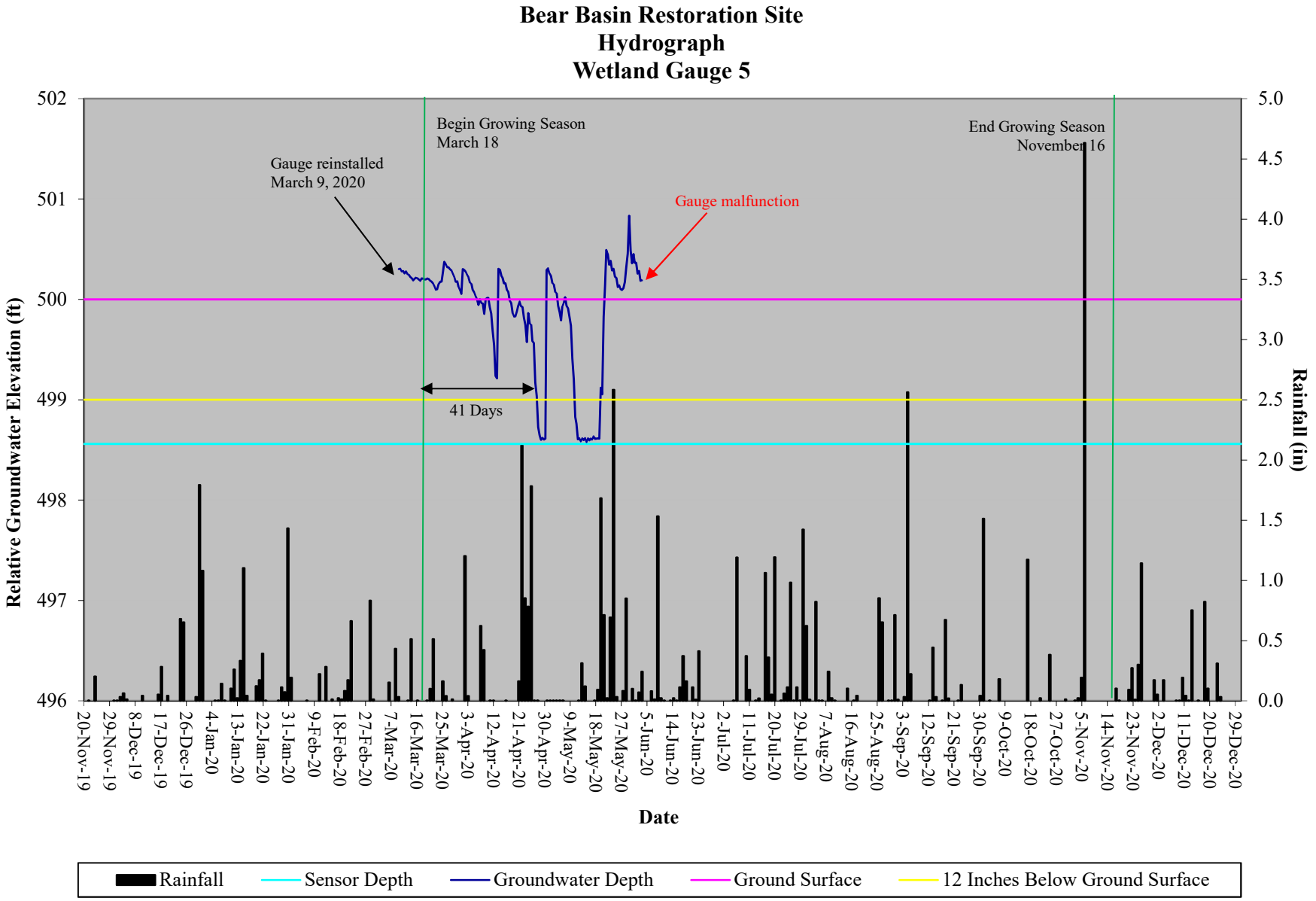


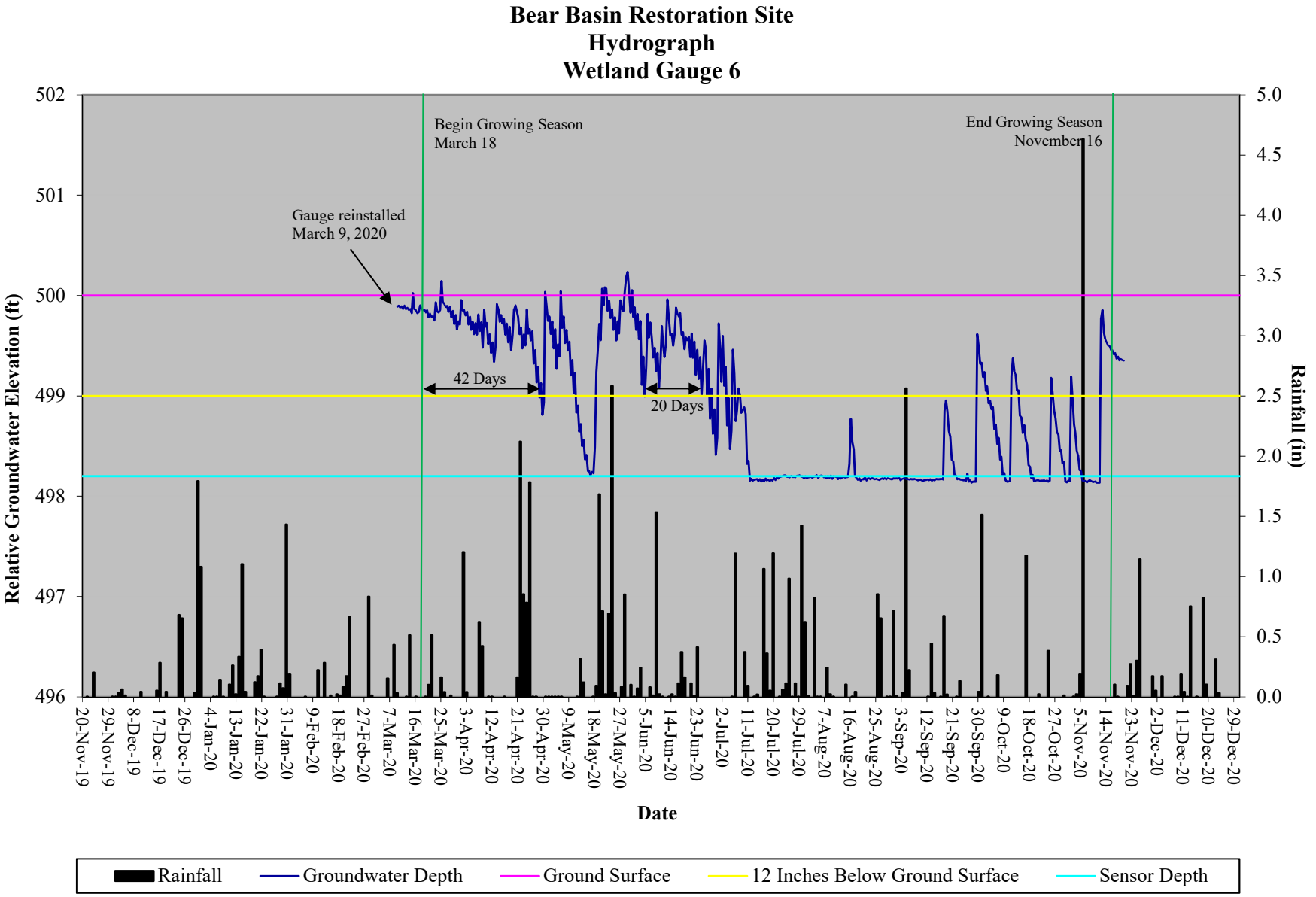

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 1
Begin Growing Season
March 18
End Growing Season
November 16
Gauge malfunction
20 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth


Bear Basin Restoration Site
Hydrograph
Wetland Gauge 2
Gauge reinstalled March 9, 2020
Begin Growing Season March 18
End Growing Season November 16
56 Days
53 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

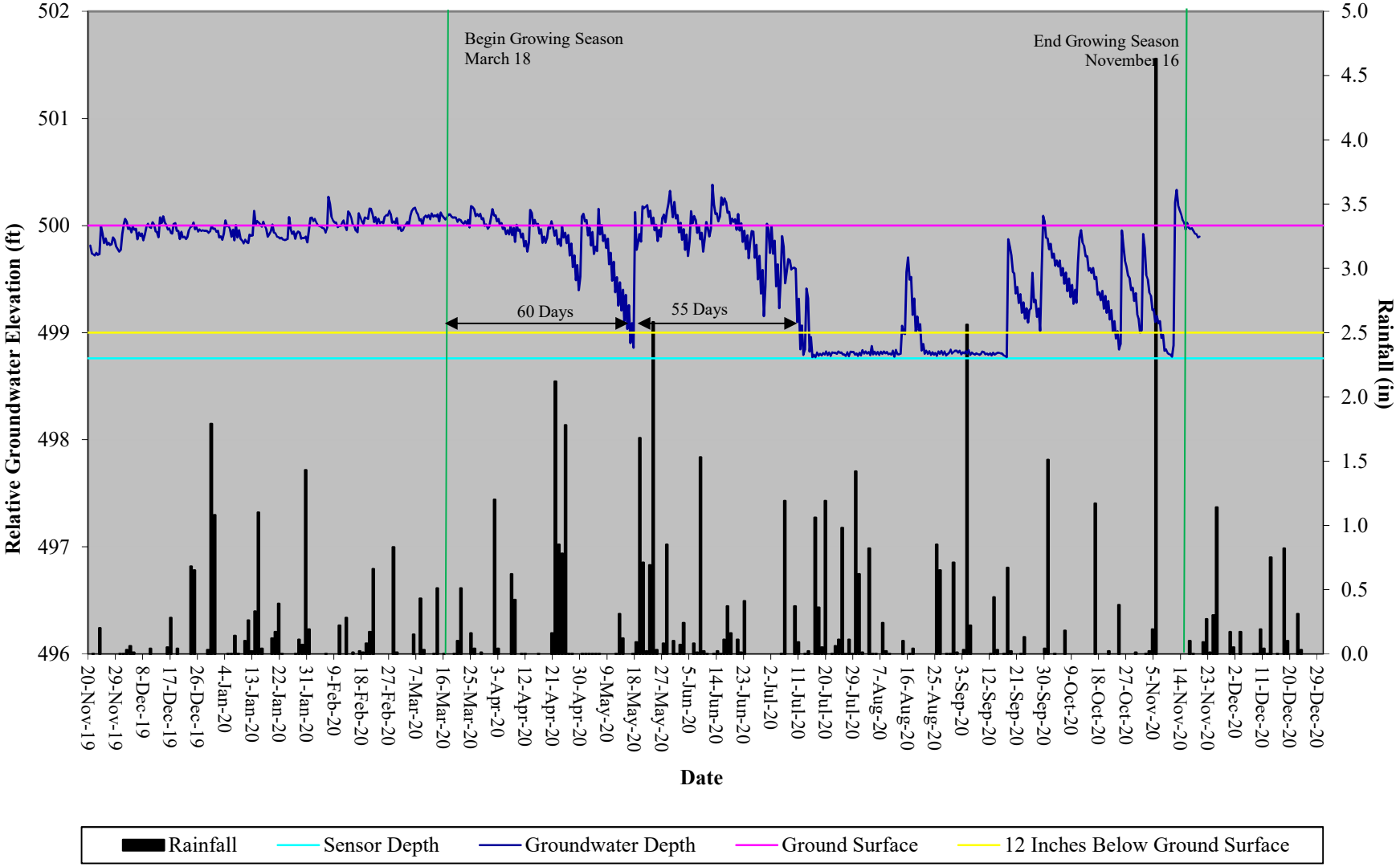

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 3
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
25 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

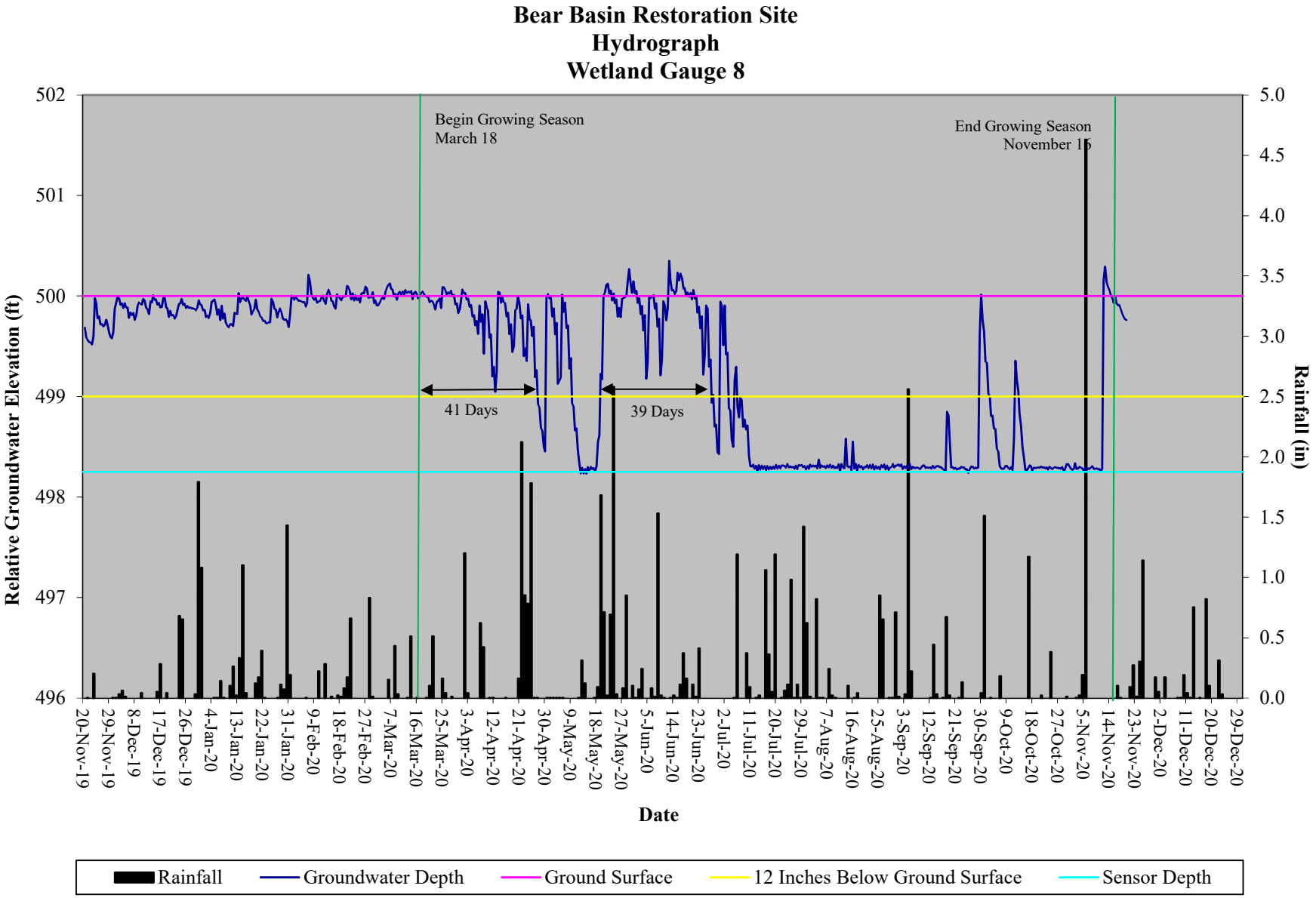

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 4
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
7 Days
Gauge malfunction
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

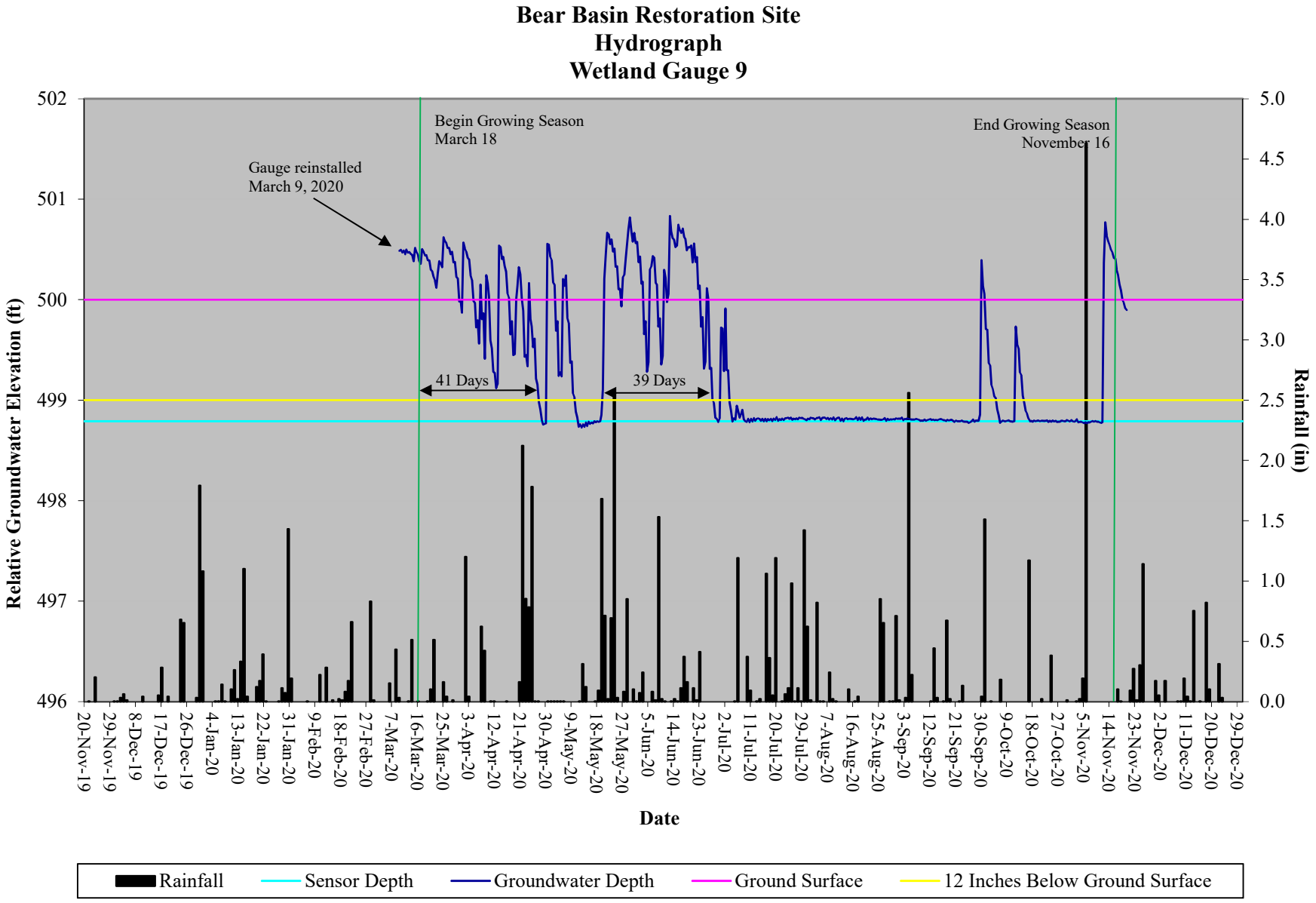

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 5
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
Gauge malfunction
41 Days
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

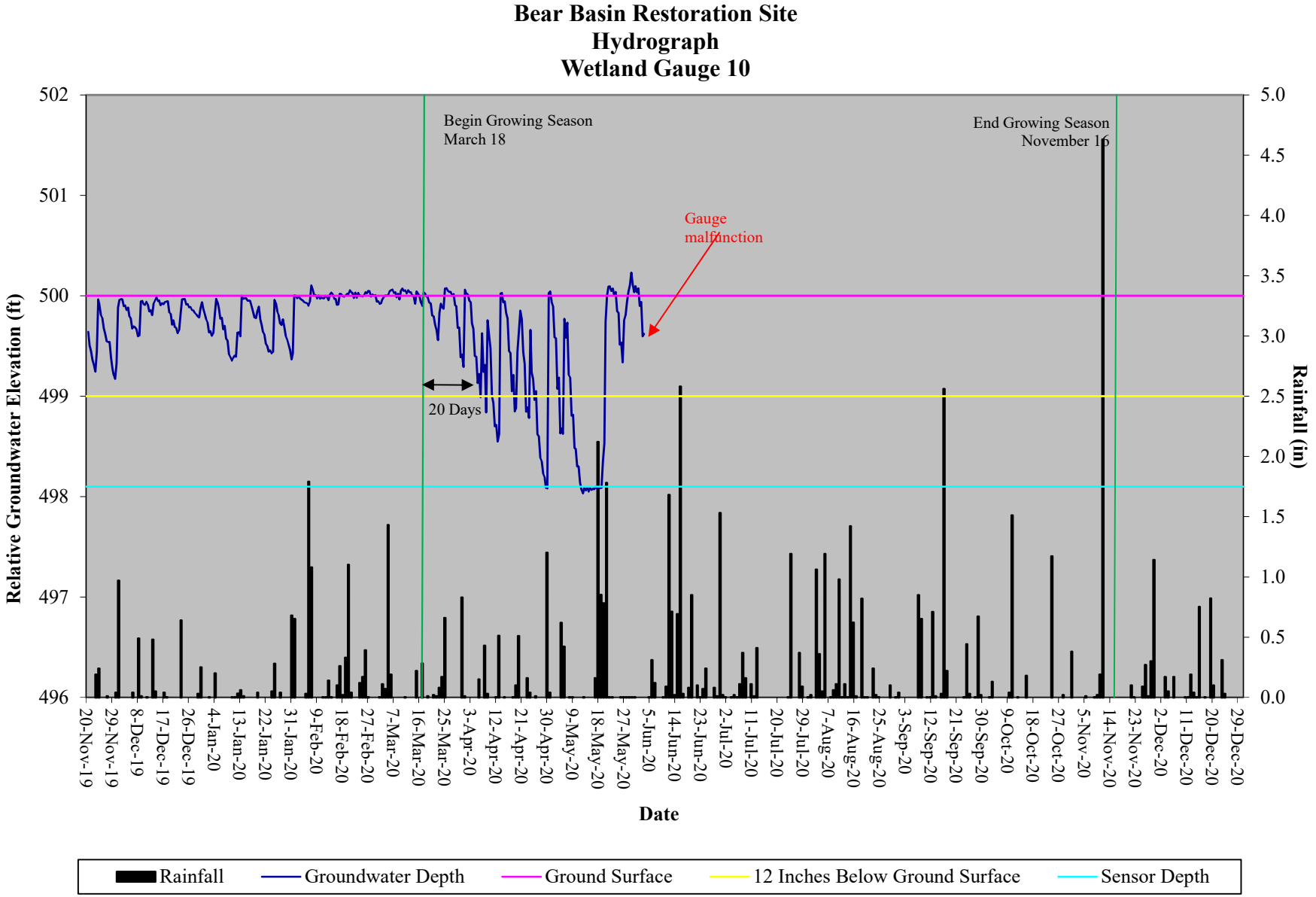

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 6
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
42 Days
20 Days
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 7

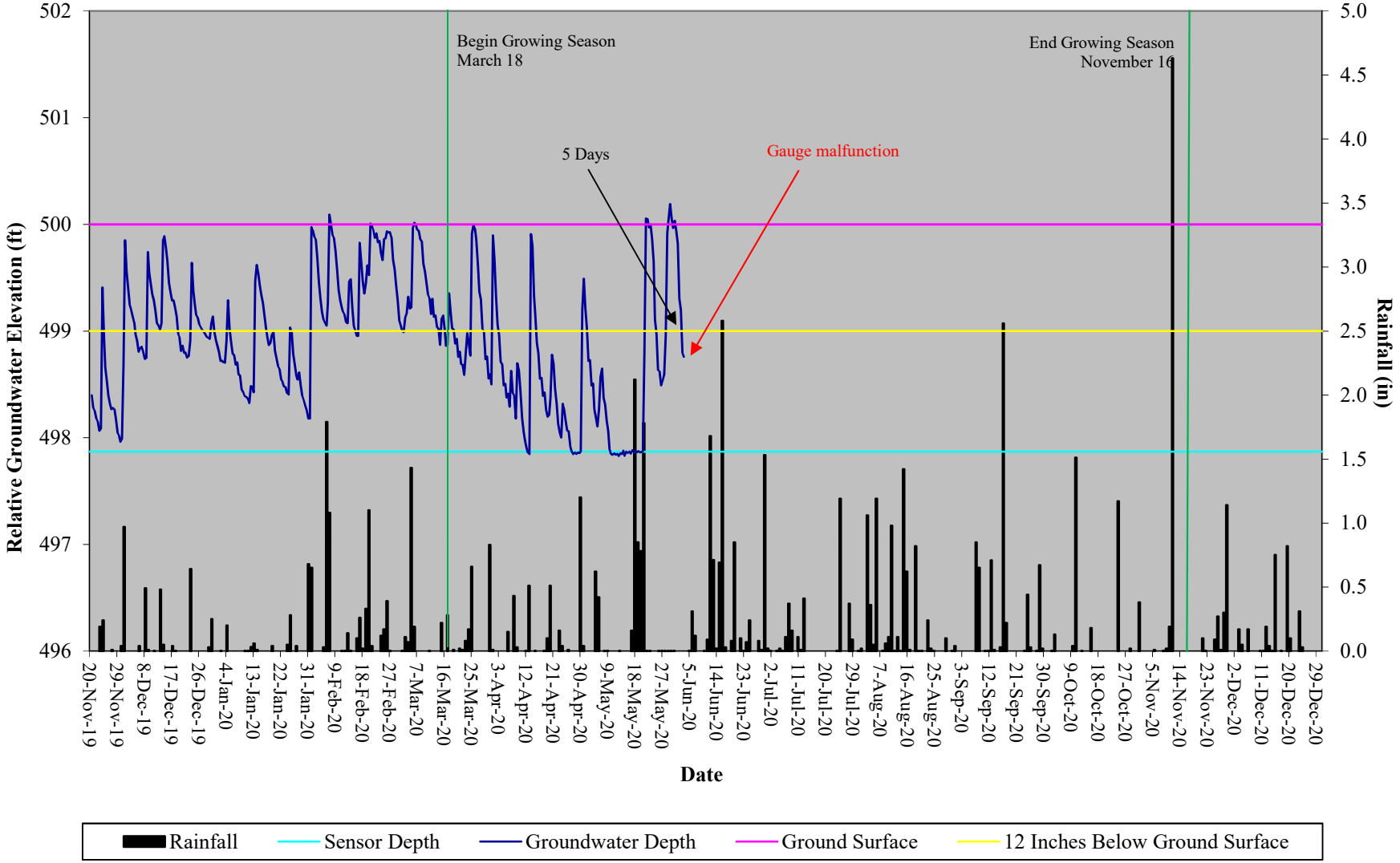



Bear Basin Restoration Site
Hydrograph
Wetland Gauge 8
Begin Growing Season
March 18
End Growing Season
November 15
41 Days
39 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

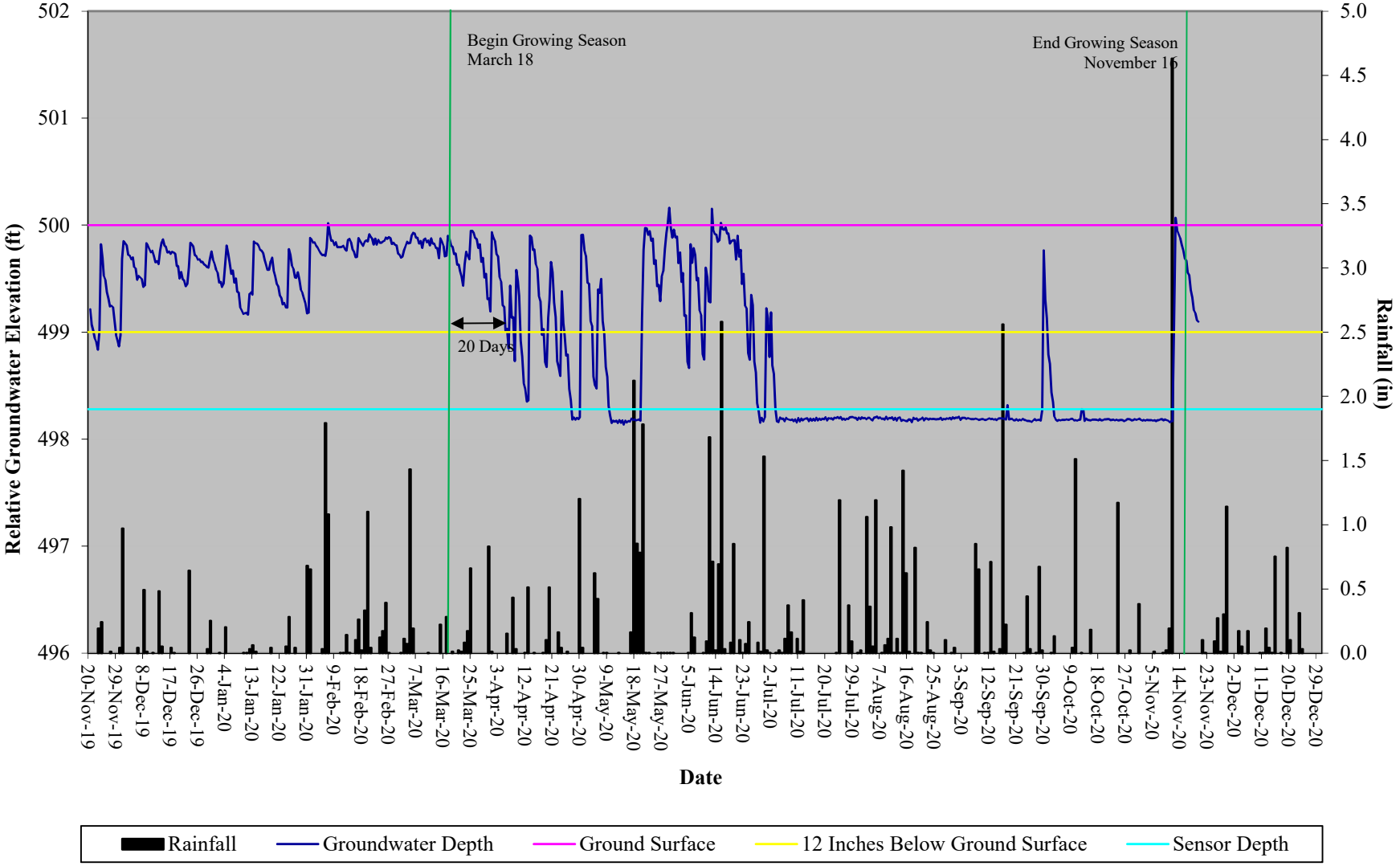

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 9
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
41 Days
39 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

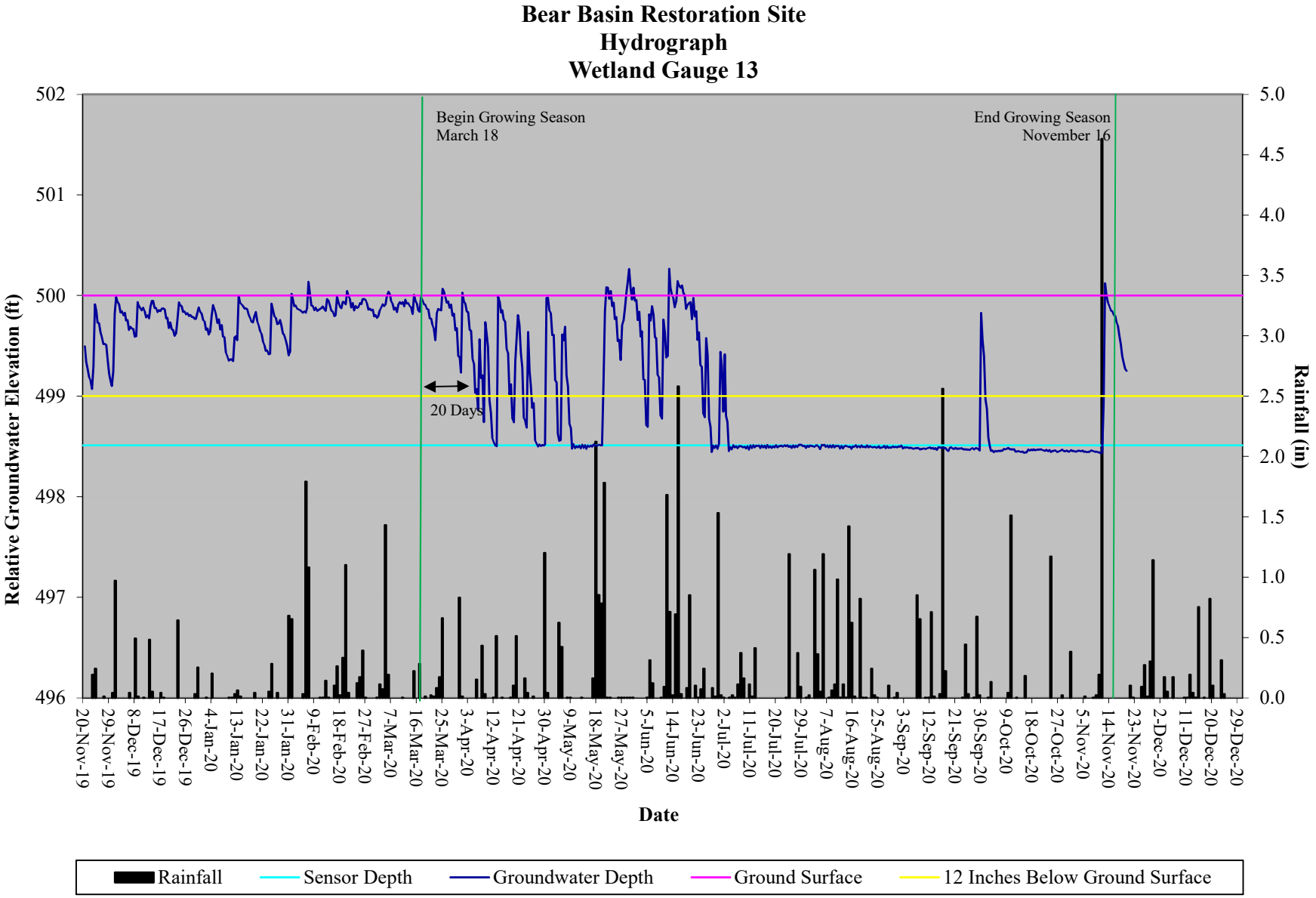

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 10
Begin Growing Season
March 18
End Growing Season
November 16
Gauge
malfunction
20 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

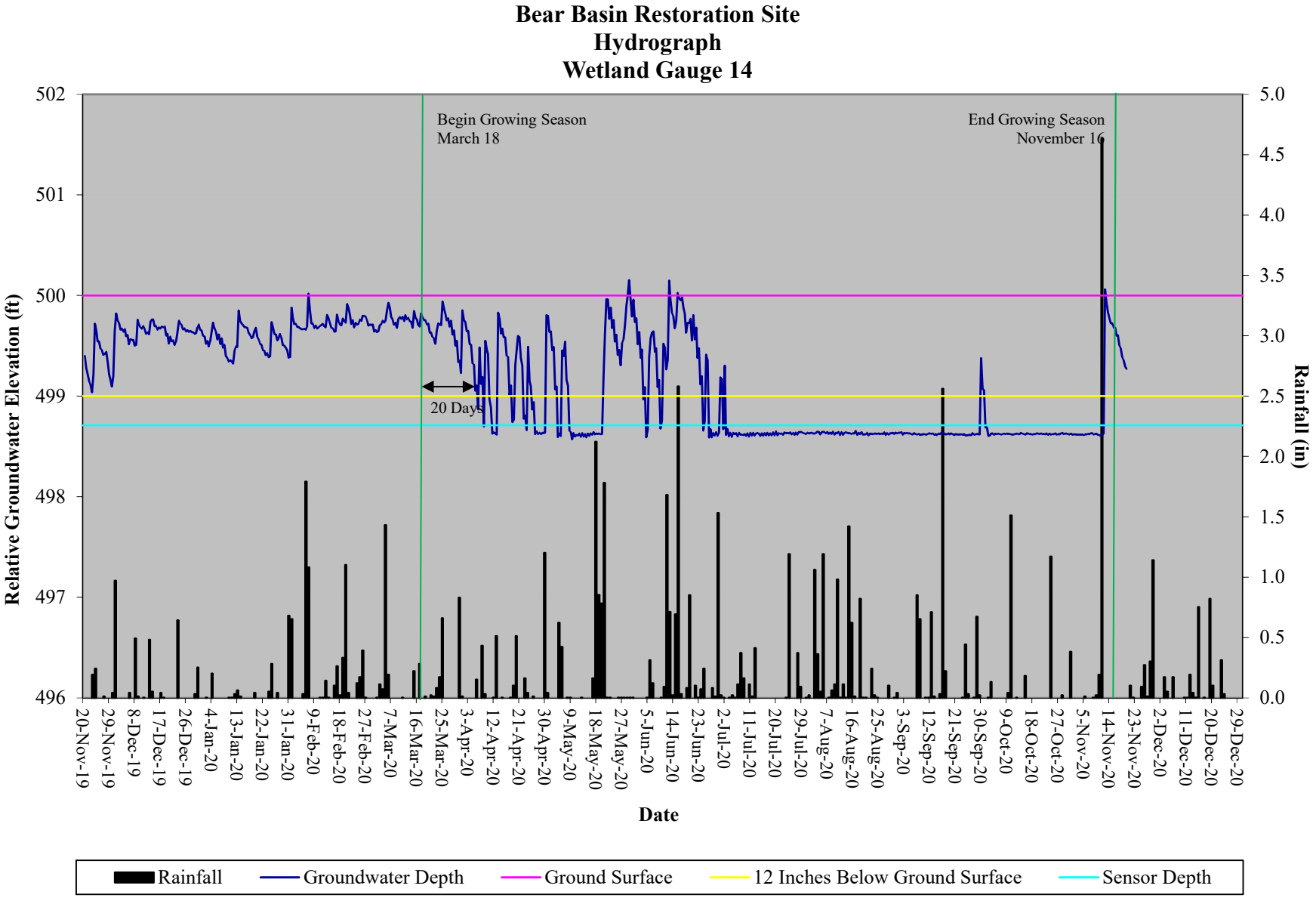
Bear Basin Restoration Site
Hydrograph
Wetland Gauge 11 - non-credit zone

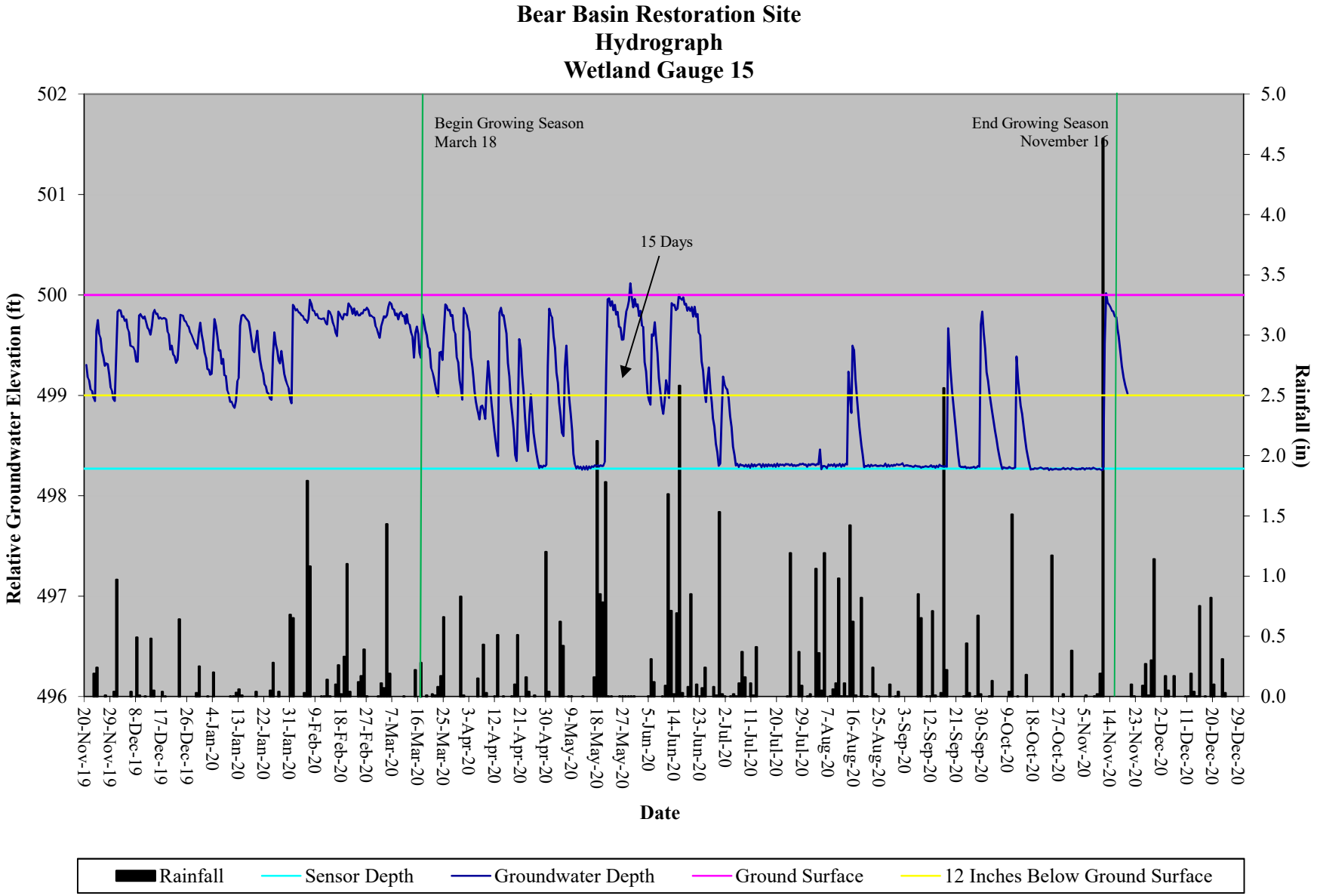


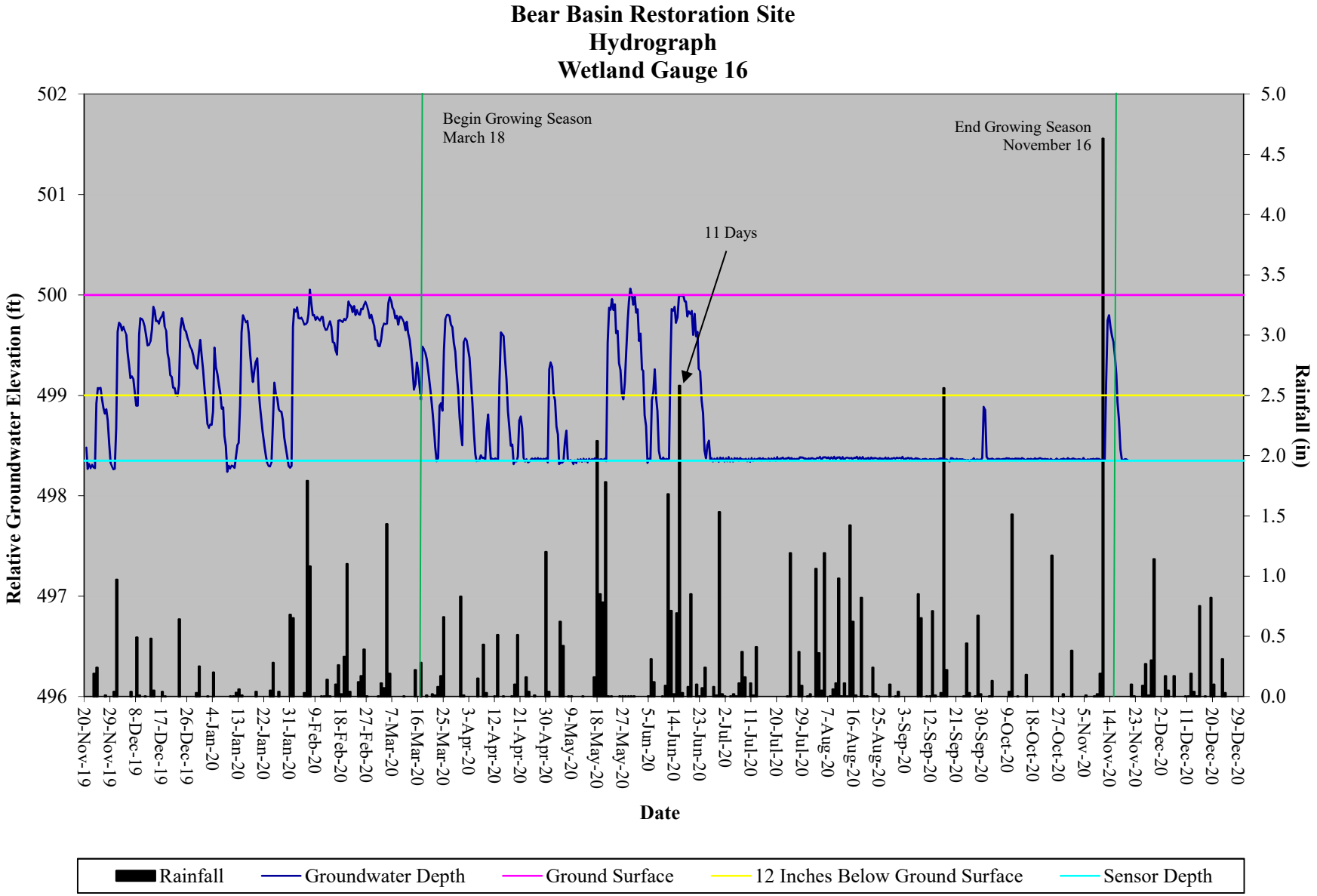
Bear Basin Restoration Site
Hydrograph
Wetland Gauge 12 - non-credit zone



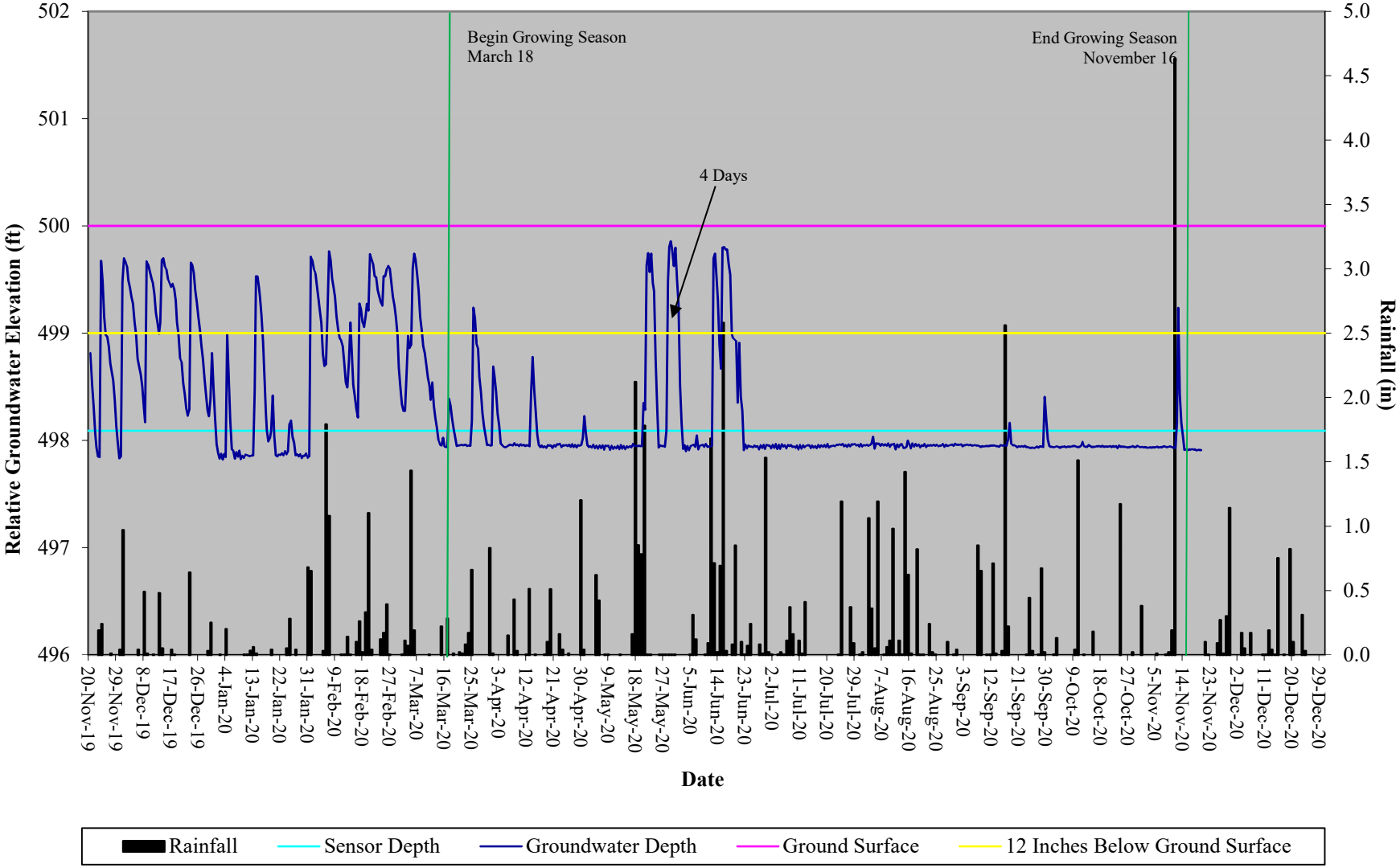

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 13
Begin Growing Season
March 18
End Growing Season
November 16
20 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface


Bear Basin Restoration Site
Hydrograph
Wetland Gauge 14
Begin Growing Season
March 18
End Growing Season
November 16
20 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

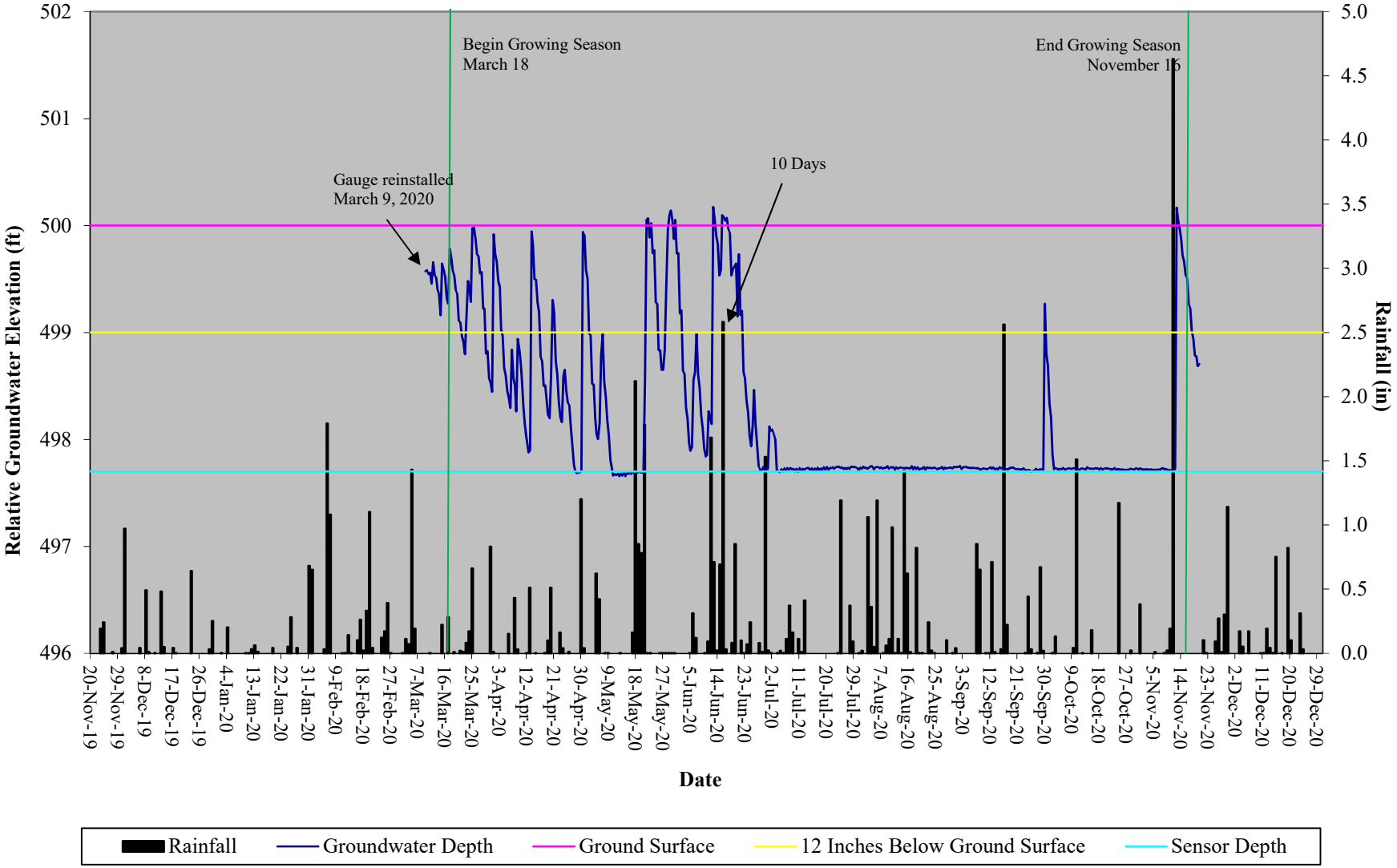

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 15
Begin Growing Season
March 18
End Growing Season
November 16
15 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface


Bear Basin Restoration Site
Hydrograph
Wetland Gauge 16
Begin Growing Season
March 18
End Growing Season
November 16
11 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

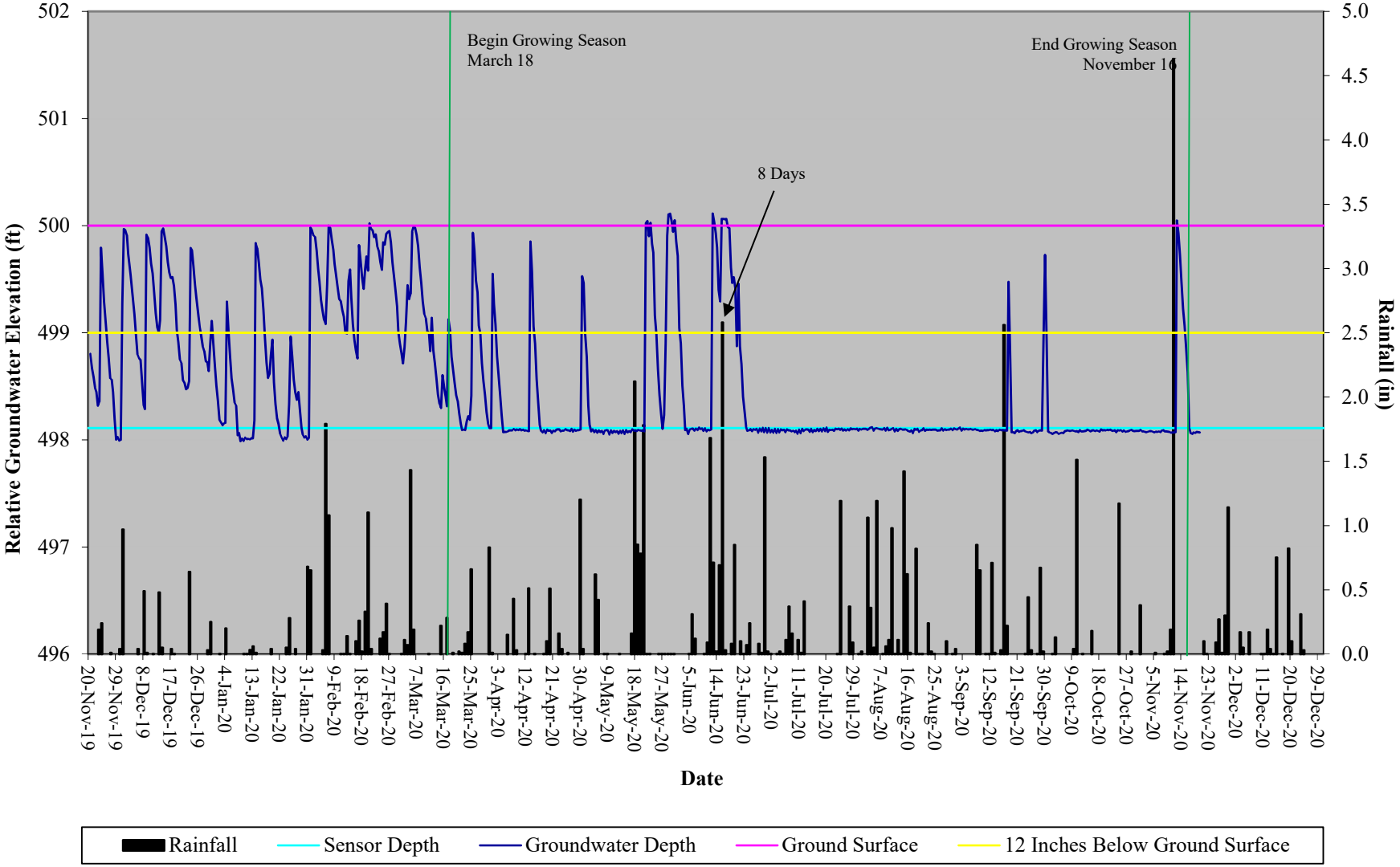
Bear Basin Restoration Site
Hydrograph
Wetland Gauge 17 - non-credit zone



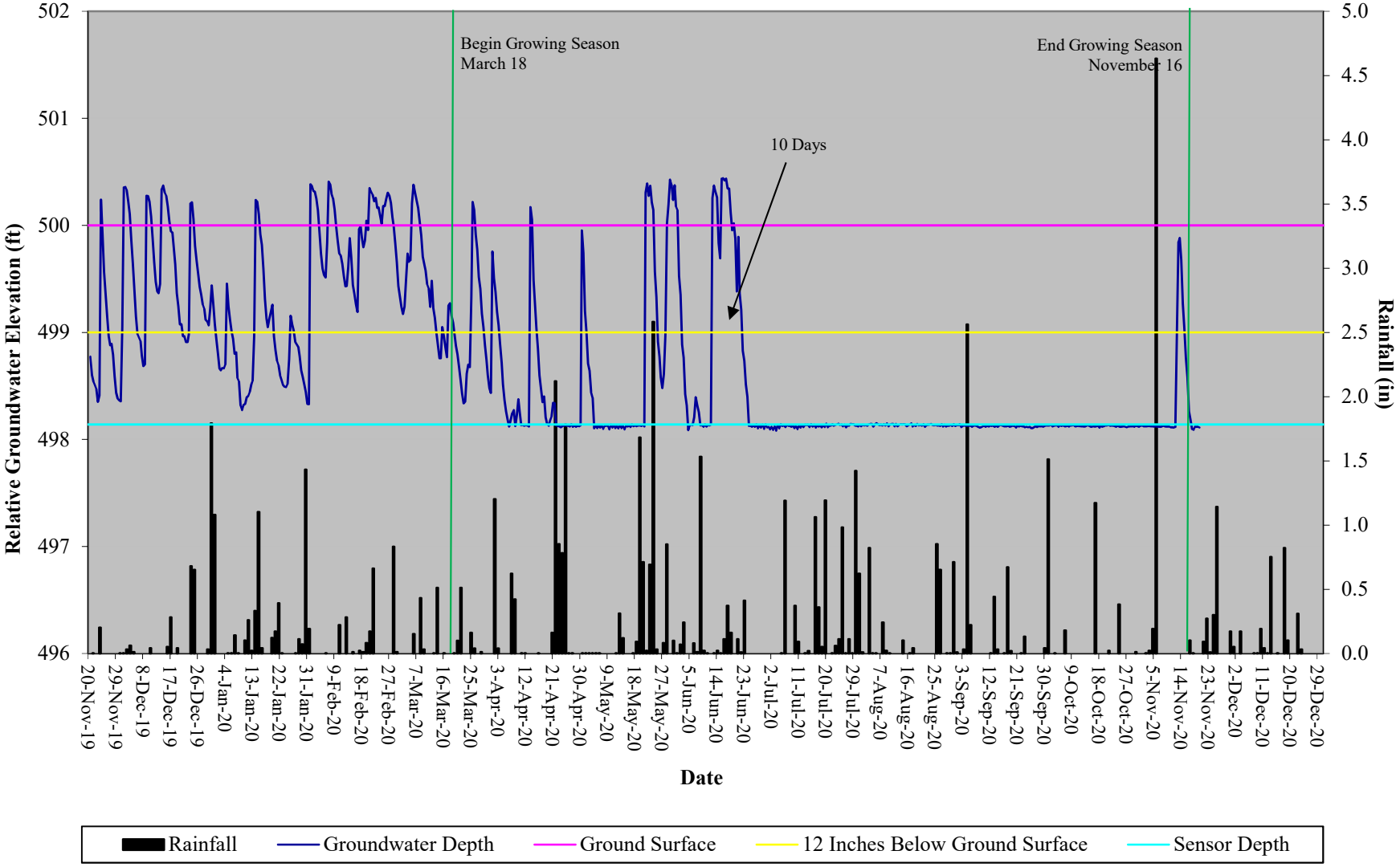
Bear Basin Restoration Site
Hydrograph
Wetland Gauge 18

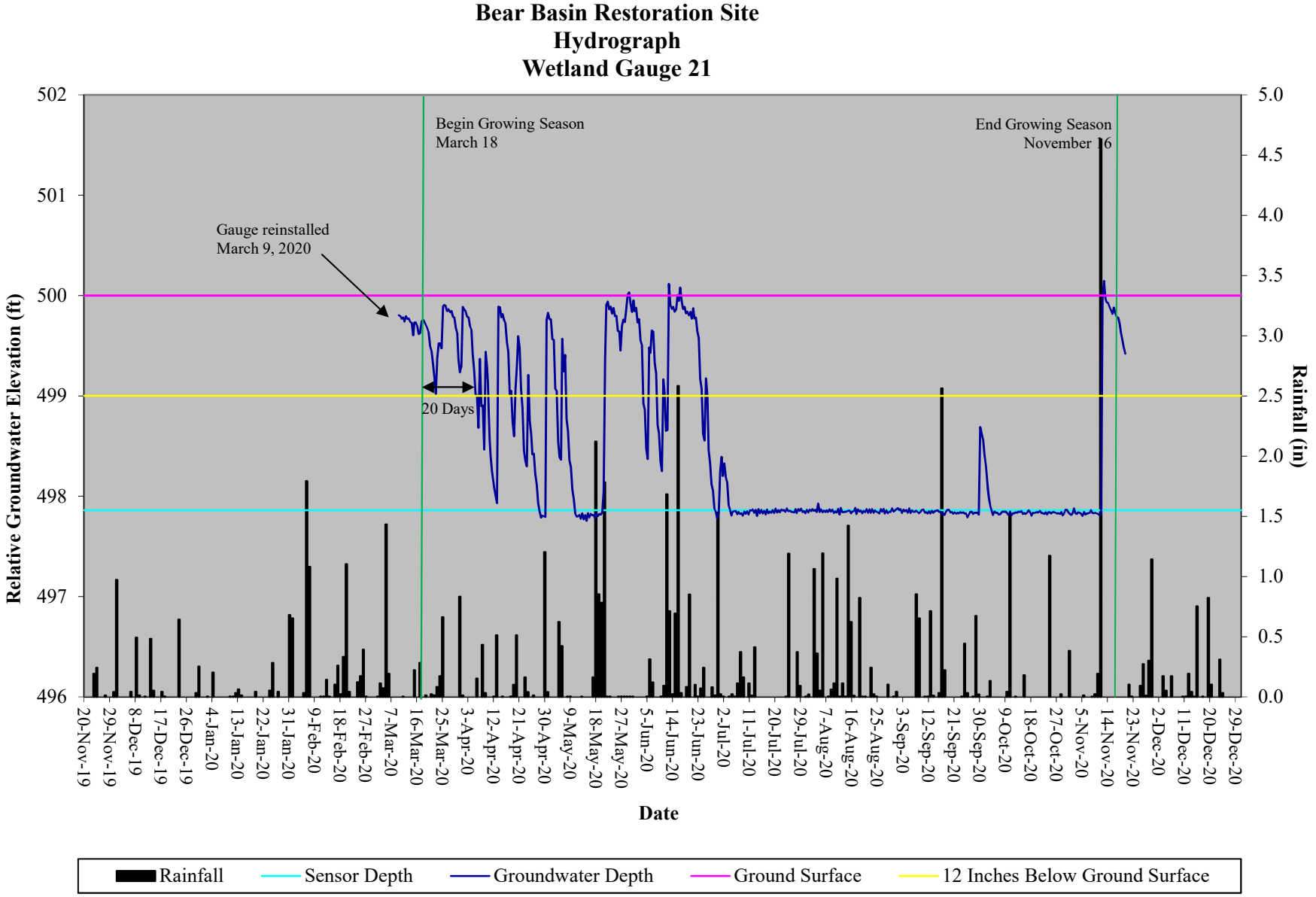


Bear Basin Restoration Site
Hydrograph
Wetland Gauge 19

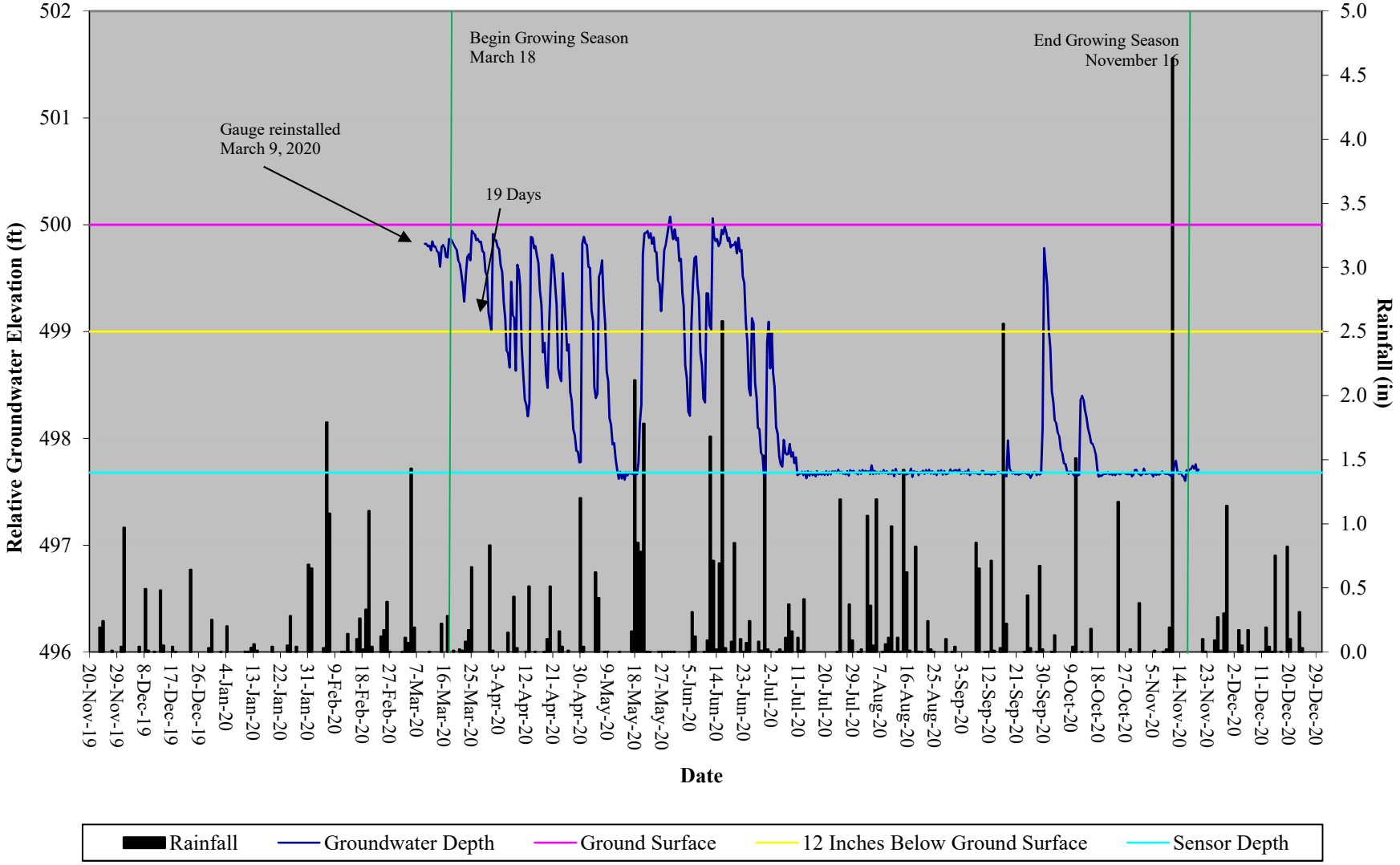


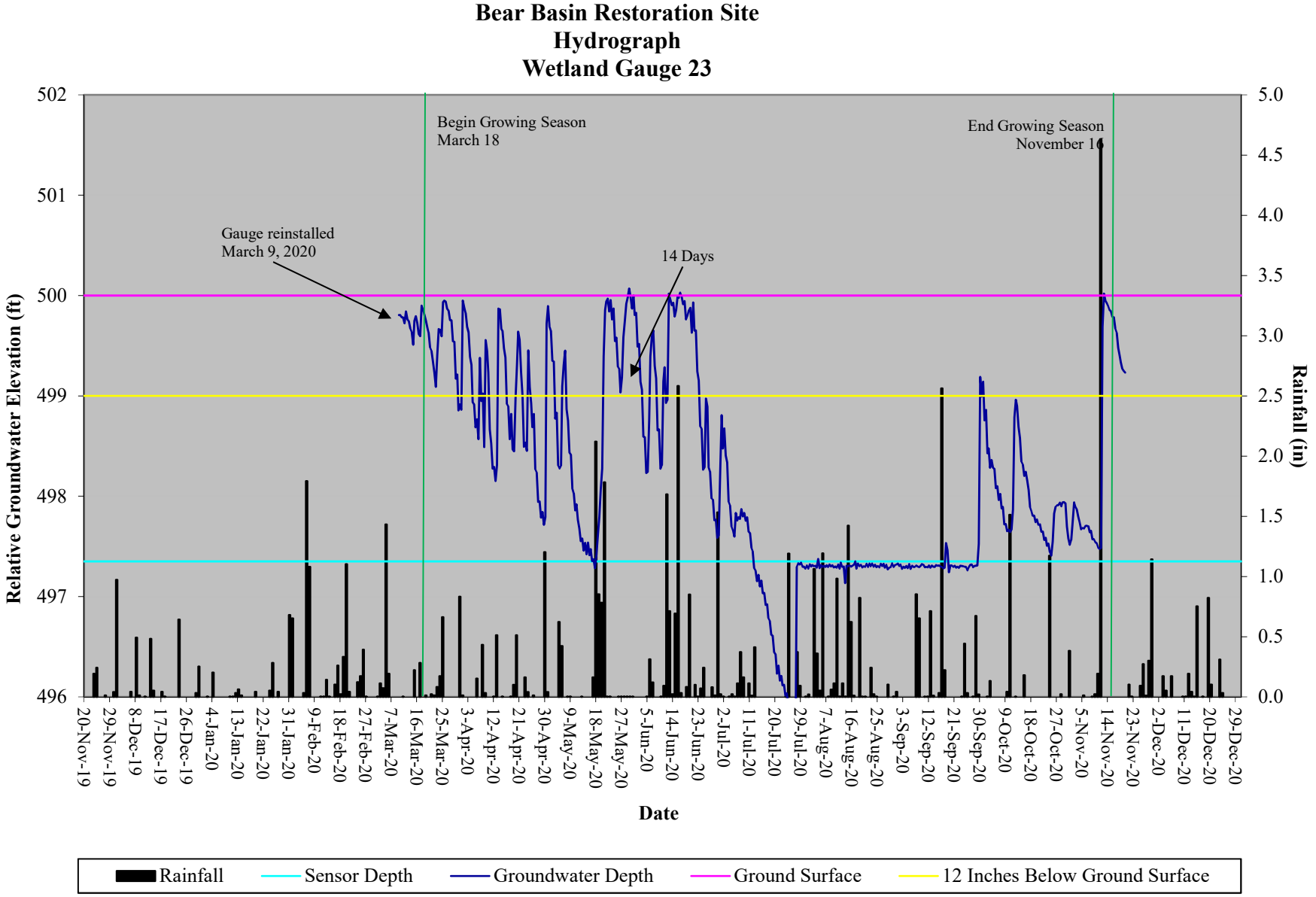
Bear Basin Restoration Site
Hydrograph
Wetland Gauge 20 - non-credit zone

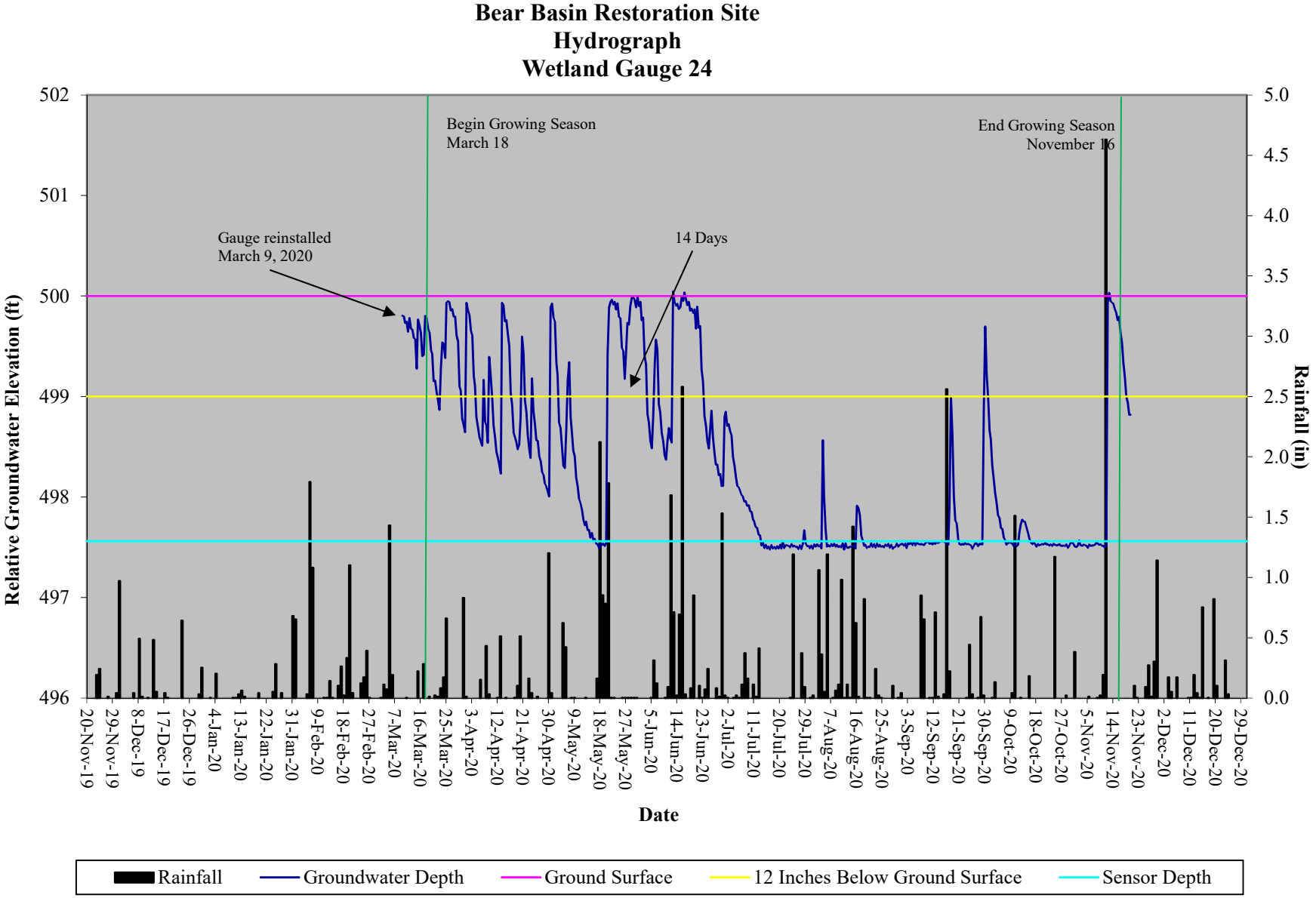



Bear Basin Restoration Site
Hydrograph
Wetland Gauge 21
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
20 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 22




Bear Basin Restoration Site
Hydrograph
Wetland Gauge 23
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
14 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface


Bear Basin Restoration Site
Hydrograph
Wetland Gauge 24
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
14 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

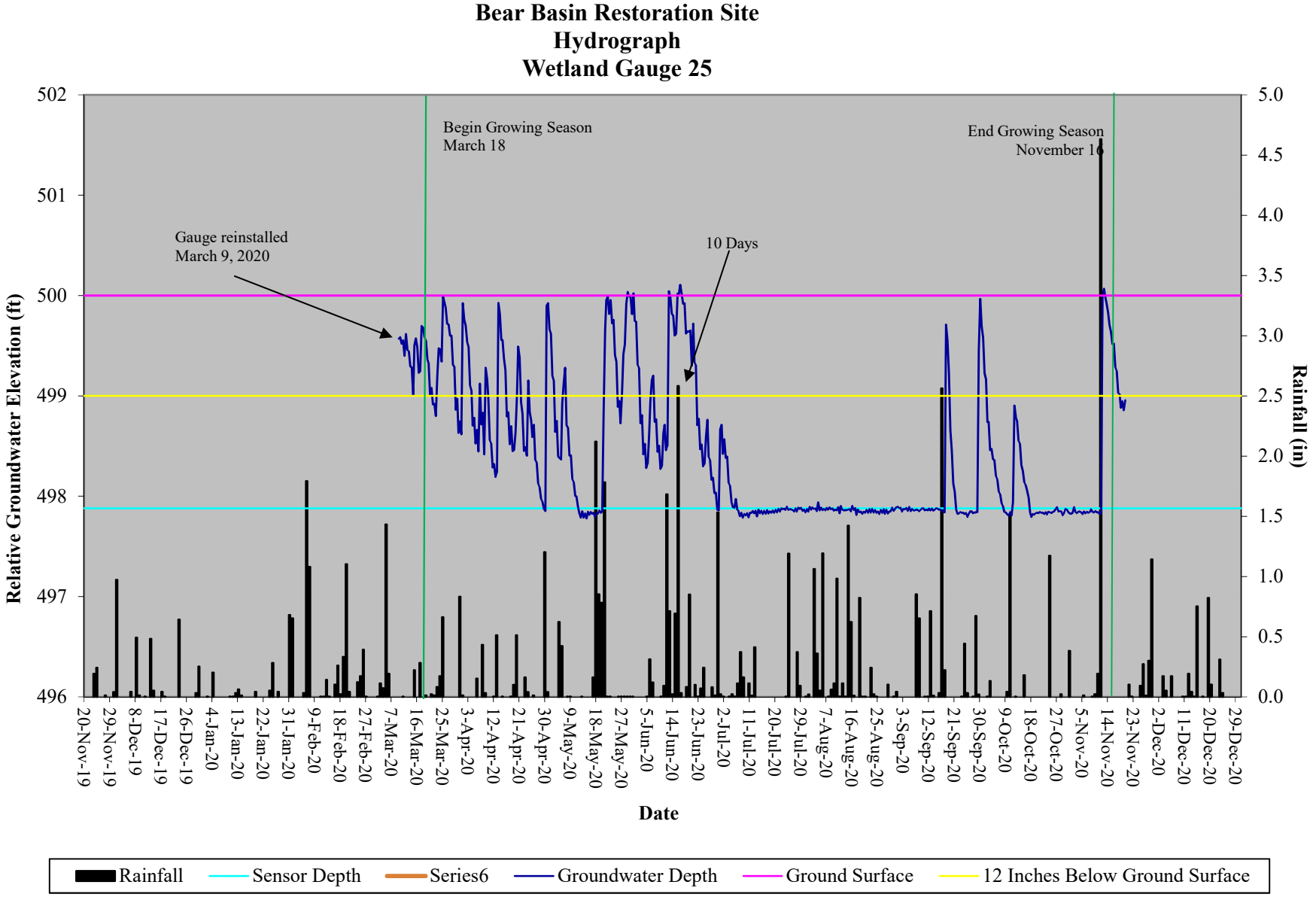

Bear Basin Restoration Site
Hydrograph
Wetland Gauge 25
Begin Growing Season
March 18
End Growing Season
November 16
Gauge reinstalled
March 9, 2020
10 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Sensor Depth
Series6
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

Table 7. Wetland Hydrology Criteria Attainment Table

Project Number and Name: 95362 - Bear Basin Restoration Site

	Success Criteria Achieved / Max Consecutive Days During Growing Season (Percentage)						
Success Criteria (20 Days) (8%)	**MY-01 2015**	**MY-02 2016**	**MY-03 2017**	**MY-04 2018**	**MY-05 2019**	**MY-06 2020**	**MY-07**
Gauge 1	Yes/23 (9.4%)	Yes/24 (9.8%)	Yes/26 (10.7%)	Yes/31 (12.7%)	No/12 (4.9%)	Yes/20 (8.2%)	
Gauge 2	Yes/28 (11.5%)	Yes/42 (17.2%)	Yes/28 (11.5%)	Yes/37 (15.2%)	Yes/40 (16.4%)	Yes/56 (23.0%)	
Gauge 3	Yes/22 (9.0%)	No/14 (5.7%)	No/10 (4.1%)	Yes/27 (11.1%)	Yes/24 (9.8%)	Yes/25 (10.2%)	
Gauge 4	No/17 (7.0%)	No/15 (6.1%)	Yes/25 (10.2%)	Yes/26 (10.7%)	No/9 (3.7%)	No/7 (2.9%)	
Gauge 5	Yes/90 (36.9%)	Yes/48 (19.7%)	Yes/30 (12.3%)	Yes/48 (19.7%)	Yes/43 (17.6%)	Yes/41 (16.8%)	
Gauge 6	Yes/28 (11.5%)	Yes/41 (16.8%)	Yes/29 (11.9%)	Yes/46 (18.9%)	Yes/39 (16.0%)	Yes/42 (17.2%)	
Gauge 7	Yes/51 (20.9%)	Yes/45 (18.4%)	Yes/25 (10.2%)	Yes/47 (19.3%)	Yes/56 (23.0%)	Yes/60 (24.6%)	
Gauge 8	Yes/28 (11.5%)	Yes/42 (17.2%)	Yes/27 (11.1%)	Yes/33 (13.5%)	Yes/41 (16.8%)	Yes/41 (16.8%)	
Gauge 9	Yes/23 (9.4%)	Yes/23 (9.4%)	Yes/25 (10.2%)	Yes/31 (12.7%)	No/13 (5.3%)	Yes/41 (16.8%)	
Gauge 10	Yes/24 (9.8%)	No/18 (7.4%)	Yes/26 (10.7%)	Yes/33 (13.5%)	Yes/23 (9.4%)	Yes/20 (8.2%)	
Gauge 11*	15 (6.1%)	15 (6.1%)	4 (1.6%)	13 (5.3%)	4 (1.6%)	5 (2.0%)	
Gauge 12*	25 (10.2%)	19 (7.8%)	25 (10.2%)	32 (13.1%)	23 (9.4%)	20 (8.2%)	
Gauge 13	Yes/27 (11.1%)	Yes/42 (17.2%)	Yes/26 (10.7%)	Yes/32 (13.1%)	No/11 (4.5%)	Yes/20 (8.2%)	
Gauge 14	Yes/25 (10.2%)	No/19 (7.8%)	Yes/26 (10.7%)	Yes/32 (13.1%)	Yes/23 (9.4%)	Yes/20 (8.2%)	
Gauge 15	Yes/35 (14.3%)	Yes/42 (17.2%)	Yes/27 (11.1%)	Yes/33 (13.5%)	No/13 (5.3%)	No/15 (6.1%)	
Gauge 16	Yes/22 (9.0%)	No/14 (5.7%)	No/10 (4.1%)	Yes/31 (12.7%)	No/12 (4.9%)	No/11 (4.5%)	
Gauge 17*	23 (9.4%)	14 (5.7%)	9 (3.7%)	14 (5.7%)	7 (2.9%)	4 (1.6%)	
Gauge 18	Yes/22 (9.0%)	No/14 (5.7%)	No/9 (3.7%)	Yes/26 (10.7%)	No/8 (3.3%)	No/10 (4.1%)	
Gauge 19	No/18 (7.4%)	No/12 (4.9%)	No/7 (2.9%)	Yes/25 (10.2%)	No/4 (1.6%)	No/8 (3.3%)	
Gauge 20*	19 (7.8%)	12 (4.9%)	7 (2.9%)	26 (10.7%)	8 (3.3%)	10 (4.1%)	
Gauge 21**				Yes/30 (12.3%)	Yes/23 (9.4%)	Yes/20 (8.2%)	
Gauge 22**				Yes/27 (11.1%)	No/10 (4.1%)	No/19 (7.8%)	
Gauge 23**				Yes/26 (10.7%)	No/12 (4.9%)	No/14 (5.7%)	
Gauge 24**				Yes/27 (11.1%)	No/9 (3.7%)	No/14 (5.7%)	
Gauge 25**				Yes/26 (10.7%)	No/8 (3.3%)	No/10 (4.1%)	

*=non-credit bearing area **=Gauge installed March 7, 2018