Monitoring Report

Twin Bays Wetland Restoration Site
DMS Contract 004739
DMS Project Number 95363

Duplin County, NC
CU #:03030007
DWR #: 2013-0455
USACE #: SAW-2012-01385

Monitoring Year 07

Prepared for:

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

Construction Completed: March 2014
Data Collection: 2020
Submitted: December 2020

Mitigation Project Name	**Twin Bays**	**USACE Action ID**	**2012-01385**
DMS ID	**95363**	**DWR Permit**	**2013-0455**
River Basin	**Cape Fear**	**Date Project Instituted**	**7/27/2012**
Cataloging Unit	**03030007**	**Date Prepared**	**4/21/2020**
County	**Duplin**	**Stream/Wet. Service Area**	**Cape Fear 03030007**

Todd J Tugwell 9/21/2020

Signature & Date of Official Approving Credit Release

1 - For NCDMS, no credits are released during the first milestone

2 - For NCDMS projects, the initial credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the IRT by posting it to the DMS portal, provided the following have been met:

1) Approved of 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) Receipt of necessary DA permit authorization or written DA approval for projects 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.

Credit Release Milestone	**Non-Riparian Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	3.180	0.000	3.180	2014	6/25/2014
3 - Year 1 Monitoring	10.00%	10.00%	1.060	0.000	1.060	2015	4/23/2015
4 - Year 2 Monitoring	10.00%	10.00%	1.060	0.000	1.060	2016	4/25/2016
5 - Year 3 Monitoring	10.00%	10.00%	1.060	0.000	1.060	2017	4/3/2017
6 - Year 4 Monitoring	10.00%	10.00%	1.060	0.000	1.060	2018	4/25/2018
7 - Year 5 Monitoring	10.00%	10.00%	1.060	0.000	1.060	2019	4/26/2019
8 - Year 6 Monitoring	10.00%	10.00%	1.060	0.000	1.060	2020	4/21/2020
9 - Year 7 Monitoring	10.00%					2021	
Stream Bankfull Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Totals	0.000	8.480		

Total Gross Credits	10.600
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	9.540
Total Percentage Released	90.00%
Remaining Unreleased Credits	1.060

Notes

Contingencies (if any)

Project Quantities

Mitigation Type	**Restoration Type**	**Physical Quantity**
Non-Riparian	Restoration	10.600

Mitigation Project Name	**Twin Bays**	**USACE Action ID**	**2012-01385**
DMS ID	**95363**	**DWR Permit**	**2013-0455**
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County	**Duplin**	**Stream/Wet. Service Area**	**Cape Fear 03030007**

Debits

							Non-Riparian Restoration Credits
Beginning Balance (mitigation credits)							**10.600**
Released Credits							**9.540**
Unrealized Credits							**0.000**
Owning Program	**Req. Id**	**TIP #**	**Project Name**	**USACE Permit #**	**DWR Permit #**	**DCM Permit #**	
Statewide Stream & Wetland ILF Program	REQ-005131		Country Haven (Caison Violation)	2004-00944			0.002
Statewide Stream & Wetland ILF Program	REQ-005276		Pender Co. Surface Water Treatment & Finished Water Trans Main	2010-01735	2010-0459		0.480
Statewide Stream & Wetland ILF Program	REQ-005290		Bunn Brantley	2009-00748			0.120
Statewide Stream & Wetland ILF Program	REQ-005346		Shelter Creek Quarry	2008-01720	2008-1555		3.640
Statewide Stream & Wetland ILF Program	REQ-005346		Shelter Creek Quarry	2008-01720	2008-1555		1.060
Statewide Stream & Wetland ILF Program	REQ-005346		Shelter Creek Quarry	2008-01720	2008-1555		0.800
Statewide Stream & Wetland ILF Program	REQ-005347		Kennedy Broiler Farm	2011-00079	2011-0142		0.170
Statewide Stream & Wetland ILF Program	REQ-005413		Grady Sanderson Farms Site	2011-01172			0.090
Statewide Stream & Wetland ILF Program	REQ-005413		Grady Sanderson Farms Site	2011-01172			0.333
Statewide Stream & Wetland ILF Program	REQ-005504		American Towers, LLC 273409	2011-01367			0.300
Statewide Stream & Wetland ILF Program	REQ-005685		Dollar General N. College Road	2012-01630	2013-0035		0.043
Statewide Stream & Wetland ILF Program	REQ-005685		Dollar General N. College Road	2012-01630	2013-0035		0.427
Statewide Stream & Wetland ILF Program	REQ-005774		Smith Creek Alandale Pump Station Removal	2012-02066	203-0035		0.140
Statewide Stream & Wetland ILF Program	REQ-008020		Settlement - Rock Hill Road Borrow Pit				0.600
Total Credits Debited							**8.205**
Remaining Available balance (Released credits)							**1.335**
Remaining balance (Unreleased credits)							**1.060**

Design and Monitoring Firm

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Suite 400
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Phone: (919) 278-2514
Fax: (919) 783-9266

Project Contact: 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 2, 2021
To: Lindsay Crocker, DMS Project Manager
From: Tim Morris, Project Manager
KCI Associates of North Carolina, PA
Subject: MY-07 Monitoring Report Comments
Twin Bays IMS#95363, Contract 004739
Cape Fear River Basin CU 03030007
Duplin County, North Carolina

Please find below our responses in italics to the MY-07 Monitoring Report comments from NCDMS received on January 19, 2021, for the Twin Bays Restoration Site.

1. Provide an explanation why KCI thinks the gauge 14 is not meeting success for this year.
   KCI Response: A discussion of this gauge has been added to the narrative section of the report. Additionally, pictures and a discussion of the two soil profiles taken near the gauge have been added to the report.

2. 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: Shapefile for the photo points, privet treatment area, and groundwater gauges have been added to the digital deliverables.

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

Sincerely,

Tim Morris
Project Manager

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Twin Bays Wetland Restoration Site, (TBWRS) completed in March 2014, restored 10.6 acres of non-riparian wetland along with 0.4 acre of upland preservation. The TBWRS is a non-riparian wetland system in the Cape Fear Basin (03030007 8-digit HUC) in southern Duplin County, North Carolina. The project is located in the 14-digit HUC 03030007090040 (Rock Fish Creek), which DMS has identified as a Targeted Local Watershed (TLW) (NCDENR, EEP 2009).

The project site is protected by an 11.72-acre permanent conservation easement held by the State of North Carolina. TBWRS is located on a single parcel located off of Cornwallis Road approximately two miles northwest of Wallace, North Carolina. The project site is bounded by Cornwallis Road to the west, a ditch along the property line to the south, and agricultural land to the east and north. Prior to construction, the site was actively used for row crop farming. The site had a long history of hydrologic modification in order to allow for farming to take place on the property.

The Cape Fear River Basin Restoration Priorities state the goals for the TBWRS's 14-digit HUC are to expand restoration opportunities and repair riparian buffers (NCDENR EEP, 2009). The project goals for TBWRS are in line with the basin priorities and include the following:

- Slow and treat the runoff of upslope agricultural drainage.
- Restore a Hardwood Flats Community.
- Develop valuable wetland habitat niches within a drained agricultural landscape.

The project goals will be addressed through the following 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.
- Modify an existing pond to its natural seep condition to feed the downslope wetland.
- Restore a native forested hardwood wetland community using natives trees and seed mixes.

There are three non-credit generating areas on the site. There is 0.4-acre of uplands located in the forested northeastern corner of the project boundary. This area remained undisturbed and is included in the TBWRS conservation easement. There is a 0.2 acre utility easement on the west side of the site along Cornwallis Road that remained undisturbed. Additionally, the southernmost ditch, located adjacent to the project easement, was left open and not filled. It is anticipated that leaving this ditch open will have minimal impacts to the overall hydrologic performance of the site. The hydrologic influence of this ditch 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 76'. Due to the fact that the southern ditch 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 ditches and surface roughening, the entire site will have more surface and groundwater, which may decrease the effect of the ditch. For this reason, the non-credit generating portion of the site is assumed to be half of the zone of influence for the ditch.

The TBWRS provided mitigation for wetland impacts within Hydrologic Unit 03030007 by restoring 10.6 acres of wetland and preserving 0.4-acre of uplands, generating 10.6 riparian wetland mitigation units (WMU's). The TBWRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. The wetland site will be deemed successful once hydrology is established and vegetation success criteria are met. During the site's seventh growing season, vegetation monitoring

did not take place as stipulated by the IRT. Sixteen of the seventeen credit bearing groundwater monitoring gauges met the success criteria. Chinese privet (*Ligustrum sinense*) growing in the two fingers near the northeast corner of the site was cut and sprayed with herbicide in August 2018. An additional treatment of privet growing in these areas was completed in August 2020. Additional easement markers were also installed in August 2020 along the northeastern boundary of the site where a small amount of encroachment had been noted.

Summary information/data related to the occurrence of items such as encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan documents available on the DMS website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

2.0 MONITORING RESULTS

The TBWRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. The wetland restoration area 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.

2.1 VEGETATION MONITORING

The success criteria for the planted species in the mitigation area is 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.

During an onsite meeting with the IRT on October 30, 2019, it was determined that vegetation monitoring did not need to be performed during Monitoring Year 7, due to the overwhelming success of the vegetation on site.

2.2 HYDROLOGY MONITORING

Wetland hydrology is 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 Duplin 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 soil survey for Duplin County does not contain growing season data; therefore, due to its close proximity, the Sampson County soil survey was used. The estimated growing season begins March 18 and ends November 11 (239 days). The water table of the restored wetlands must be within 12” of the soils surface continuously for at least 8% (19 days) of the 239-day growing season. Wetland hydrology will be monitored with nineteen automatic gauges that

record water table depth. Daily data is collected from the automatic gauges over the 7-year monitoring period.

To monitor the effect of the unfilled ditch described in Section 1.0, four sets of coupled gauges were installed perpendicular to the unfilled ditch. Each set includes a gauge that is 40' from the open ditch and another that is 75' from the ditch. An additional two gauges were installed between the coupled gauges to monitor hydrology less than 40' from the open ditch in the non-credit bearing zone.

The daily rainfall data were obtained from the NC State Climate Office for a local weather station in Jacksonville, NC. In 2020, the months of February, May, September, and November experienced above average rainfall, while January, March, April, June, August, October experienced average rainfall. The month of July recorded below average rainfall for the site. Overall, the area experienced above average rainfall during the 2020 growing season.

During the site's seventh growing season, sixteen of the seventeen credit-bearing gauges met the hydrologic success criteria. The gauge that did not meet the success criteria was Gauge 14. This gauge is located near the upper limit of the elevations on site and as such would be expected to be the driest of the gauges on site. Despite being located in the driest part of the site, this gauge has met the success criteria in 4 out of the 7 monitoring years. A soil profile taken next to the gauge on January 12, 2021 showed evidence of higher chroma soils, but another profile taken approximately 3 feet away from the gauge showed a depleted matrix with redox concentrations. This indicates that the borderline hydrology that this gauge has demonstrated throughout the monitoring period is a localized occurrence and that more robust wetland hydrology exists in close proximity to the gauge. Please see Appendix B – Visual Assessment Data for pictures of these soil profiles. One of the two non-credit bearing gauges achieved the success criteria this year. This gauge (Gauge 6) has met the hydrology success criteria every previous growing season except for the first.

3.0 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)

NCDENR, Ecosystem Enhancement Program. 2009. Lower Yadkin Pee-Dee River Basin Priorities 2009. Raleigh, NC. http://www.nceep.net/services/restplans/Yadkin_Pee_Dee_RBRP_2009_Final.pdf

NCSU BAE. North Carolina State University, Biological and Agricultural Engineering. 2011. Method to Determine Lateral Effect of a Drainage Ditch on Adjacent Wetland Hydrology. Last accessed 11/2012 at: http://www.bae.ncsu.edu/soil_water/projects/lateral_effect.html

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

Appendix A

Project Vicinity Map and Background Tables

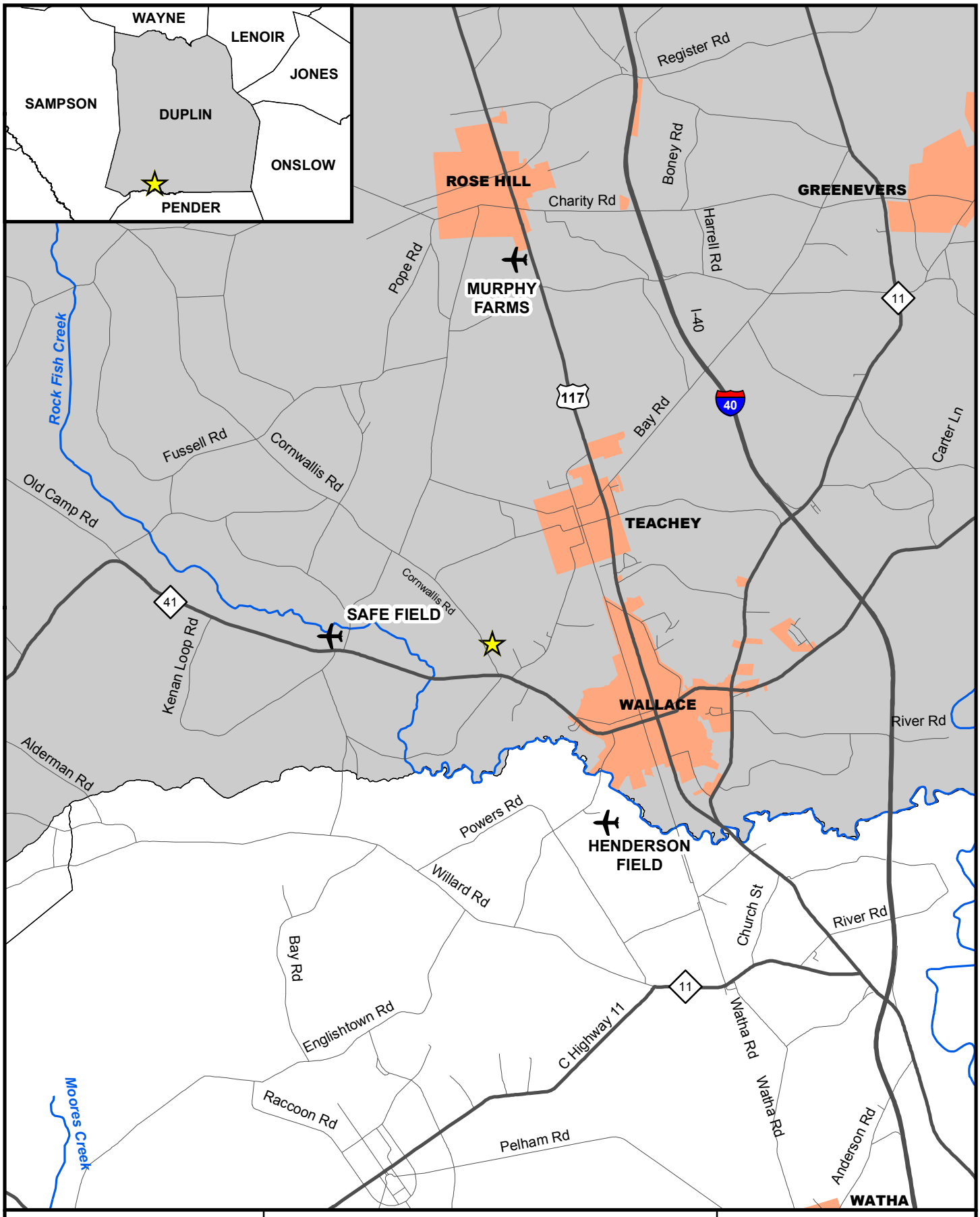


FIGURE 1. PROJECT SITE VICINITY MAP
TWIN BAYS WETLAND RESTORATION SITE
DUPLIN COUNTY, NC

Table 1. Project Components and Mitigation Credits									
Twin Bays Wetland Restoration Site, DMS Project # 95363									
Mitigation Credits									
	Stream		**Riparian Wetland**		**Non-riparian Wetland**		**Buffer**	**Nitrogen Nutrient Offset**	**Phosphorous Nutrient Offset**
Type	R	RE	R	RE	R	RE			
Acres					10.6				
Credits					10.6				
TOTAL CREDITS					10.6				
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	Central and Southern portion of project easement		10.6 acres		-		Restoration	10.6 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					10.6 acres				
Enhancement									
Enhancement I									
Enhancement II									
Creation									
Preservation									0.4 acre
High Quality Preservation									
TOTAL	**-**		**-**	**-**	**10.6 acres**			**-**	**0.4 acre**
TOTAL WMU	**-**		**-**	**-**	**10.6**			**-**	**-**

Table 2. Project Activity & Reporting History Twin Bays Wetland Restoration Site, DMS Project # 95363		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Oct 2013
Final Design - Construction Plans		Dec 2013
Construction		Feb/March 2014
Planting		March 2014
Baseline Monitoring/Report	April 2014	May 2014
Vegetation Monitoring	April 10, 2014	
Photo Points	April 10, 2015	
Year 1 Monitoring	Nov 2014	Dec 2014
Vegetation Monitoring	Nov 3, 2014	
Photo Points	Nov 3, 2014	
Gauge Download	Nov 2017, 2014	
Supplemental Planting		March 2015
Year 2 Monitoring	Nov 2015	Jan 2016
Vegetation Monitoring	July 30, 2015	
Photo Points	July 30, 2015	
Gauge Download	Nov 25, 2015	
Year 3 Monitoring	Dec 2016	Dec 2016
Vegetation Monitoring	July 6, 2016	
Photo Points	Aug 23, 2016	
Gauge Download	Dec 14, 2016	
Year 4 Monitoring	Nov 2017	Dec 2017
Vegetation Monitoring	N/A	
Photo Points	Nov 30, 2017	
Gauge Download	Nov 30, 2017	
Year 5 Monitoring	Nov 2018	Dec 2018
Vegetation Monitoring	July 13, 2018	
Photo Points	Nov 13, 2018	
Gauge Download	Nov 13, 2018	
Invasive Treatment		August 6, 2018
Year 6 Monitoring	Nov 2019	Dec 2019
Vegetation Monitoring	N/A	
Photo Points	Nov 13, 2019	
Gauge Download	Nov 13, 2019	
Invasive Treatment		August 13, 2020
Year 7 Monitoring	Nov 2020	Dec 2020
Vegetation Monitoring	N/A	
Photo Points	Nov 20, 2020	
Gauge Download	Nov 20, 2020	

Table 3. Project Contacts **Twin Bays Wetland Restoration Site, DMS Project # 95363**	
Design Firm	KCI Associates of North Carolina, PA 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	Forestree Management Co. 1280 Maudis Road Bailey, NC 27807 Contact: Mr. Tony Cortez Phone: (252) 243-2513
Monitoring Performers	
	KCI Associates of North Carolina, PA 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 Information			
Twin Bays Wetland Restoration Site, DMS Project # 95363			
Project Name	Twin Bays Wetland Restoration Site		
County	Duplin County		
Project Area (acres)	11.72 acres		
Project Coordinates (lat. and long.)	34.748418 N , -78.027129 W		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	Cape Fear		
USGS Hydrologic Unit 8-digit	03030007	**USGS Hydrologic Unit 14-digit**	03030007090040
DWQ Sub-basin	18-74-29b		
Project Drainage Area (acres)	25.4 acres		
Project Drainage Area Percentage of Impervious Area	2%		
CGIA Land Use Classification	93% Cultivated, 2% Mixed Shrubland, and 5% Low-Intensity Development		
Wetland Summary Information (Post-Restoration)			
Parameters	**Wetland Area**		
Size of Wetland (acres)	10.6 acres		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian		
Mapped Soil Series	Rains (Torhunta, Murville/Leon and Udorthents by detailed soil investigation)		
Drainage class	Poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Hillside seepage / precipitation		
Hydrologic Impairment	Ditching and Crops		
Native vegetation community	Hardwood Flats Community		
Percent composition of exotic invasive vegetation	0%		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes, received 404 permit	N/A
Waters of the United States – Section 401	Yes	Yes, received 401 permit	N/A
Endangered Species Act*	No	N/A	N/A
Historic Preservation Act*	No	N/A	N/A
Coastal Zone Management Act * (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	FEMA Floodplain Checklist
Essential Fisheries Habitat*	No	N/A	N/A

Appendix B

Visual Assessment Data

LEGEND:

- CONSERVATION EASEMENT
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- VEG PLOT TOTAL / PLANTED STEM DENSITY — 1489 / 983
- WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION
- WETLAND GAUGE BELOW HYDROLOGIC CRITERION
- PHOTO POINT

* *VEG DATA FROM MY05 (2018)*
IMAGE SOURCE: NC 2016 ORTHOIMAGERY

NC GRID MAG (83)

–50′ –25′ 0′ 50′ 100′
GRAPHIC SCALE

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

TWIN BAYS
WETLAND RESTORATION SITE
DMS PROJECT #95363
WALLACE, DUPLIN COUNTY, NORTH CAROLINA
MONITORING YEAR 07

DATE: DEC 2020
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 1

Table 5. Vegetation Condition Assessment
Twin Bays Restoration Site, DMS Project #95363

Planted Acreage 10.6 **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 acre	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 acre	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 acre	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).	1,000 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

PP1a – MY-00 – 4/10/14

PP1a – MY07 – 11/20/20

PP1b– MY-00 – 4/10/14

PP1b – MY07 – 11/20/20

PP2a – MY-00 – 4/10/14

PP2a – MY07 – 11/20/20

PP2b – MY-00 – 4/10/14

PP2b – MY07 – 11/20/20

PP3 – MY-00 – 4/10/14

PP3 – MY07 – 11/20/20

PP4a – MY-00 – 4/10/14

PP4a – MY07 – 11/20/20

PP4b – MY-00 – 4/10/14

PP4b – MY07 – 11/20/20

PP5a – MY-00 – 4/10/14

PP5a – MY07 – 11/20/20

PP5b – MY-00 – 4/10/14

PP5b – MY07 – 11/20/20

PP6a – MY-00 – 4/10/14

PP6a – MY07 – 11/20/20

PP6b– MY-00 – 4/10/14

PP6b – MY07 – 11/20/20

Soil Profiles Taken Near Gauge 14

Soil profile taken next to Gauge 14 – 1/12/21

Depleted matrix about 3’ from Gauge 14 – 1/12/21

Redox concentrations about 3’ from Gauge 14 – 1/12/21

Appendix C

Vegetation Plot Data

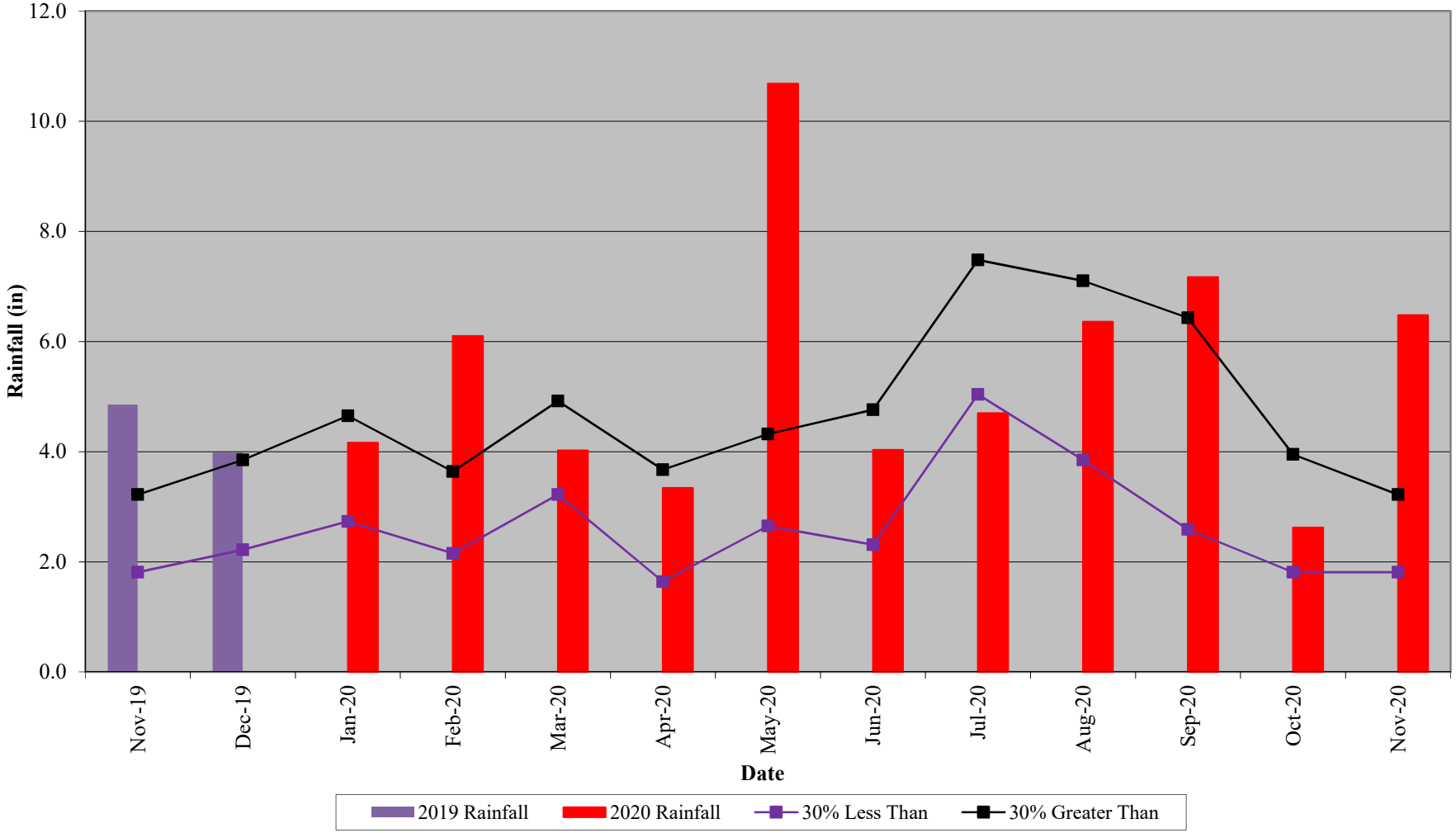
Table 6. CVS Stem Count Total and Planted by Plot and Species
DMS Project Code 95363. Project Name: Twin Bays Restoration Site

Annual Means																	
			MY5 (2018)			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
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	3	3	32	3	3	9	3	3	9	3	3	7	5	5	5
Aronia arbutifolia	Red Chokeberry	Shrub	8	8	8	8	8	11	7	7	7	8	8	8	11	11	11
Baccharis	baccharis	Shrub			16			12									
Baccharis halimifolia	eastern baccharis	Shrub						2			11			7			
Betula nigra	river birch	Tree	49	49	49	49	49	49	48	48	48	48	48	48	47	47	47
Diospyros virginiana	common persimmon	Tree						1									
Fraxinus pennsylvanica	green ash	Tree	26	26	26	25	25	25	26	26	26	24	24	24	5	5	5
Juglans nigra	black walnut	Tree			1												
Liquidambar styraciflua	sweetgum	Tree			4			1			1			1			
Liriodendron tulipifera	tuliptree	Tree	2	2	2	3	3	3	3	3	3	1	1	1	18	18	18
Magnolia virginiana	sweetbay	Tree	16	16	16	15	15	15	15	15	15	13	13	13	17	17	17
Nyssa biflora	swamp tupelo	Tree									5						
Pinus taeda	loblolly pine	Tree			42			2									
Platanus occidentalis	American sycamore	Tree	3	3	10	3	3	4	3	3	7	3	3	3			
Quercus michauxii	swamp chestnut oak	Tree	59	59	59	59	59	59	59	59	59	54	54	54			
Quercus pagoda	cherrybark oak	Tree	20	20	29	21	21	23	21	21	22	23	23	23	22	22	22
Quercus palustris	pin oak	Tree	1	1	1	1	1	1									
Quercus phellos	willow oak	Tree	20	20	21	20	20	20	20	20	20	9	9	9			
Salix nigra	black willow	Tree			11			7			2			3			
Sambucus	elderberry	Shrub			2												
Sambucus canadensis	Common Elderberry	Shrub									3						
Taxodium distichum	bald cypress	Tree	18	18	19	18	18	18	16	16	16	6	6	6	1	1	1
Ulmus americana	American elm	Tree													8	8	8
Unknown		Shrub or Tree										10	10	10	104	104	104
Vaccinium corymbosum	highbush blueberry	Shrub	18	18	20	19	19	19	22	22	22	20	20	20	22	22	22
		Stem count	243	243	368	244	244	281	243	243	276	222	222	237	260	260	260
		size (ares)	10			10			10			10			10		
		size (ACRES)	0.25			0.25			0.25			0.25			0.25		
		Species count	13	13	19	13	13	19	12	12	17	13	13	16	11	11	11
		Stems per ACRE	983	983	1489	987	987	1137	983	983	1117	898	898	959	1052	1052	1052

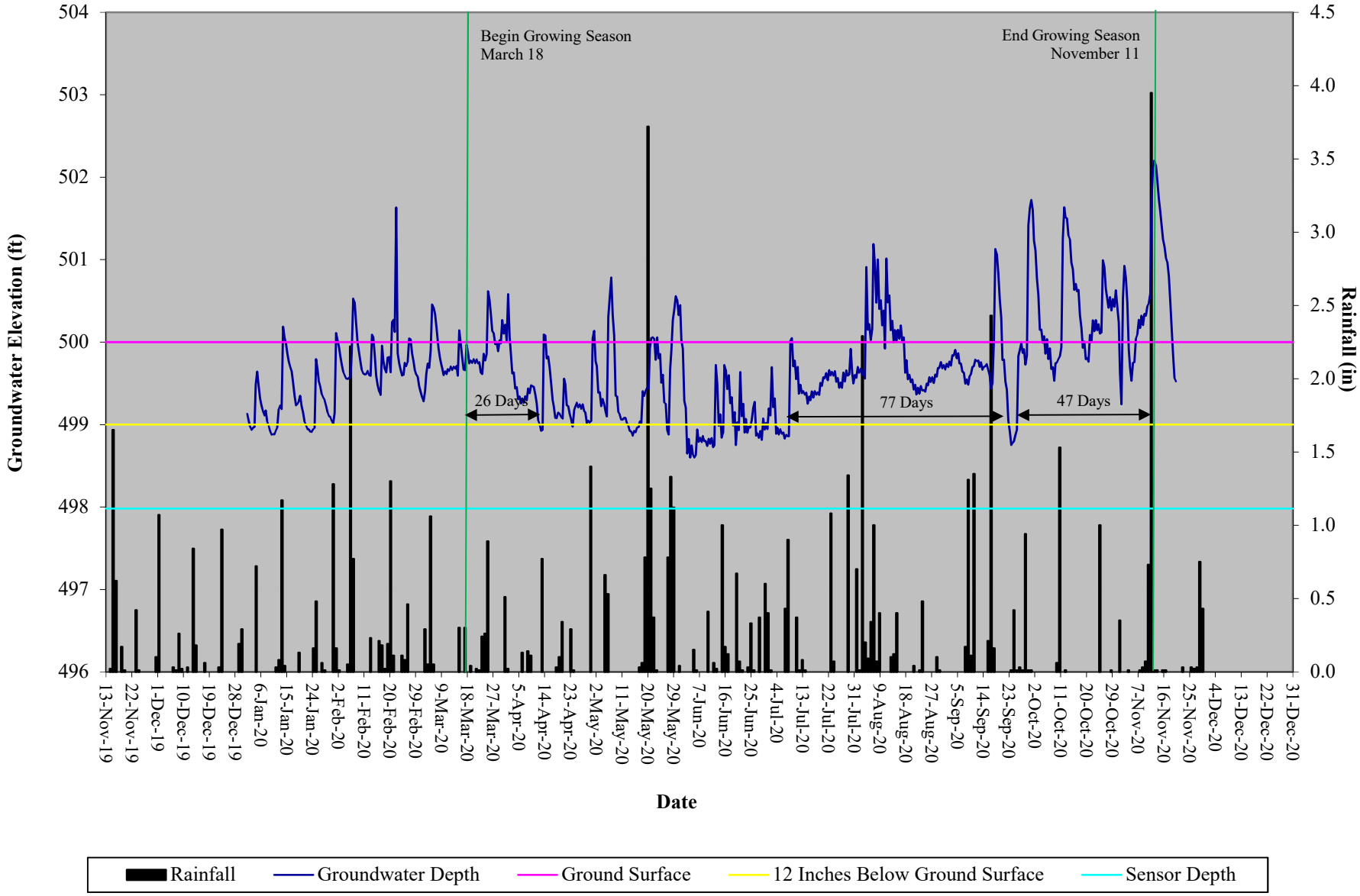
Appendix D

Hydrologic Data

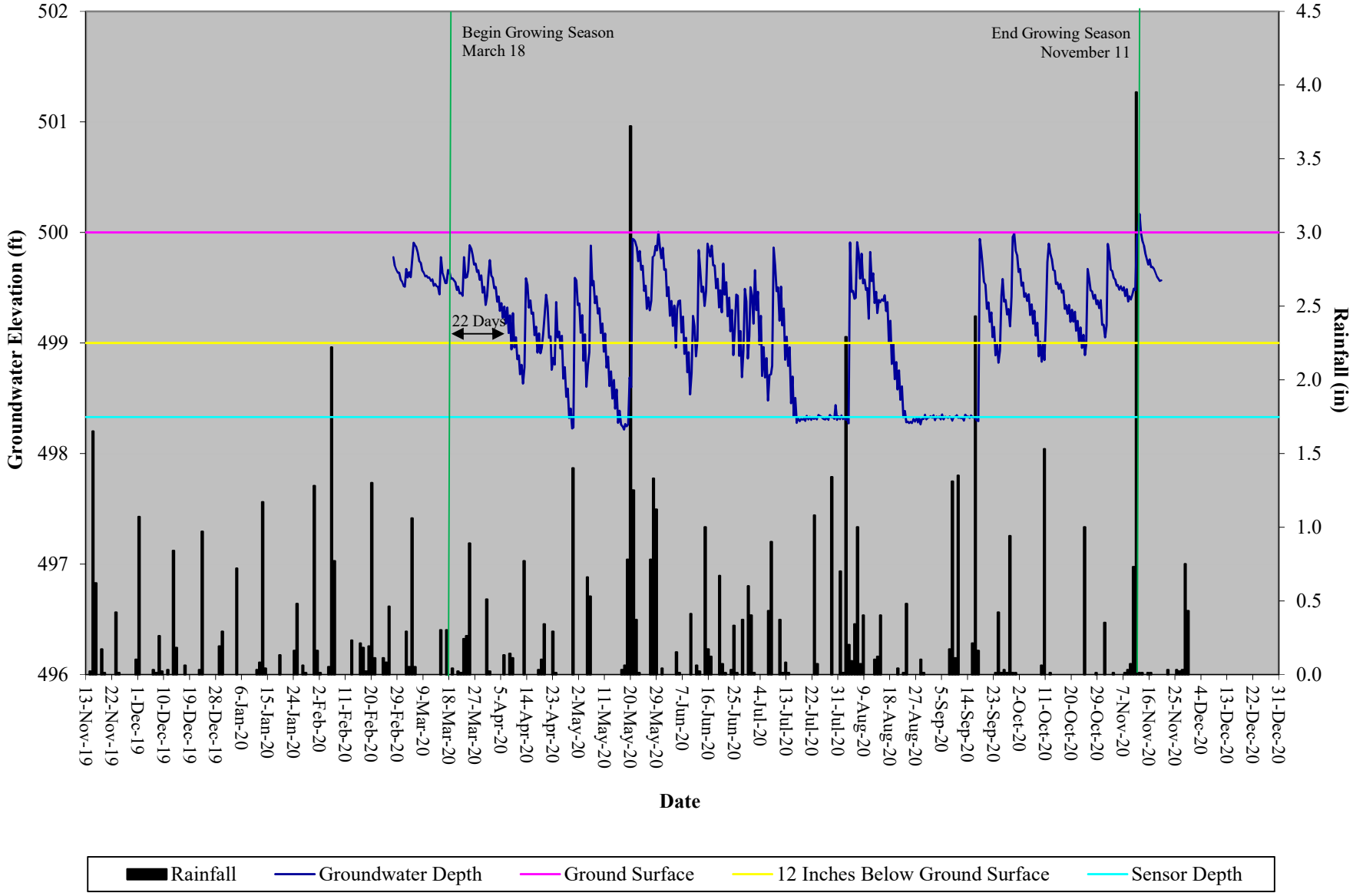
Twin Bays Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Warsaw, NC



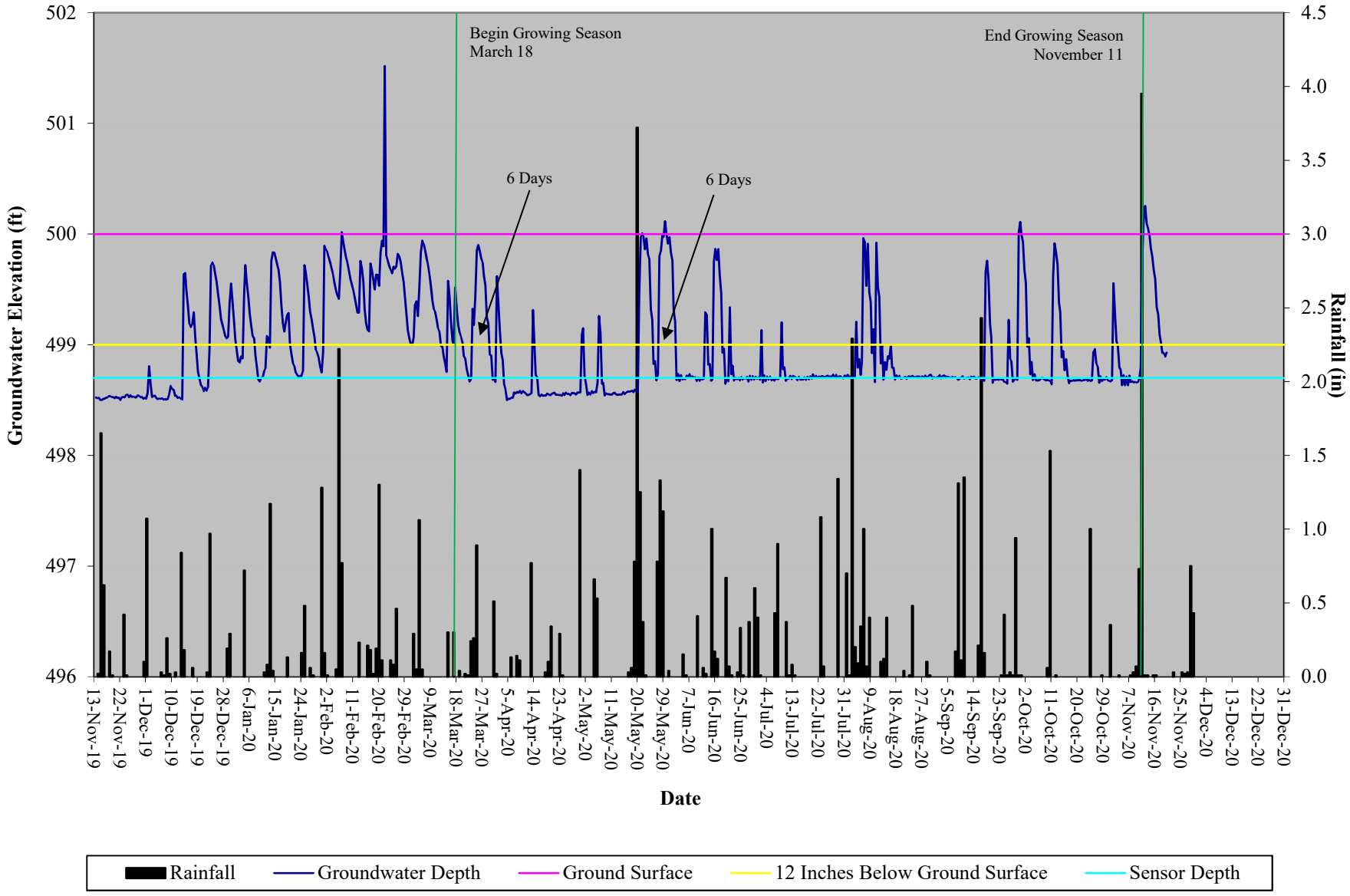
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 1



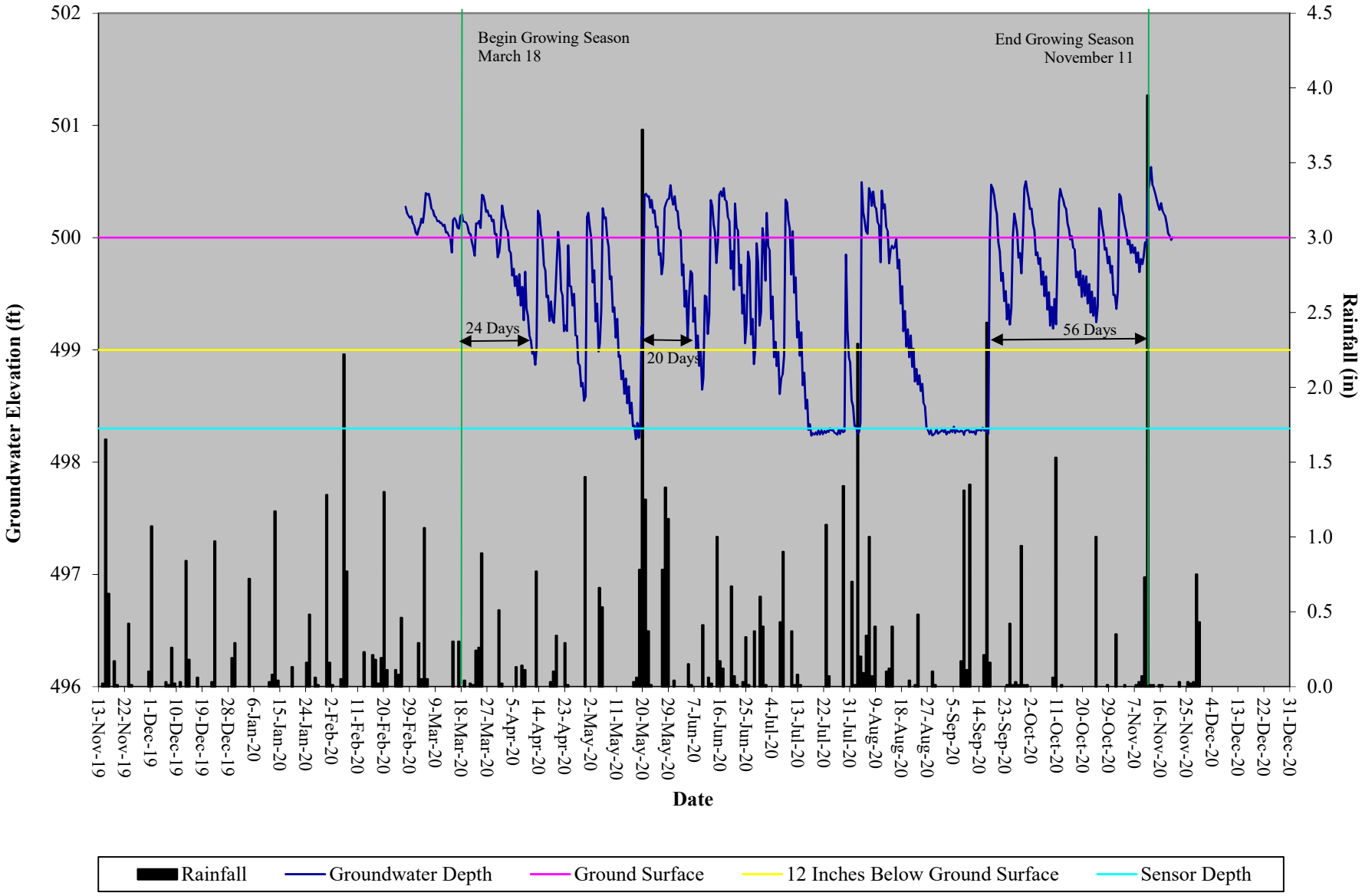
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 2



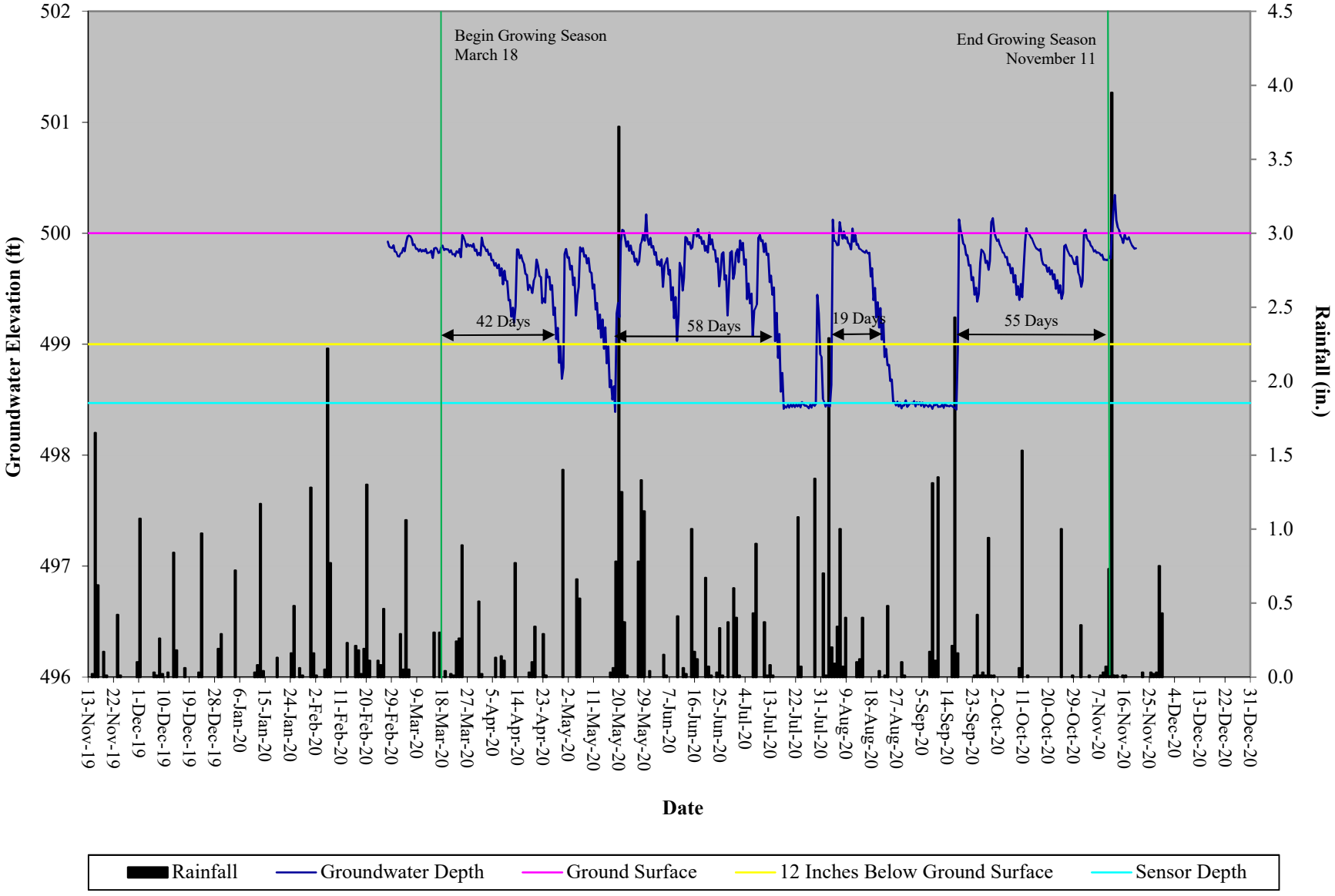
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 3 - non-credit bearing



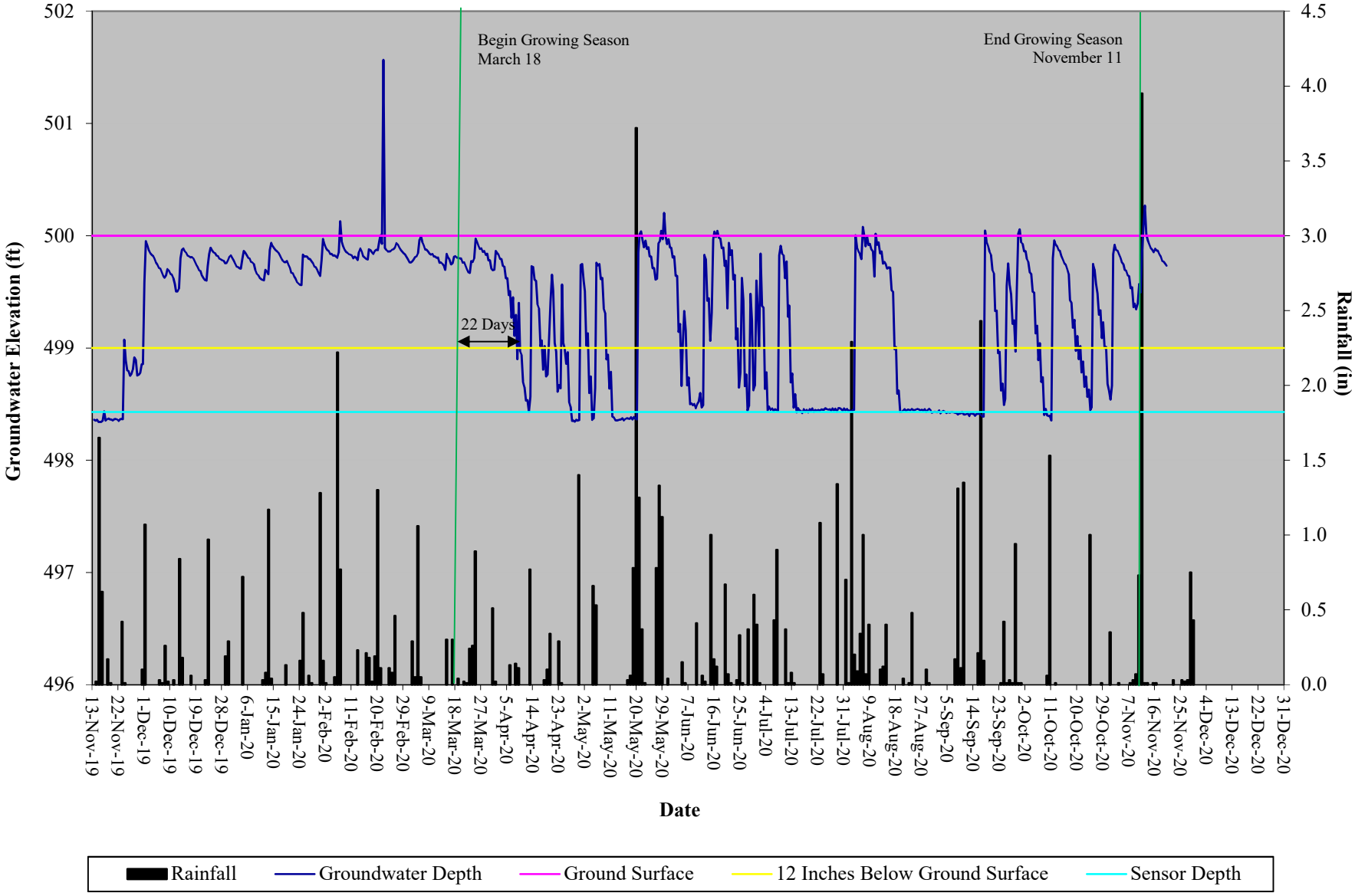
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 4



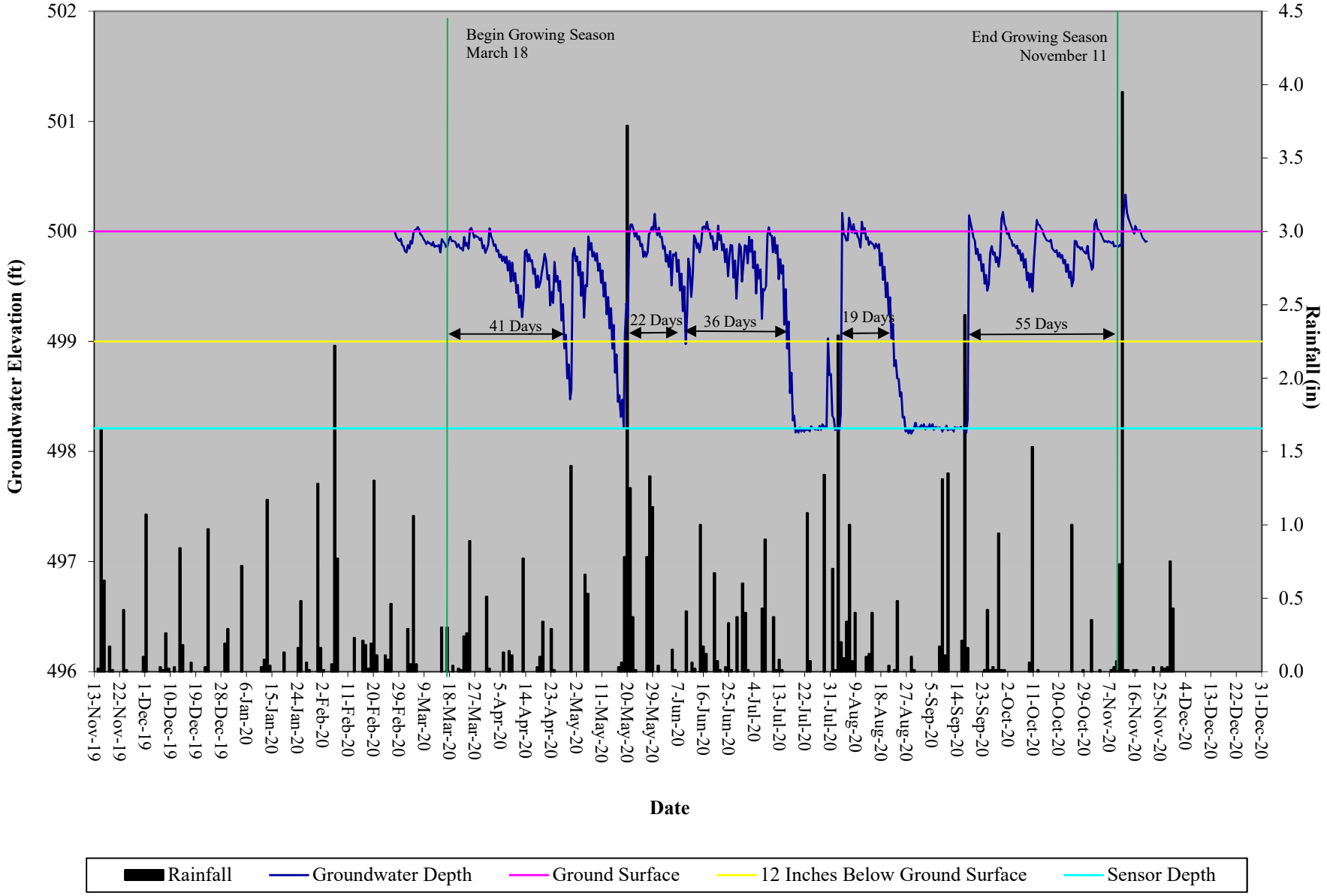
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 5



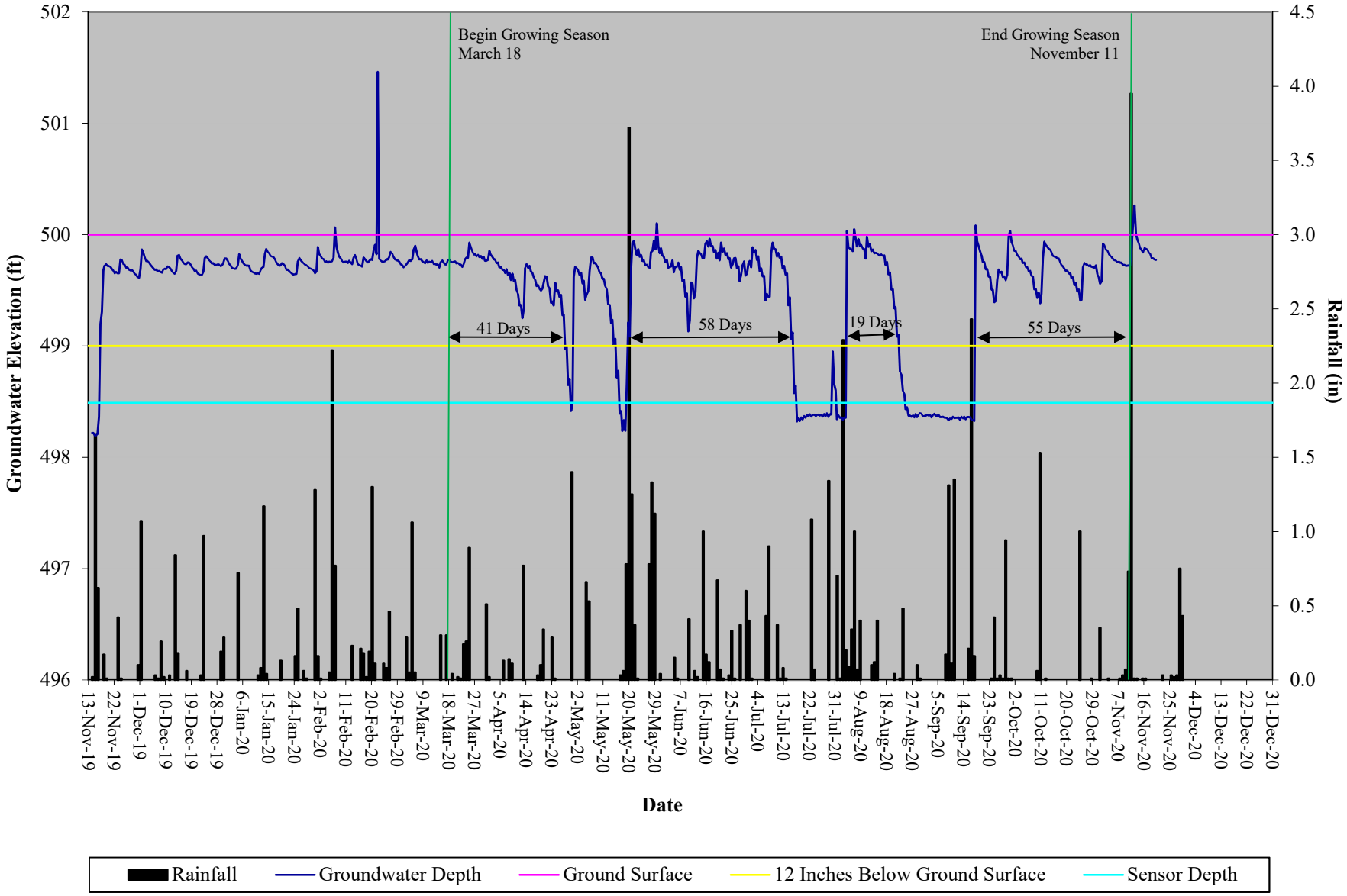
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 6 - non-credit bearing



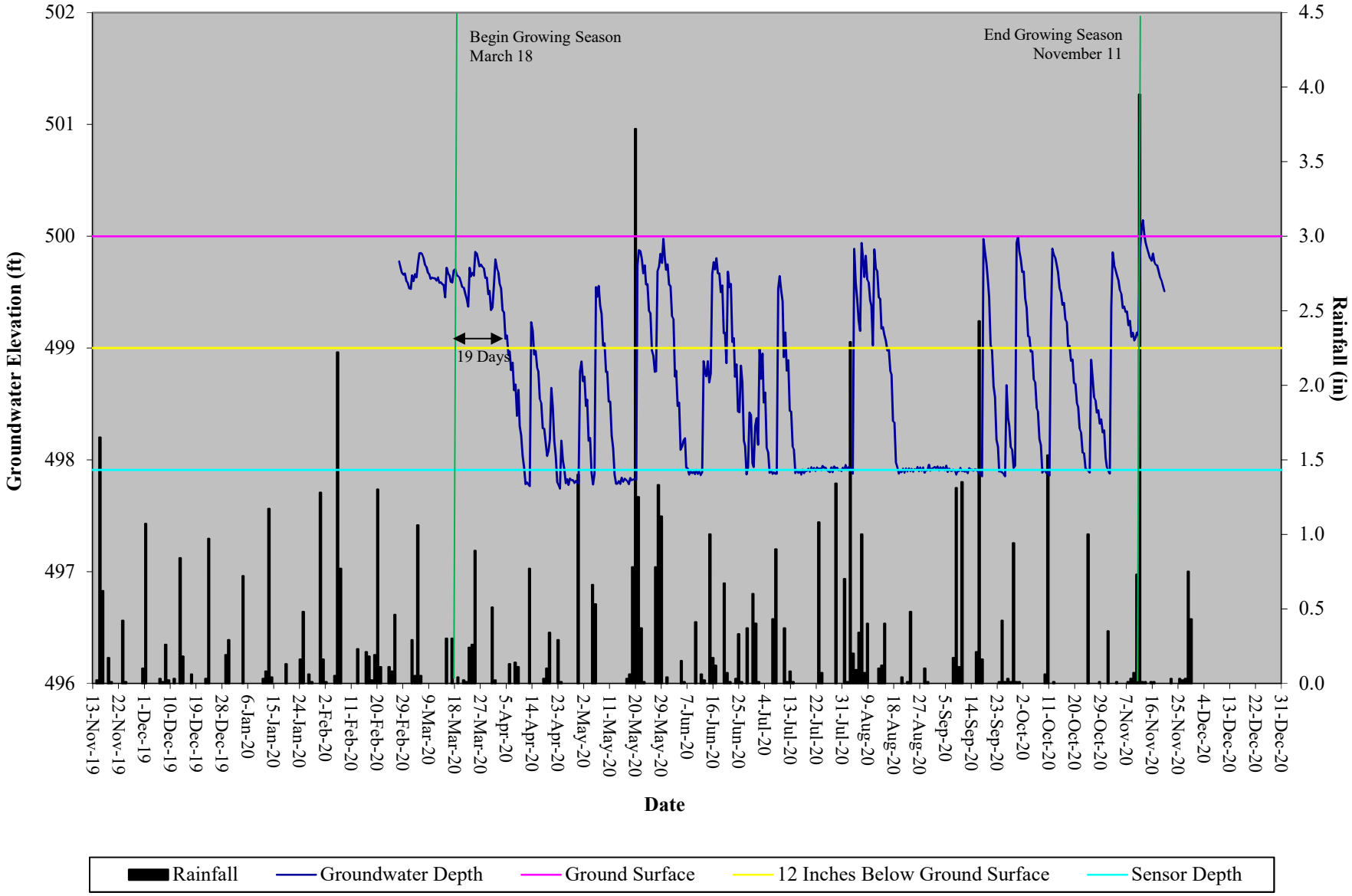
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 7



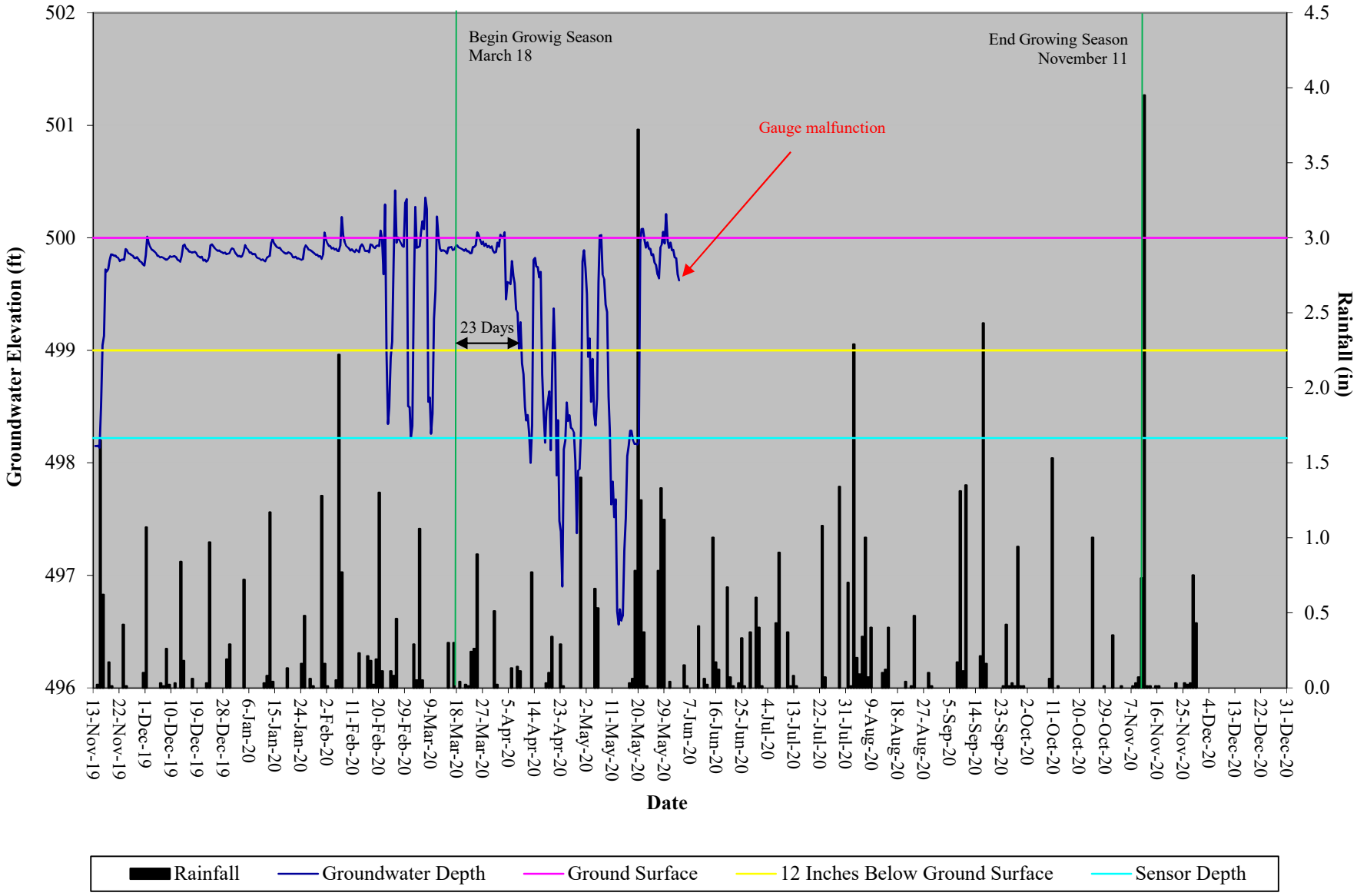
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 8



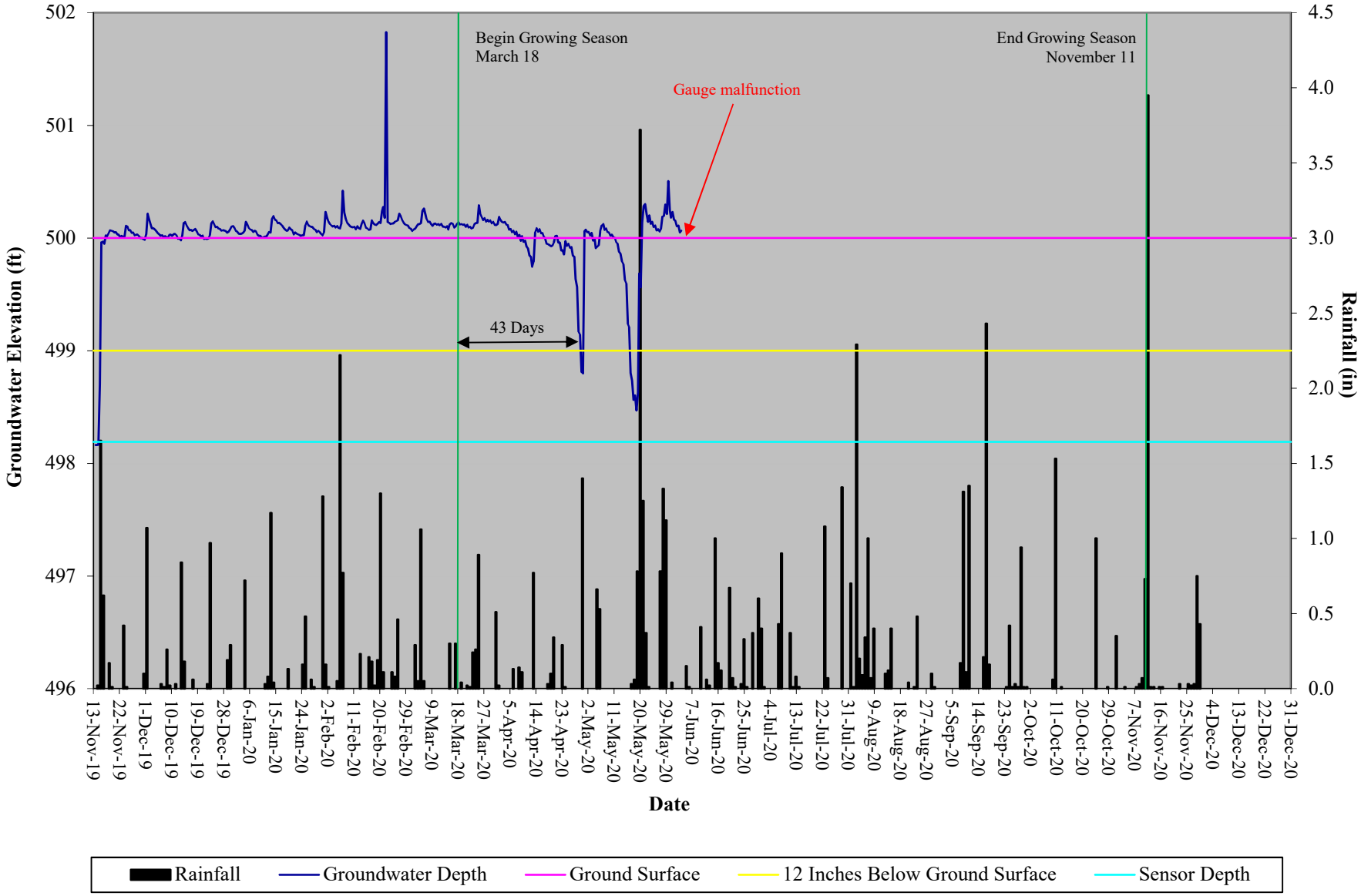
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 9



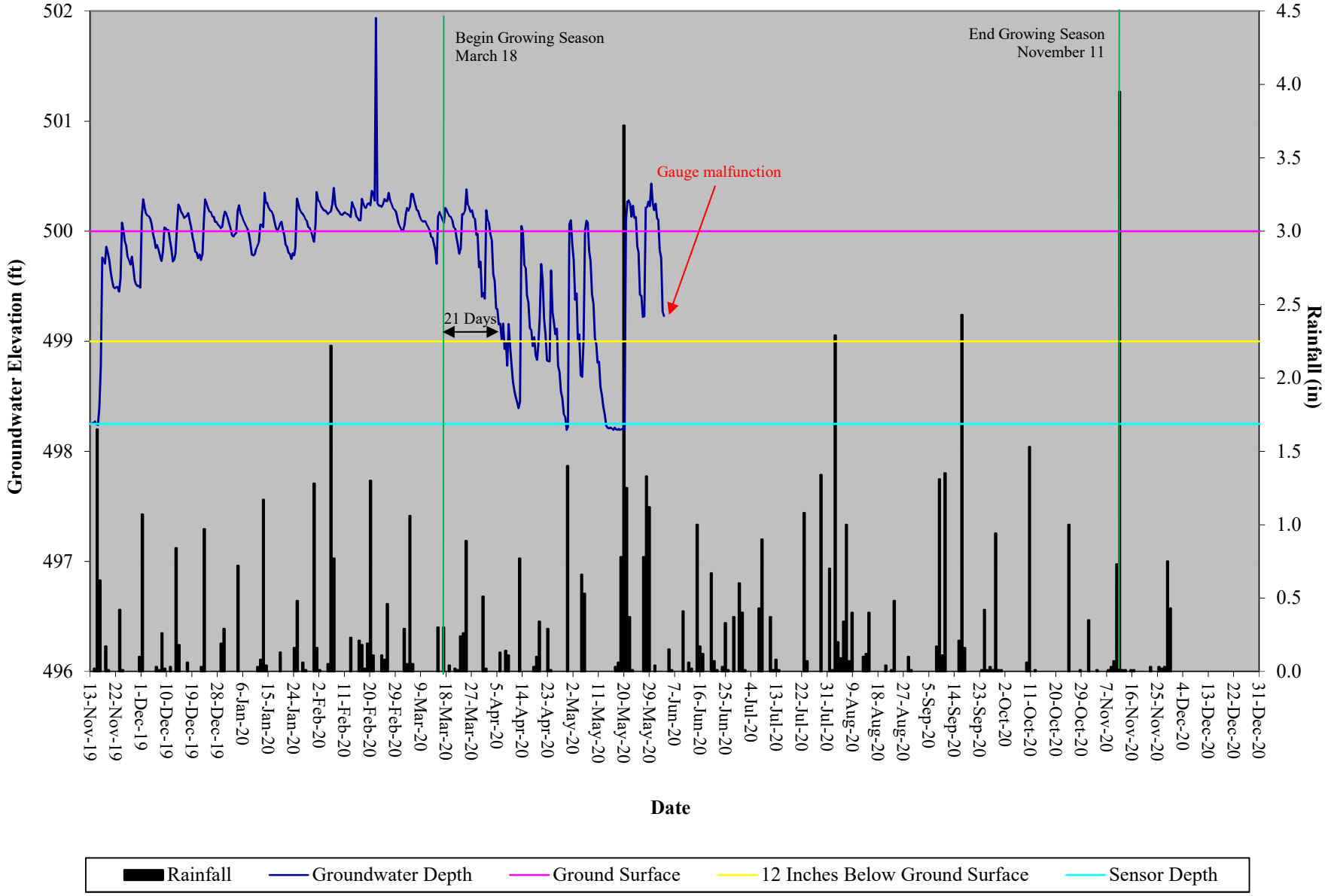
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 10



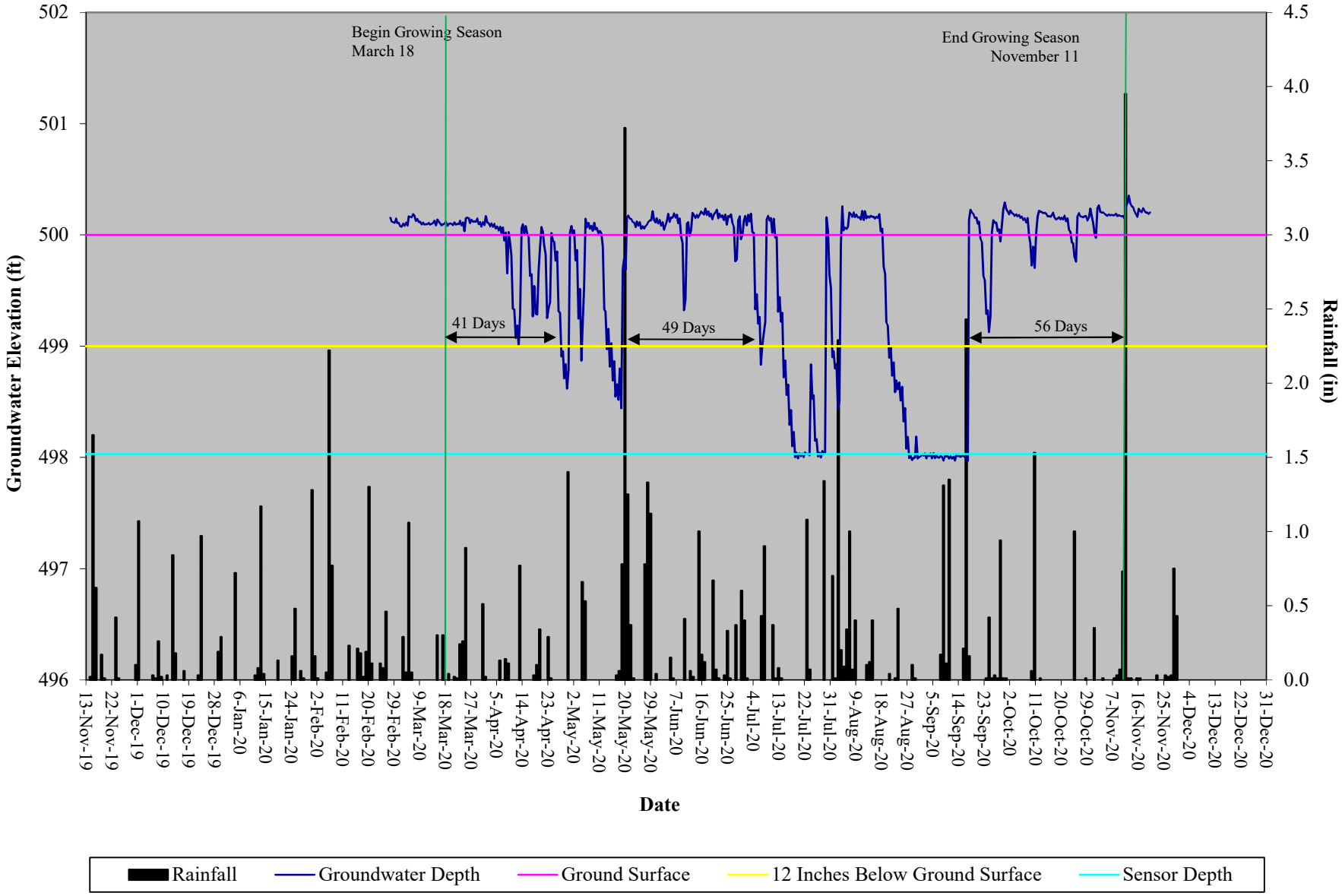
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 11



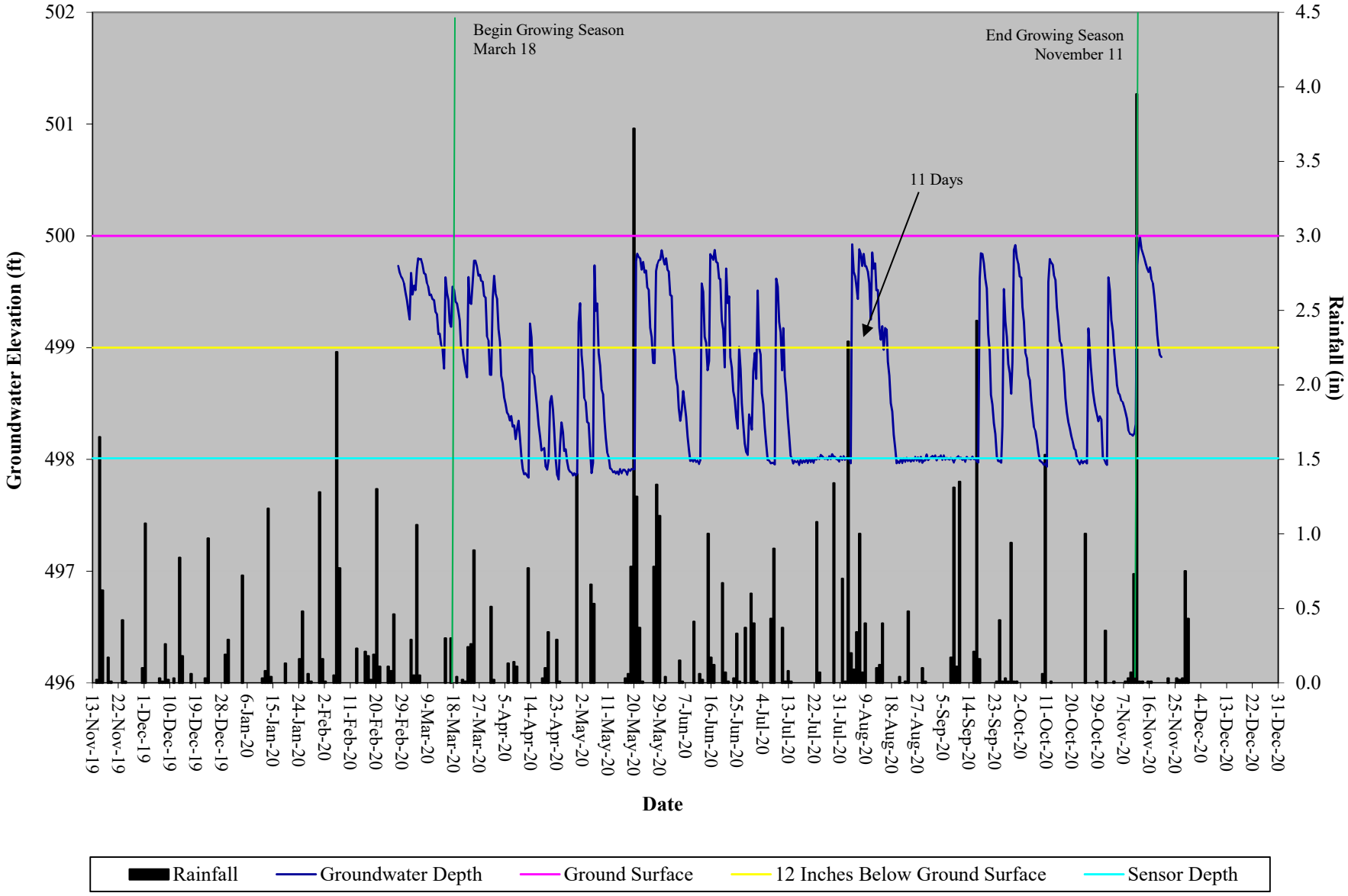
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 12



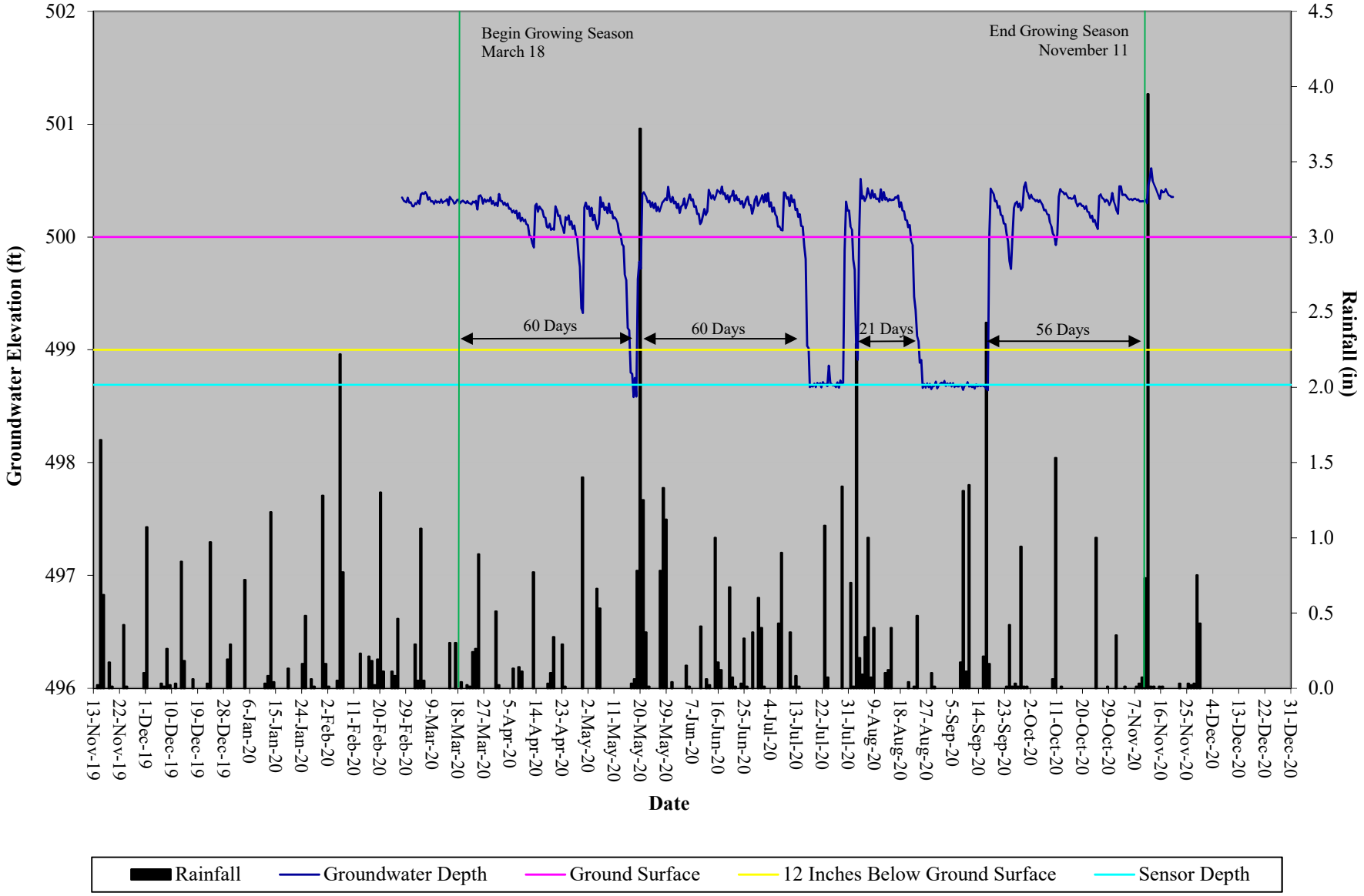
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 13



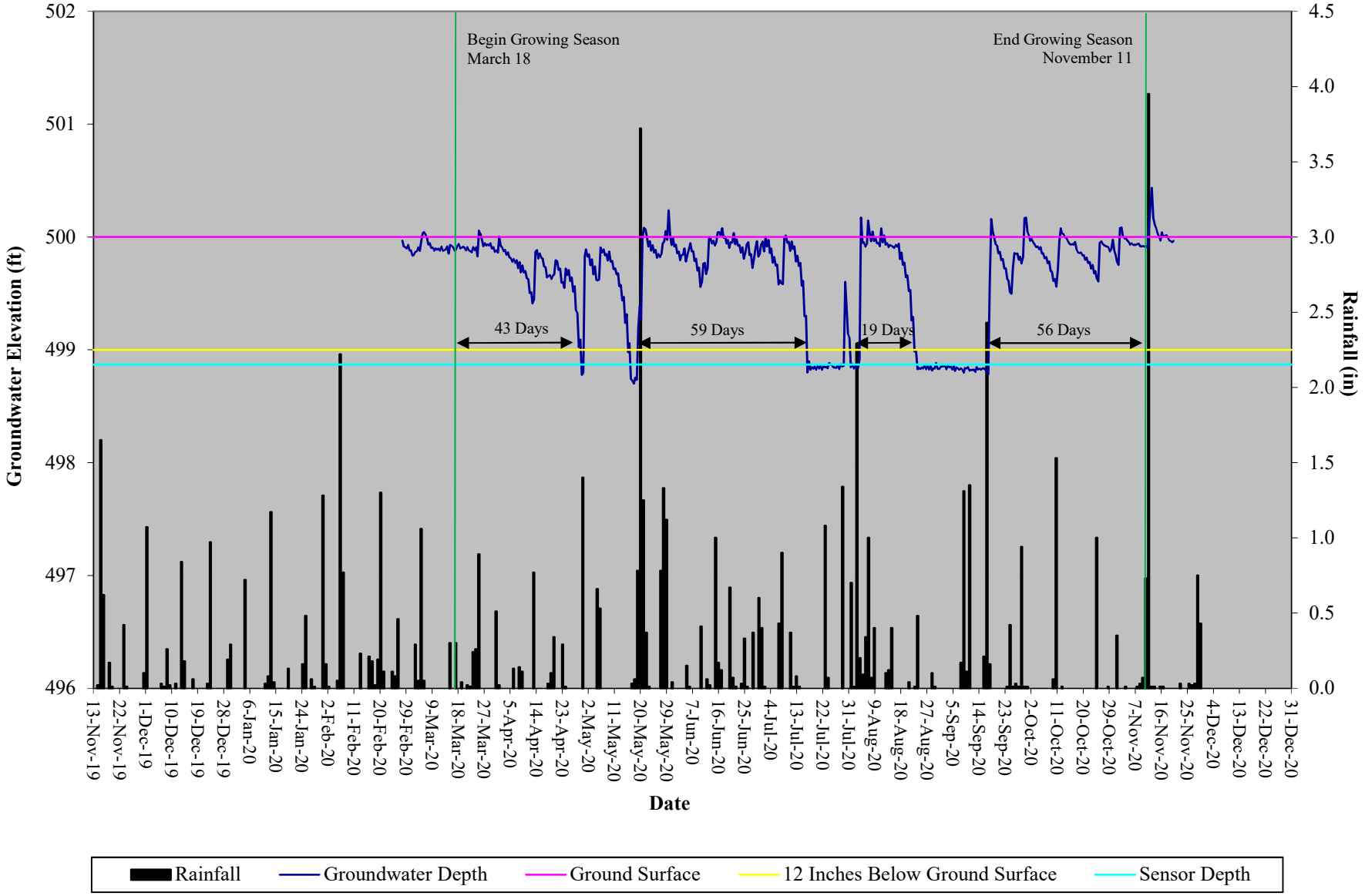
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 14



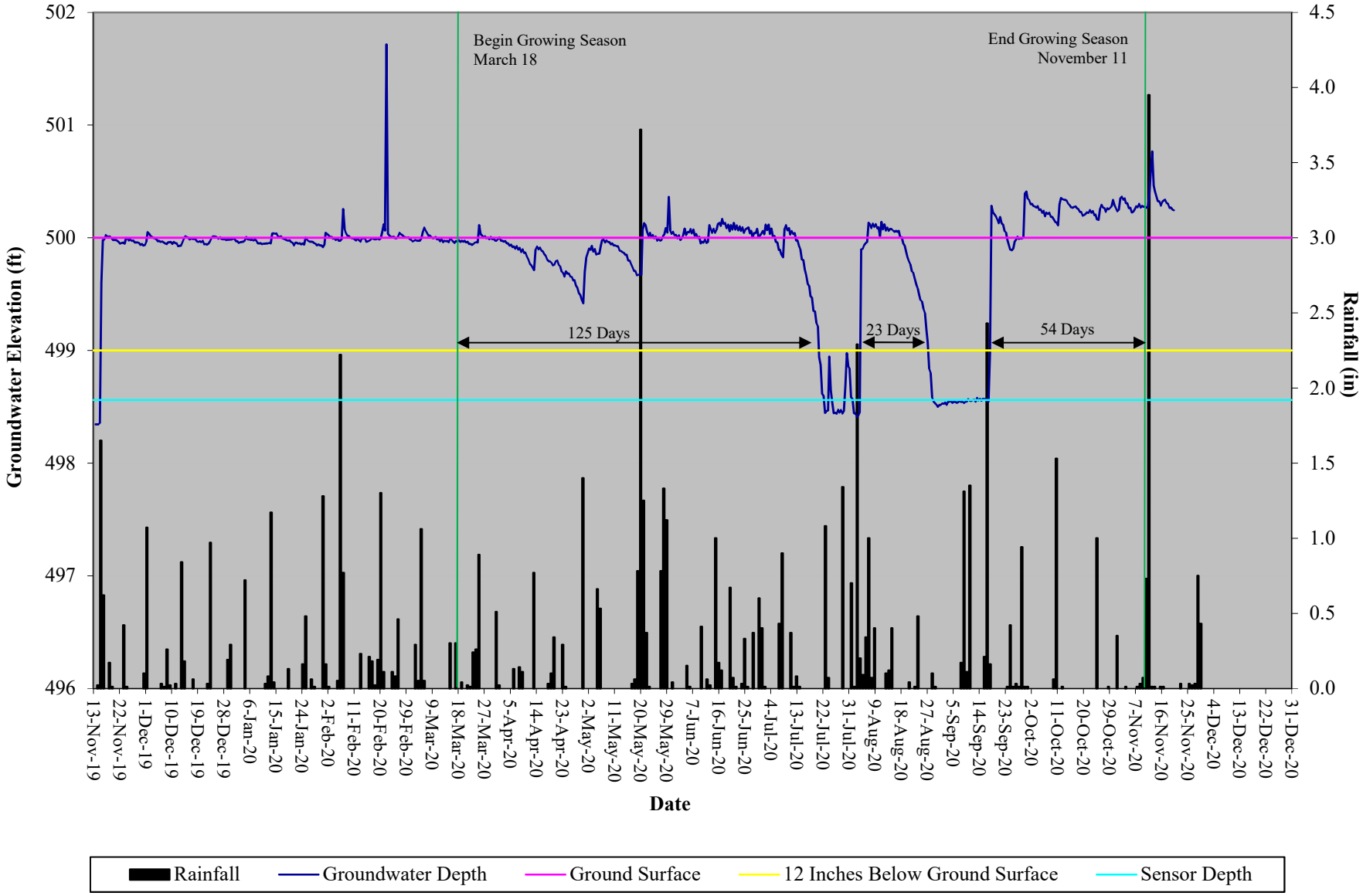
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 15



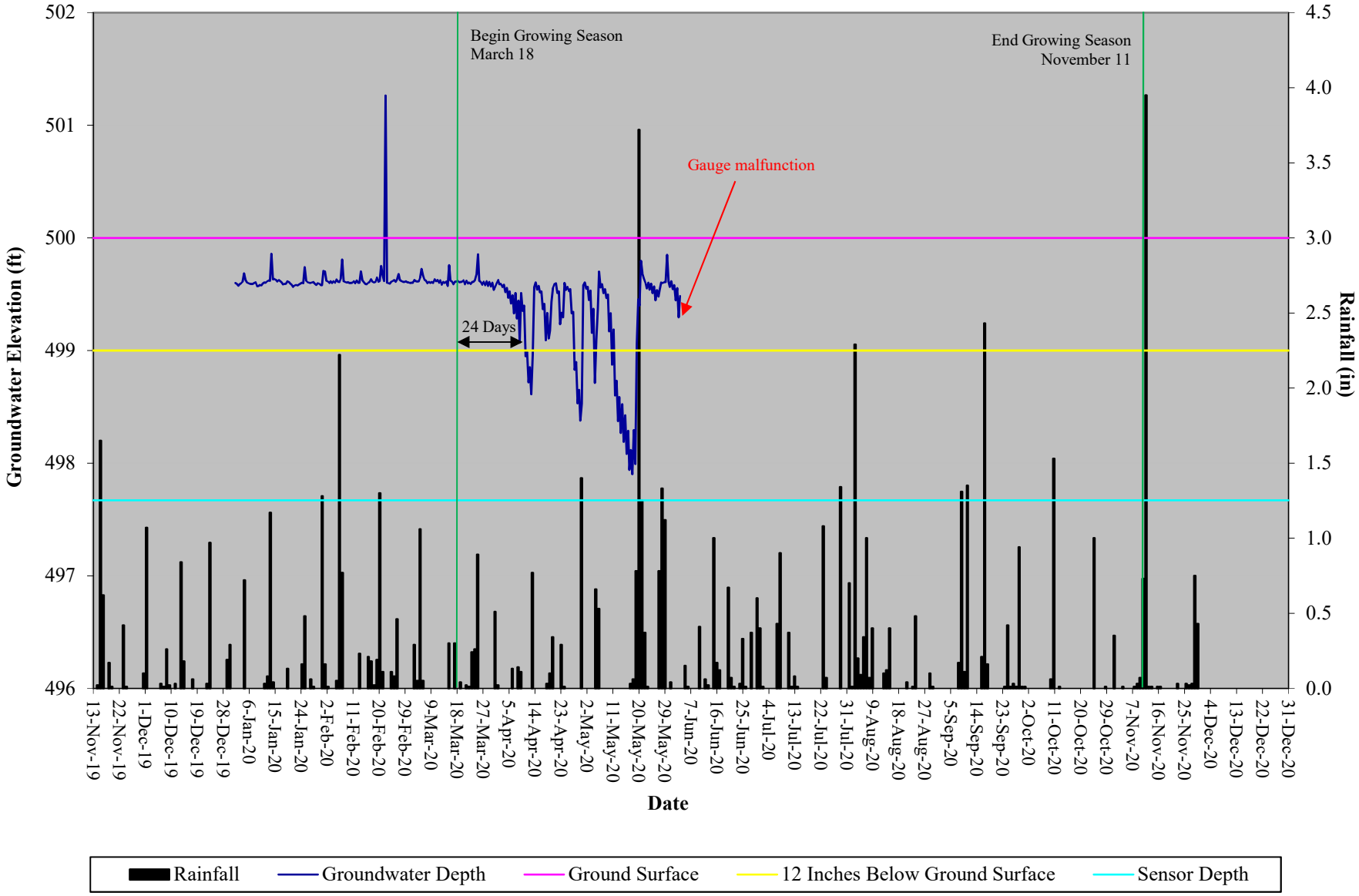
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 16



Twin Bays Restoration Site
Hydrograph
Wetland Gauge 17



Twin Bays Restoration Site
Hydrograph
Wetland Gauge 18



Twin Bays Restoration Site
Hydrograph
Wetland Gauge 19

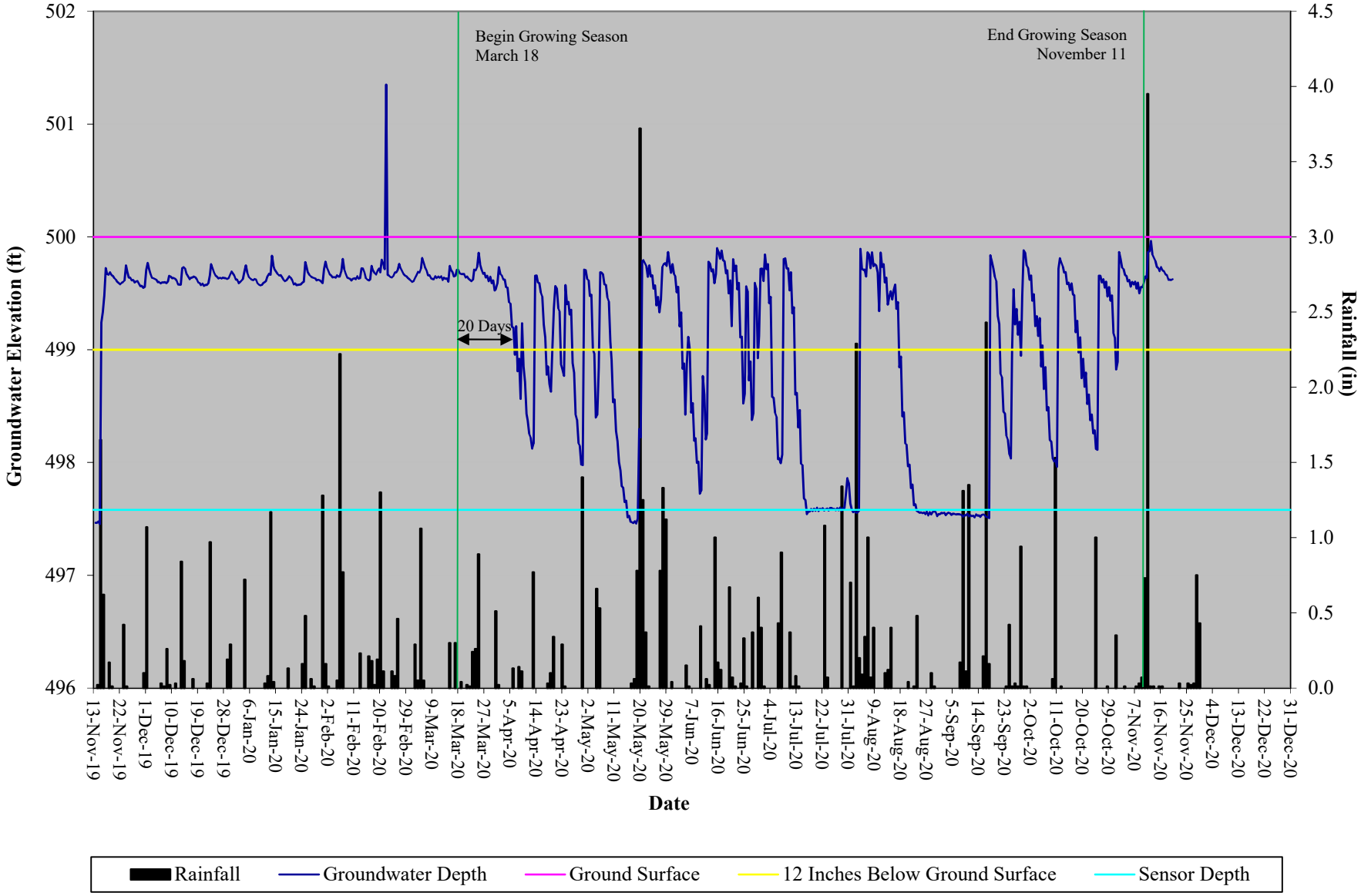


Table 7. Wetland Hydrology Attainment Table
Twin Bays Restoration Site, DMS Project #95363

	Greater than 8% Continuous Saturation/Max Consecutive Days During Growing Season (Percentage)						
Gauge #	**MY-01 2014**	**MY-02 2015**	**MY-03 2016**	**MY-04 2017**	**MY-05 2018**	**MY-06 2019**	**MY-07 2020**
Gauge 1	Yes/25 (10.5%)	Yes/105 (43.9%)	No‡/2 (0.8%)	No/9 (3.8%)	Yes/19 (8.0%)	No/5 (2.1%)	Yes/77 (32.2%)
Gauge 2	No/16 (6.5%)	Yes/75 (31.4%)	Yes/36 (14.9%)	Yes/30 (12.6%)	Yes/49 (20.3%)	Yes/41 (16.9%)	Yes/22 (9.2%)
Gauge 3*	13 (5.2%)	18 (7.3%)	10 (4.0%)	14 (5.9%)	19 (8.0%)	9 (3.8%)	6 (2.5%)
Gauge 4	Yes/26 (10.9%)	Yes/92 (38.5%)	Yes/36 (15.1%)	Yes/56 (23.4%)	Yes/57 (23.6%)	No/2‡ (0.6%)	Yes/56 (23.4%)
Gauge 5	Yes/27 (11.1%)	Yes/98 (41.0%)	Yes/53 (22.2%)	Yes/53 (22.2%)	Yes/57 (23.6%)	Yes/46 (19.0%)	Yes/58 (24.3%)
Gauge 6*	13 (5.4%)	41 (17.2%)	28 (11.5%)	26 (10.9%)	47 (19.7%)	26 (10.9%)	22 (9.2%)
Gauge 7	Yes/27 (11.1%)	Yes/75 (31.4%)	Yes/36 (14.9%)	Yes/51 (21.3%)	Yes/56 (23.2%)	Yes/46 (19.0%)	Yes/55 (23.0%)
Gauge 8	Yes/24 10.0%	Yes/75 (31.4%)	Yes/89 (37.0%)	Yes/37 (15.5%)	Yes/56 (23.2%)	Yes/44 (18.45)	Yes/58 (24.3%)
Gauge 9	No/17 (6.9%)	Yes/92 (38.3%)	Yes/27 (11.1%)	Yes/24 (10.0%)	Yes/21 (8.6%)	Yes/23 (9.6%)	Yes/19 (8.0%)
Gauge 10	Yes/24 (9.8%)	Yes/22 (9.2%)	Yes/49 (20.5%)	Yes/26 (10.9%)	Yes/47 (19.7%)	Yes/25 (10.3%)	Yes/23 (9.6%)
Gauge 11	Yes/28 (11.7%)	Yes/100 (41.8%)	Yes/92 (38.5%	Yes/58 (24.3%)	Yes/57 (23.6%)	Yes/47 (19.5%)	Yes/43 (18.0%)
Gauge 12	No/14 (5.9%)	Yes/103 (43.1%)	No/18 (7.3%)	Yes/26 (10.9%)	Yes/34 (14.2%)	Yes/23 (9.6%)	Yes/21 (8.8%)
Gauge 13	No/15 (6.1%)	Yes/74 (30.8%)	Yes/54 (22.6%)	Yes/41 (17.2%)	Yes/56 (23.2%)	Yes/44 (18.2%)	Yes/56 (23.4%)
Gauge 14	Yes/22 (9.0%)	Yes/19 (8.0%)	No/13 (5.2%)	Yes/24 (10.0%)	Yes/19 (8.0%)	No/10‡ (4.0%)	No/11 (4.6%)
Gauge 15	Yes/27 (11.1%)	Yes/76 (31.8%)	Yes/95 (39.7%	Yes/60 (25.1%)	Yes/59 (24.5%)	Yes/47 (19.5%)	Yes/60 (25.1%)
Gauge 16	Yes/49 20.3%	Yes/76 (31.8%)	Yes/59 (24.5%)	Yes/58 (24.3%)	Yes/58 (24.1%)	Yes/46 (19.0%)	Yes/59 (24.7%)
Gauge 17**	-	Yes/104 (43.5%)	Yes/103 (42.9%)	Yes/73 (30.5%)	Yes/118 (49.2%)	Yes/55 (22.8%)	Yes/125 (52.3%)
Gauge 18†	-	-	-	Yes/58 (24.3%)	Yes/48 (19.9%)	Yes/41 (16.9%)	Yes/24 (10.0%)
Gauge 19†	-	-	-	No/15 (6.3%)	Yes/36 (14.9%)	Yes/23 (9.6%)	Yes/20 (8.4%)

* = Gauge in the non-credit bearing zone
** = Gauge installed 3/8/2015
† = Gauge installed 4/6/2017
‡=Gauge malfunctioned

Appendix E

Additional Information

KCI ASSOCIATES OF NC

ISO 9001:2015 CERTIFIED

ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS

4505 Falls of Neuse Rd., Suite 400 • Raleigh, NC 27609 • Phone 919-783-9214 • Fax 919-783-9266

Date: October 30, 2019

Attendees: Lindsay Crocker, NC Division of Mitigation Services
Jeremiah Dow, NC Division of Mitigation Services
Jeff Schaffer, NC Division of Mitigation Services
Mac Haupt, NC Division of Water Resources
Erin Davis, Division of Water Resources
Todd Tugwell, US Army Corps of Engineers
Jordan Jessop, US Army Corps of Engineers
Tim Morris, KCI Technologies, Inc.
Kevin O'Briant, KCI Technologies, Inc.

From: Tim Morris, Project Manager
KCI Technologies, Inc.

Subject: Twin Bays Project
Non-Riparian Wetland Mitigation – Cape Fear 07
Credit Release – Field Review
Duplin County, North Carolina

Purpose

A field review meeting was conducted for the above referenced project on October 30, 2019. The purpose of the meeting was to visit the site on the ground since the IRT had not been to the site since the post contract site walk. No significant performance issues were noted in the monitoring reports leading up to the meeting.

Meeting Minutes

Vegetation (trees, shrubs and herbaceous) was thriving at the site. The IRT commented on the diversity of trees and shrubs throughout the site. In some areas there was full canopy closure and herbaceous vegetation was already being shaded out. Based on the health and vigor of the vegetation the IRT agreed that no additional vegetation monitoring would be required for the Year 6 monitoring report.

Some privet was noted around the forested bays at the top of the project. This privet would continue to be treated as part of the on-going maintenance program.

Some minor scalping of the easement along the field edges on the north end of the easement was noted. KCI called the landowner and informed him of the issue and also will install additional signage to prevent this from occurring in the future monitoring years.