

Juniper Bay Wetland Mitigation Site
Robeson County, North Carolina
NCEEP Project Number 201

2010 Annual Monitoring Report

Construction Completion: Phase I 2004; Phase II 2006

Data Collection: 2010

Submitted: November 2010



Submitted To:
NCDENR/Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652



Monitoring Contact:

Environmental Services, Inc.
524 S. New Hope Road
Raleigh, North Carolina 27610
919-212-1760
www.environmentalservicesinc.com



**ENVIRONMENTAL
SERVICES, INC.**

Table of Contents

1.0. Executive Summary..... 4

2.0. Methodology 4

3.0. References 4

4.0. Project Condition and Monitoring Data Appendices 5

 Appendix A. Project Vicinity Map and Background Tables

 Figure 1. Vicinity Map

 Table 1. Project Restoration Component

 Table 2. Project Activity and Reporting History

 Table 3. Project Contacts Table

 Table 4. Project Attributes Table

 Appendix B. Visual Assessment Data

 Figure 2. Current Condition Plan View (CCPV)

 Table 5. Vegetation Condition Assessment Table

 Vegetation Plot Photos

 Appendix C. Vegetation Plot Data

 Table 6. Vegetation Plot Mitigation Success Summary Table

 Table 7. CVS Vegetation Metadata Table

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

 Appendix D. Hydrologic Data

 Figure 3. Juniper Bay 30-70 Percentile Graph for Rainfall in 2009

 Figure 4. Gauge Hydrologic Data Graphs

 Table 9. Wetland Hydrology Criteria Attainment

1.0. Executive Summary

The Juniper Bay Mitigation Site (JBMS) is a Carolina bay located in Robeson County, North Carolina and comprises 728.5 acres. The site is monitored for two primary wetland parameters: hydrology and vegetation. In order to demonstrate successful mitigation, hydrologic and vegetation monitoring will be conducted for a minimum of five years. Vegetative data will be correlated with the appropriate hydrologic data from the groundwater monitoring gauges to determine if success criteria are being met. The site was constructed by the North Carolina Department of Transportation (NCDOT) and is managed by the North Carolina Ecosystem Enhancement Program (EEP) with the following goals and objectives.

Goals

- Provide compensatory wetland mitigation credits for Transportation Improvement Projects (TIP) in the Lumber River Basin (Hydrologic Unit 03040203).
- Restore the hydrologic functions to a Carolina bay previously used for agricultural production with a drainage ditch network. The mitigation component in which jurisdictional hydrology is to be enhanced or restored comprises 567.7 acres.
- Restore natural wetland functions, processes, structure, and species composition to the site.
- Establish wetland forest vegetation within the site. The two community types planned for establishment are Peatland Atlantic White Cedar Forest/Bay Forest and Pond Pine Woodland/Bay Forest.

Objectives

- Hydrologic monitoring is implemented utilizing groundwater monitoring gauges installed in representative locations in the two community types. Hydrologic restoration is considered successful if the soil is ponded, flooded, or saturated within 12 inches of the surface for at least 12.5% of the growing season.
- Stem counts by species are conducted for 20 vegetation plots (10 meter X 10 meter) using the Level 1 and 2 Carolina Vegetation Survey (CVS)-EEP Protocol for Recording Vegetation, Version 4.0 (Lee et al. 2006). Natural recruits are included in the stem counts using the CVS-EEP Level 2 protocol. Photographs of the vegetation plots from the same viewpoints are taken annually to provide a visual record of plot growth.

Vegetation Conditions

The 2010 monitoring event for the JBMS represents the fifth year of monitoring. The minimum survival rates for vegetative success are as follows: 320 stems/acre of target species at the end of Year 3, 290 stems/acre at the end of Year 4, and 260 stems/acre at the end of Year 5. Therefore, any plots with stem counts less than 260 stems/acre will not have met the vegetative success criterion for Year 5 monitoring. Natural recruits are included in the stem counts using the Level 2 protocol.

In 2010, 13 of the 20 plots (65.0%) met the Year 5 success criterion of 260 stems/acre. In the Peatland Atlantic White Cedar Forest/Bay Forest community, four of the nine (44.4%) plots met the vegetative success criterion. Nine of the 11 (81.8%) plots in the Pond Pine Woodland/Bay Forest community met the vegetative success criterion. The anomalies of specific plots not meeting the vegetation success rate do not accurately reflect the overall

vegetation success for the entire site. An overall mean of 362 stems/acre is obtained when all plots within the site are considered, which is above the Year 5 vegetation success criterion of 260 stems/acre. Furthermore, based upon the stem deaths within the plots during the 2010 monitoring year, it appears the mortality rate for the surviving stems within the plots has stabilized.

Hydrology Conditions

Forty-three automated groundwater monitoring gauges are installed across the site. The hydrologic success criterion requires the soil to be ponded, flooded, or saturated within 12 inches of the surface for a least 12.5% of the growing season during years with normal precipitation. The growing season extends from March 25th to November 4th in Robeson County (225 days). Therefore, in order to demonstrate hydrologic success, a gauge must have saturated conditions for a minimum of 28 consecutive days during the growing season. During the 2010 monitoring period, 21 of the 43 monitoring gauges met the hydrologic success criterion, a 48.8 % success rate. However, based on the JBMS Mitigation Plan, there are 13 perimeter gauges that are located adjacent to the perimeter ditch in the Pond Pine Woodland/Bay Forest community. The perimeter ditch remains open in order to avoid hydrologic trespass issues. The location of these 13 gauges represents portions of the site which are not expected to meet the wetland criterion due to the zone of influence exerted by the ditch. Twelve of the 13 perimeter gauges failed to meet the jurisdictional hydrology criterion during the Year 5 monitoring, a 7.7% success rate. Of the remaining 30 interior gauges, 20 met the hydrologic success criterion, a 66.6% success rate.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0. Methodology Section

The fifth year of monitoring for JBMS occurred in 2010. Using the CVS-EEP Protocol for Recording Vegetation, Version 4.0 (Lee et al. 2006), 20 (10 meter X 10 meter) plots were designated across the site based on proximity to groundwater gauges and representative conditions for the site as a whole. Stem counts by species were conducted for each plot, including vigor and damage estimates. The stem counts included planted woody stems and natural recruits as part of the Level 1 and 2 CVS-EEP Protocol. The taxonomic standard for vegetation that was applied was the Manual of the Vascular Flora of the Carolinas (Radford et al. 1968). Photographs of the vegetation plots from the same viewpoints annually were taken to provide a visual record of plot growth. Automated groundwater monitoring gauges (RDS, Inc. Ecotone WM monitors) were installed across the site to monitor site hydrology. Monitoring gauges were installed in representative locations in each proposed community type and were installed in accordance with USACE (United States Army Corps of Engineers) guidelines. No deviations regarding sampling procedures occurred.

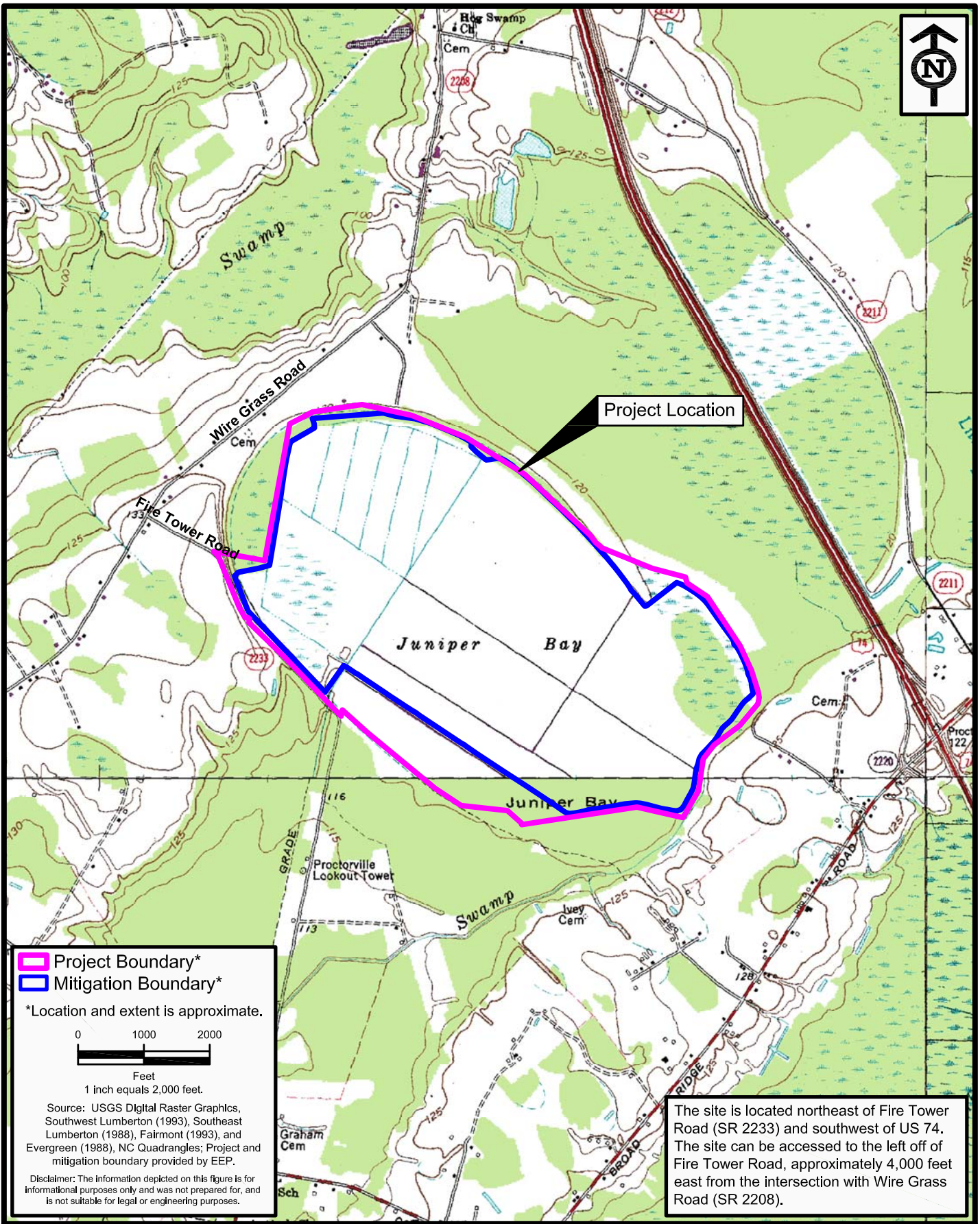
3.0. References

Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved September 1 2010, from: <http://cvs.bio.unc.edu/methods.htm>.

Radford, Albert E., H.E. Ahles, and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. The University of North Carolina Press, Chapel Hill, NC. 1183 pp.

4.0. Project Condition and Monitoring Data Appendices

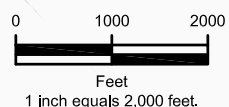
Appendix A
Project Vicinity Map and Background Tables



Project Location

- Project Boundary*
- Mitigation Boundary*

*Location and extent is approximate.



Source: USGS Digital Raster Graphics, Southwest Lumberton (1993), Southeast Lumberton (1988), Fairmont (1993), and Evergreen (1988), NC Quadrangles; Project and mitigation boundary provided by EEP.

Disclaimer: The information depicted on this figure is for informational purposes only and was not prepared for, and is not suitable for legal or engineering purposes.

The site is located northeast of Fire Tower Road (SR 2233) and southwest of US 74. The site can be accessed to the left off of Fire Tower Road, approximately 4,000 feet east from the intersection with Wire Grass Road (SR 2208).



ENVIRONMENTAL SERVICES, INC.
524 S. New Hope Road
Raleigh, North Carolina 27610
(919) 212-1760
(919) 212-1707 FAX
www.environmentalservicesinc.com



Ecosystem Enhancement PROGRAM

Composite Vicinity Map
Juniper Bay
Robeson County, North Carolina
Monitoring Report Year 5

Project:	ER07008.00
Date:	Nov 2010
Drwn/Chkd:	KT/GT
Figure:	1

Table 1 lists the estimated wetland acreage by community type to be restored or enhanced.

Table 1. Project Restoration Components Juniper Bay Wetland Mitigation Site-EEP # 201		
Community Type	Mitigation Type	Acreage
Peatland Atlantic White Cedar Forest	Restoration	264.8
Peatland Atlantic White Cedar Forest	Enhancement	11.8
Pond Pine Woodland	Restoration	291.1
	Total	567.7
Non-restorable areas		
	Total	160.8
Juniper Bay Mitigation Site		Total
		728.5

Table 2 provides the timeline for data collection and actual completion for construction and monitoring milestones of the JBMS. The dates for several activities were unavailable.

Table 2. Project Activity and Reporting History Juniper Bay Wetland Mitigation Site-EEP # 201		
Activity or Report	Data Collection Complete	Actual Completion
Restoration Plan	N/A	N/A
Final Design-90%	N/A	N/A
Construction	N/A	Phase I Feb 2004; Phase II Jan 2006
Temporary S&E mix applied to entire site	N/A	N/A
Permanent Seed mix applied	N/A	N/A
Mitigation Plan/ As-built (Year 0 Monitoring- baseline)	N/A	Feb 2006
Year 1 Monitoring	Nov 2006	Dec 2006
Year 2 Monitoring	Nov 2007	Dec 2007
Year 3 Monitoring	Sept 2008	Oct 2008
Year 4 Monitoring	Sept 2009	Nov 2009
Year 5 Monitoring	Nov 2010	Nov 2010

The point of contact for various phases and monitoring of the JBMS are provided in Table 3.

Table 3. Project Contacts Table Juniper Bay Wetland Mitigation Site-EEP # 201	
Designer Primary project design POC	N.C. Department of Transportation-Natural Environment Unit Arcadis
Construction Contractor Construction contractor POC	NCDOT Division 6 Robeson County Maintenance Eugene McKeithan, Highway Maintenance Engineer
Planting Contractor Planting contractor POC	Professional Consolidated, LLC Henry Rozo
Seeding Contractor Seeding contractor POC	NCDOT Division 6 Roadside Environmental Unit James Barnes, Division Roadside Environmental Engineer
Nursery Stock Suppliers	NC Forestry Service (hardwoods); Coastal Plain Conservation Nursery (bays); Hillis Nursery (bays)
Monitoring Performers Wetland and Vegetation POC	Environmental Services, Inc. 524 S. New Hope Road Raleigh, North Carolina 27610 Todd Milam (919) 212-1760

Relevant project background information for the JBMS is provided in Table 4. The North Carolina Division of Water Quality (NCDWQ) classification for Project and Reference was unavailable at the time of report submission.

Table 4. Project Attributes Table Juniper Bay Wetland Mitigation Site-EEP # 201	
Project County	Robeson County
Drainage Area	904 Acres; 756 acres within the site perimeter
Drainage impervious cover estimate (%)	1%
Physiographic Region	Coastal Plain
Ecoregion	651 Atlantic Southern Loam Plain
Cowardin Classification	PFOB4/6
Dominant soil types	Ponzer muck, Leon sand, Rutledge loamy sand, Pantego fine sandy loam
Reference site ID	Tatum Millpond Bay, Bladen County, NC
USGS HUC for Project and Reference	03040203
NCDWQ Sub-basin for Project and Reference	03-07-54
NCDWQ classification for Project and Reference	N/A
Any portion of the project 303d listed?	No
Any upstream portion 303d listed?	No
% of project easement fenced	Gate at access road

Appendix B
Visual Assessment Data

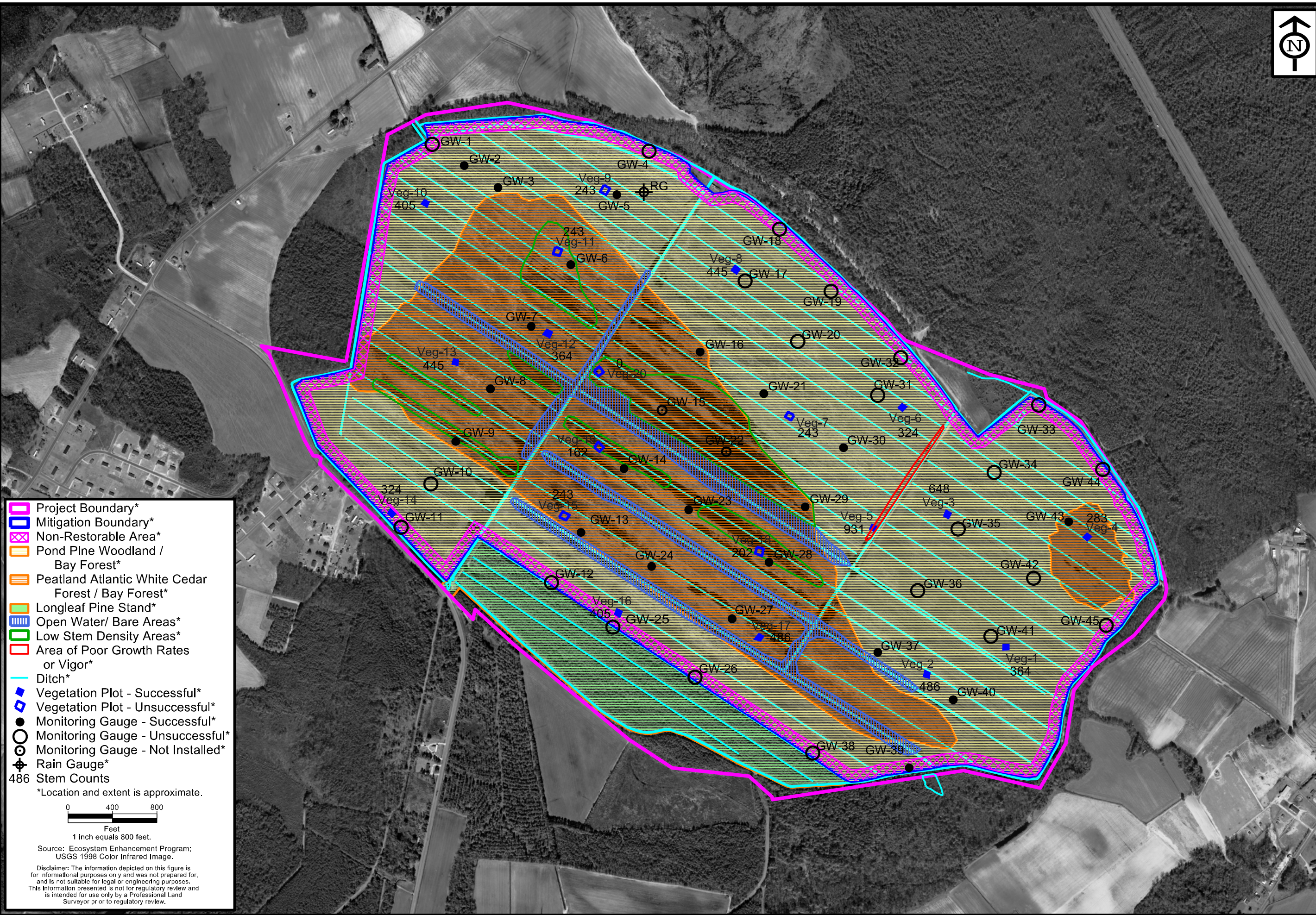


Project: ER07008.00
 Date: Nov 2010
 Drwn/Chkd: KT/GT
 Figure: 2

Current Condition Plan View
Juniper Bay - EEP Project # 201
 Robeson County, North Carolina
 Monitoring Report Year 5



ENVIRONMENTAL SERVICES, INC.
 524 S. New Hope Road
 Raleigh, North Carolina 27610
 (919) 212-1780
 (919) 212-1707 FAX
 www.environmentalservicesinc.com



- Project Boundary*
- Mitigation Boundary*
- Non-Restorable Area*
- Pond Pine Woodland / Bay Forest*
- Peatland Atlantic White Cedar Forest / Bay Forest*
- Longleaf Pine Stand*
- Open Water/ Bare Areas*
- Low Stem Density Areas*
- Area of Poor Growth Rates or Vigor*
- Ditch*
- Vegetation Plot - Successful*
- Vegetation Plot - Unsuccessful*
- Monitoring Gauge - Successful*
- Monitoring Gauge - Unsuccessful*
- Monitoring Gauge - Not Installed*
- Rain Gauge*
- Stem Counts

*Location and extent is approximate.

0 400 800
 Feet
 1 inch equals 800 feet.

Source: Ecosystem Enhancement Program;
 USGS 1998 Color Infrared Image.

Disclaimer: The information depicted on this figure is for informational purposes only and was not prepared for, and is not suitable for legal or engineering purposes. This information presented is not for regulatory review and is intended for use only by a Professional Land Surveyor prior to regulatory review.

**Table 5. Vegetation Condition Assessment Table
Juniper Bay Wetland Mitigation Site-EEP# 201**

Planted Acreage 698.1						
Vegetation Category	Definition	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Open water/Bare areas	Very limited woody or emergent vegetation growth due to fluctuating high water levels throughout the season.	0.1 acre	Blue outline	2	38.8	5.6%
2. Low stem density areas	Woody stem densities below target levels based on MY5 stem count criteria. Comprised primarily of emergent vegetation.	0.1 acre	Green outline	7	44.3	6.3%
3. Areas of poor growth rates or vigor	Woody stems of a size class that are small given the monitoring year.	0.1 acre	Red Outline	1	1.1	0.2%
Easement Acreage 728.5						
Vegetation Category	Definition	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
4. Invasive Areas of concern	Areas of invasive growth	N/A	N/A	N/A	N/A	N/A
5. Easement encroachment area	Areas of encroachment	N/A	N/A	N/A	N/A	N/A

Vegetation Monitoring Plot Photos

PLOT 1



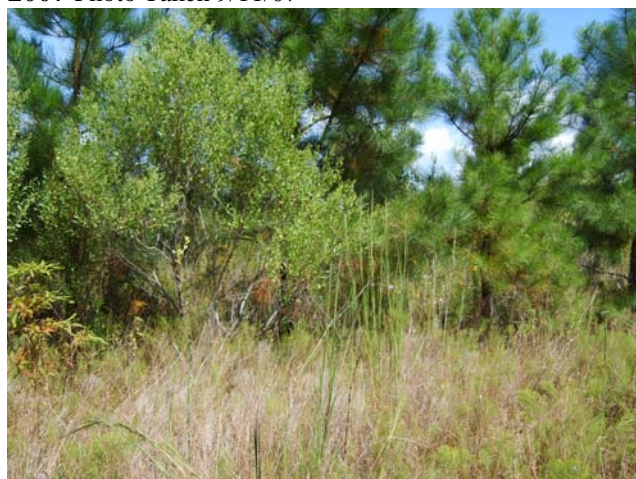
2006 Photo Taken 9/19/06



2007 Photo Taken 9/11/07



2008 Photo Taken 10/21/08



2009 Photo Taken 9/22/09



2010 Photo Taken 9/21/10

PLOT 2



2006 Photo Taken 9/19/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/21/2008



2009 Photo Taken 9/23/2009



2010 Photo Taken 9/21/10

PLOT 3



2006 Photo Taken 9/19/06



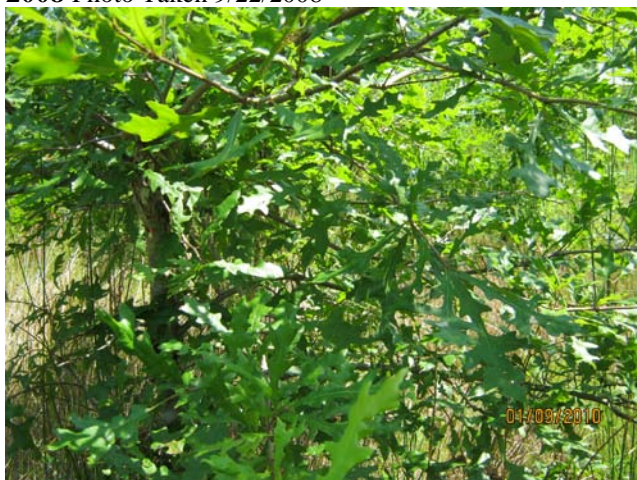
2007 Photo Taken 9/10/07



2008 Photo Taken 9/22/2008



2009 Photo Taken 9/23/2009



2010 Photo Taken 9/1/10

PLOT 4



2006 Photo Taken 9/21/06



2007 Photo Taken 9/10/07



2008 Photo Taken 9/22/08



2009 Photo Taken 9/27/09



2010 Photo Taken 9/1/10

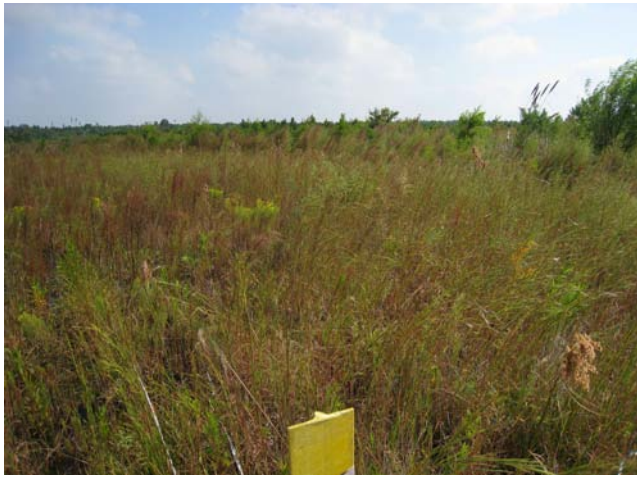
PLOT 5



2006 Photo Taken 9/19/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/22/09



2010 Photo Taken 9/1/10

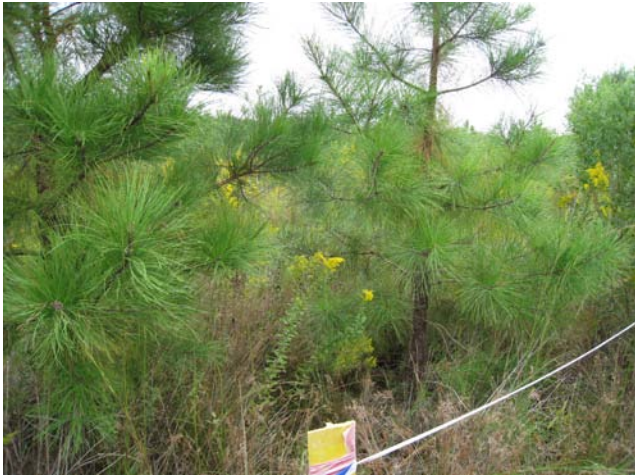
PLOT 6



2006 Photo Taken 9/19/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/23/09



2010 Photo Taken 9/1/10

PLOT 7



2006 Photo Taken 9/19/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/22/08



2009 Photo Taken 9/22/09



2010 Photo Taken 9/1/10

PLOT 8



2006 Photo Taken 9/19/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/27/09



2010 Photo Taken 9/15/10

PLOT 9



2006 Photo Taken 9/18/06



2007 Photo Taken 9/12/07



2008 Photo Taken 9/22/2008



2009 Photo Taken 9/23/2009



2010 Photo Taken 9/13/2010

PLOT 10



2006 Photo Taken 9/18/06



2007 Photo Taken 9/12/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/27/09



2010 Photo Taken 9/13/2010

PLOT 11



2006 Photo Taken 9/18/06



2007 Photo Taken 9/12/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/27/09



2010 Photo Taken 9/13/2010

PLOT 12



2006 Photo Taken 9/18/06



2007 Photo Taken 9/12/07



2008 Photo Taken 9/22/08



2009 Photo Taken 9/23/09



2010 Photo Taken 9/13/2010

PLOT 13



2006 Photo Taken 9/18/06



2007 Photo Taken 9/12/07



2008 Photo Taken 9/22/08



2009 Photo Taken 9/27/09



2010 Photo Taken 9/13/10

PLOT 14



2006 Photo Taken 9/18/06



2007 Photo Taken 9/12/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/22/09



2010 Photo Taken 9/1/10

PLOT 15



2006 Photo Taken 9/20/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/22/08



2009 Photo Taken 9/22/09



2010 Photo Taken 9/15/10

PLOT 16



2006 Photo Taken 9/20/06



2007 Photo Taken 9/10/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/22/09



2010 Photo Taken 9/1/10

PLOT 17



2006 Photo Taken 9/20/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/21/08



2009 Photo Taken 9/23/09



2010 Photo Taken 9/1/10

PLOT 18



2006 Photo Taken 9/20/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/22/08



2009 Photo Taken 9/27/09



2010 Photo Taken 9/1/10

PLOT 19



2006 Photo Taken 9/20/06



2007 Photo Taken 9/11/07



2008 Photo Taken 9/22/08



2009 Photo Taken 9/22/09



2010 Photo Taken 9/15/2010

PLOT 20



2006 Photo Taken 9/21/06



2007 Photo Taken 9/11/07

***No 2008 Photo for Plot 20-**
No stem survival after Year 2



2009 Photo Taken 9/27/09



2010 Photo Taken 9/8/2010

Appendix C

Vegetation Plot Data

Table 6 provides a summary of the vegetation success for the 20 vegetation plots within the JBMS.

Table 6. Vegetation Plot Mitigation Success Summary Table Juniper Bay Wetland Mitigation Site-EEP# 201		
Peatland Atlantic White Cedar Forest/ Bay Forest		
Vegetation Plot	Vegetative Success Met	Community Type Mean
Veg-4	Y	44.4%
Veg-11	N	
Veg-12	Y	
Veg-13	Y	
Veg-15	N	
Veg-17	Y	
Veg-18	N	
Veg-19	N	
Veg-20	N	
Pond Pine Woodland/Bay Forest		
Vegetation Plot	Vegetative Success Met	Community Type Mean
Veg-1	Y	81.8%
Veg-2	Y	
Veg-3	Y	
Veg-5	Y	
Veg-6	Y	
Veg-7	N	
Veg-8	Y	
Veg-9	N	
Veg-10	Y	
Veg-14	Y	
Veg-16	Y	

Table 7. Vegetation Metadata Table

Report Prepared By	M. Todd Milam						
Date Prepared	11/9/2010 15:58						
database name	ESI-2010-A_JuniperBay.mdb						
database location	P:\Projects\2007\ER07-008\2010 Monitoring\Veg Plot Data						
computer name	ES01076						
file size	53149696						
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	Description	River Basin	length(ft)	area (sq m)	Required Plots (calculated)	Sampled Plots
201	Juniper Bay	A Carolina bay mitigation site	Lumber		728.5		20

Table 8. Stem Count Total and Planted by Plot and Species

Scientific Name	Common Name	Species Type	00201-01-0001			00201-01-0002			00201-01-0003			00201-01-0004		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
<i>Acer rubrum</i>	red maple	Tree						1						4
<i>Baccharis halimifolia</i>	baccharis	Shrub Tree												
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	Tree												
<i>Liquidambar styraciflua</i>	sweetgum	Tree												
<i>Magnolia virginiana</i>	sweetbay	Shrub Tree												
<i>Morella cerifera</i>	wax myrtle	Shrub												
<i>Nyssa aquatica</i>	water tupelo	Tree										1	1	
<i>Persea palustris</i>	swamp bay	Tree												
<i>Pinus serotina</i>	pond pine	Tree										1	1	
<i>Pinus taeda</i>	loblolly pine	Tree		6	6		5	5						
<i>Quercus lyrata</i>	overcup oak	Tree		2	2					12	12			
<i>Salix nigra</i>	black willow	Tree						2						
<i>Taxodium ascendens</i>	pond cypress	Tree												
<i>Taxodium distichum</i>	bald cypress	Tree		1	1		4	4		4	4		1	1
Stem count			0	9	9	0	9	12	0	16	16	0	3	7
size (acres)			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02		
Species count			0	3	3	0	2	4	0	2	2	0	3	4
Stems per ACRE			0	364.2	364.2	0	364.2	485.6	0	647.5	647.5	0	121.4	283.3

Table 8. Continues.

Table 8. Stem Count Total and Planted by Plot and Species continued.

Scientific Name	Common Name	Species Type	00201-01-0005			00201-01-0006			00201-01-0007			00201-01-0008		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
<i>Acer rubrum</i>	red maple	Tree												1
<i>Baccharis halmifolia</i>	baccharis	Shrub Tree												
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	Tree												
<i>Liquidambar styraciflua</i>	sweetgum	Tree						1						
<i>Magnolia virginiana</i>	sweetbay	Shrub Tree												
<i>Morella cerifera</i>	wax myrtle	Shrub												
<i>Nyssa aquatica</i>	water tupelo	Tree												
<i>Persea palustris</i>	swamp bay	Tree												
<i>Pinus serotina</i>	pond pine	Tree												
<i>Pinus taeda</i>	loblolly pine	Tree					2	2		5	5		2	2
<i>Quercus lyrata</i>	overcup oak	Tree					1	1					2	2
<i>Salix nigra</i>	black willow	Tree			3									1
<i>Taxodium ascendens</i>	pond cypress	Tree												
<i>Taxodium distichum</i>	bald cypress	Tree		20	20		4	4		1	1		5	5
Stem count			0	20	23	0	7	8	0	6	6	0	9	11
size (acres)			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02		
Species count			0	1	2	0	3	4	0	2	2	0	3	5
Stems per ACRE			0	809.4	930.8	0	283.3	323.7	0	242.8	242.8	0	364.2	445.2

Table 8. Continues.

Table 8. Stem Count Total and Planted by Plot and Species continued.

Scientific Name	Common Name	Species Type	00201-01-0009			00201-01-0010			00201-01-0011			00201-01-0012		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
<i>Acer rubrum</i>	red maple	Tree									1			
<i>Baccharis halmifolia</i>	baccharis	Shrub Tree												
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	Tree												
<i>Liquidambar styraciflua</i>	sweetgum	Tree			1									
<i>Magnolia virginiana</i>	sweetbay	Shrub Tree												
<i>Morella cerifera</i>	wax myrtle	Shrub												
<i>Nyssa aquatica</i>	water tupelo	Tree												
<i>Persea palustris</i>	swamp bay	Tree												
<i>Pinus serotina</i>	pond pine	Tree							3	3				1
<i>Pinus taeda</i>	loblolly pine	Tree		3	3		10	10					4	4
<i>Quercus lyrata</i>	overcup oak	Tree		1	1									
<i>Salix nigra</i>	black willow	Tree			1									
<i>Taxodium ascendens</i>	pond cypress	Tree											1	1
<i>Taxodium distichum</i>	bald cypress	Tree							2	2			3	3
Stem count			0	4	6	0	10	10	0	5	6	0	8	9
size (acres)			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02		
Species count			0	2	4	0	1	1	0	2	3	0	3	4
Stems per ACRE			0	161.9	242.8	0	404.7	404.7	0	202.3	242.8	0	323.7	364.2

Table 8. Continues.

Table 8. Stem Count Total and Planted by Plot and Species continued.

Scientific Name	Common Name	Species Type	00201-01-0013			00201-01-0014			00201-02-0015			00201-02-0016		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
<i>Acer rubrum</i>	red maple	Tree								1			1	
<i>Baccharis halmifolia</i>	baccharis	Shrub Tree												
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	Tree										2	2	
<i>Liquidambar styraciflua</i>	sweetgum	Tree												
<i>Magnolia virginiana</i>	sweetbay	Shrub Tree					2	2		3	3			
<i>Morella cerifera</i>	wax myrtle	Shrub												
<i>Nyssa aquatica</i>	water tupelo	Tree										1	1	
<i>Persea palustris</i>	swamp bay	Tree												
<i>Pinus serotina</i>	pond pine	Tree			1			1				1	1	
<i>Pinus taeda</i>	loblolly pine	Tree		7	7		5	5						
<i>Quercus lyrata</i>	overcup oak	Tree			2							3	3	
<i>Salix nigra</i>	black willow	Tree			1								2	
<i>Taxodium ascendens</i>	pond cypress	Tree												
<i>Taxodium distichum</i>	bald cypress	Tree							2	2				
Stem count			0	7	11	0	7	8	0	5	6	0	7	10
size (acres)			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02		
Species count			0	1	4	0	2	3	0	2	3	0	4	6
Stems per ACRE			0	283.3	445.2	0	283.3	323.7	0	202.3	242.8	0	283.3	404.7

Table 8. Continues.

Table 8. Stem Count Total and Planted by Plot and Species continued.

scientific Name	Common Name	Species Type	00201-02-0017			00201-02-0018			00201-02-0019			00201-02-0020		
			P-LS	P-all	T	P-LS	P-LS	P-LS	P-LS	P-all	T	P-LS	P-all	T
<i>Acer rubrum</i>	red maple	Tree												
<i>Baccharis halmifolia</i>	baccharis	Shrub Tree												
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	Tree												
<i>Liquidambar styraciflua</i>	sweetgum	Tree												
<i>Magnolia virginiana</i>	sweetbay	Shrub Tree					2	2						
<i>Morella cerifera</i>	wax myrtle	Shrub												
<i>Nyssa aquatica</i>	water tupelo	Tree					3	3						
<i>Persea palustris</i>	swamp bay	Tree												
<i>Pinus serotina</i>	pond pine	Tree		6	8									
<i>Pinus taeda</i>	loblolly pine	Tree												
<i>Quercus lyrata</i>	overcup oak	Tree												
<i>Salix nigra</i>	black willow	Tree												
<i>Taxodium ascendens</i>	pond cypress	Tree												
<i>Taxodium distichum</i>	bald cypress	Tree		4	4					4	4			
Stem count			0	10	12	0	5	5	0	4	4	0	0	0
size (acres)			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02		
Species count			0	2	2	0	2	2	0	1	1	0	0	0
Stems per ACRE			0	404.7	485.6	0	202.3	202.3	0	161.9	161.9	0	0	0

Table 8. Continues.

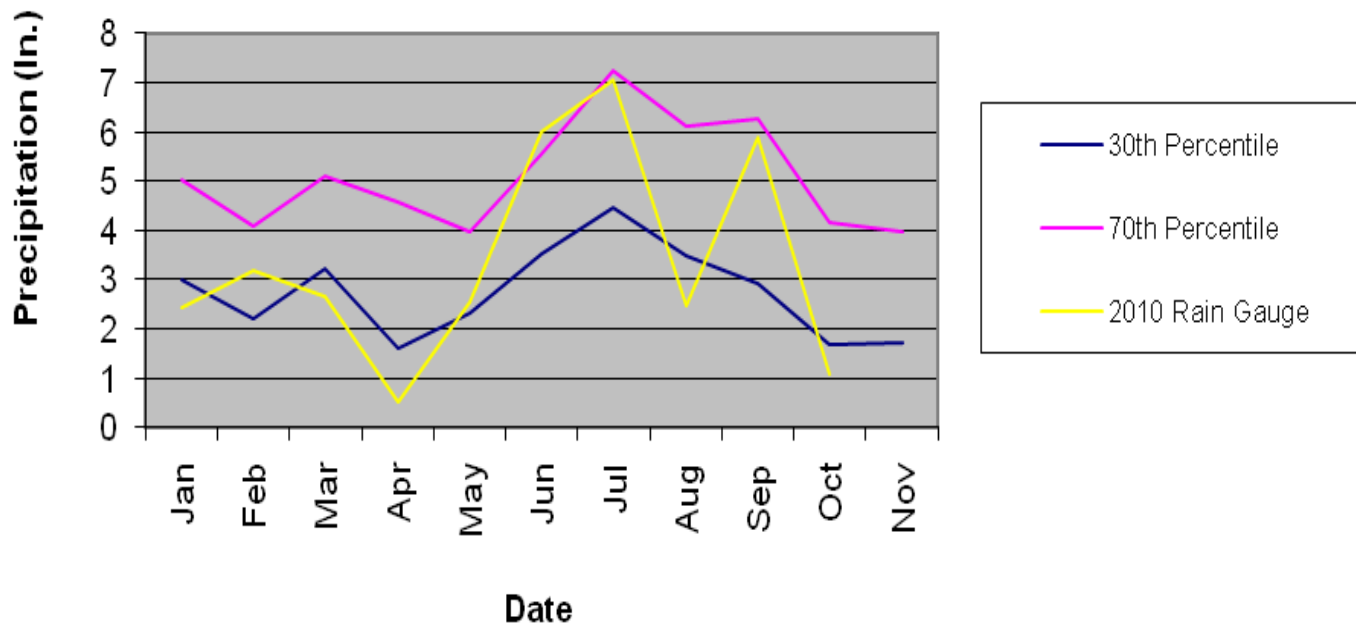
Table 8. Stem Count Total and Planted by Plot and Species concluded.

Scientific Name	Common Name	Species Type	MY4 (2010)			MY3 (2009)			MY2 (2008)			MY1 (2007)			MY0 (2006)		
			P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
<i>Acer rubrum</i>	red maple	Tree			9												8
<i>Baccharis halmifolia</i>	baccharis	Shrub Tree															1
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	Tree		2	2		2	2		2	2		2	2		2	2
<i>Liquidambar styraciflua</i>	sweetgum	Tree			2												2
<i>Magnolia virginiana</i>	sweetbay	Shrub Tree		7	7		8	8		8	8		8	8		8	8
<i>Morella cerifera</i>	wax myrtle	Shrub															1
<i>Nyssa aquatica</i>	water tupelo	Tree		5	5		6	6		6	6		7	7		14	15
<i>Persea palustris</i>	swamp bay	Tree														7	7
<i>Pinus serotina</i>	pond pine	Tree		11	16		14	14		15	15		16	16		20	20
<i>Pinus taeda</i>	loblolly pine	Tree		49	49		49	49		49	49		51	51		52	52
<i>Quercus lyrata</i>	overcup oak	Tree		21	23		21	21		21	21		22	22		28	28
<i>Salix nigra</i>	black willow	Tree			10												18
<i>Taxodium ascendens</i>	pond cypress	Tree		1	1		1	1									
<i>Taxodium distichum</i>	bald cypress	Tree		55	55		55	55		54	54		55	55		58	58
Stem count			0	151	179	0	156	156	0	155	155	0	161	161	0	189	220
size (acres)			20			20			20			20			20		
size (ACRES)			0.49			0.49			0.49			0.49			0.49		
Species count			0	8	11	0	8	8	0	7	7	0	7	7	0	8	13
Stems per ACRE			0	305.5	362.2	0	315.7	315.7	0	313.6	313.6	0	325.8	325.8	0	382.4	445.2

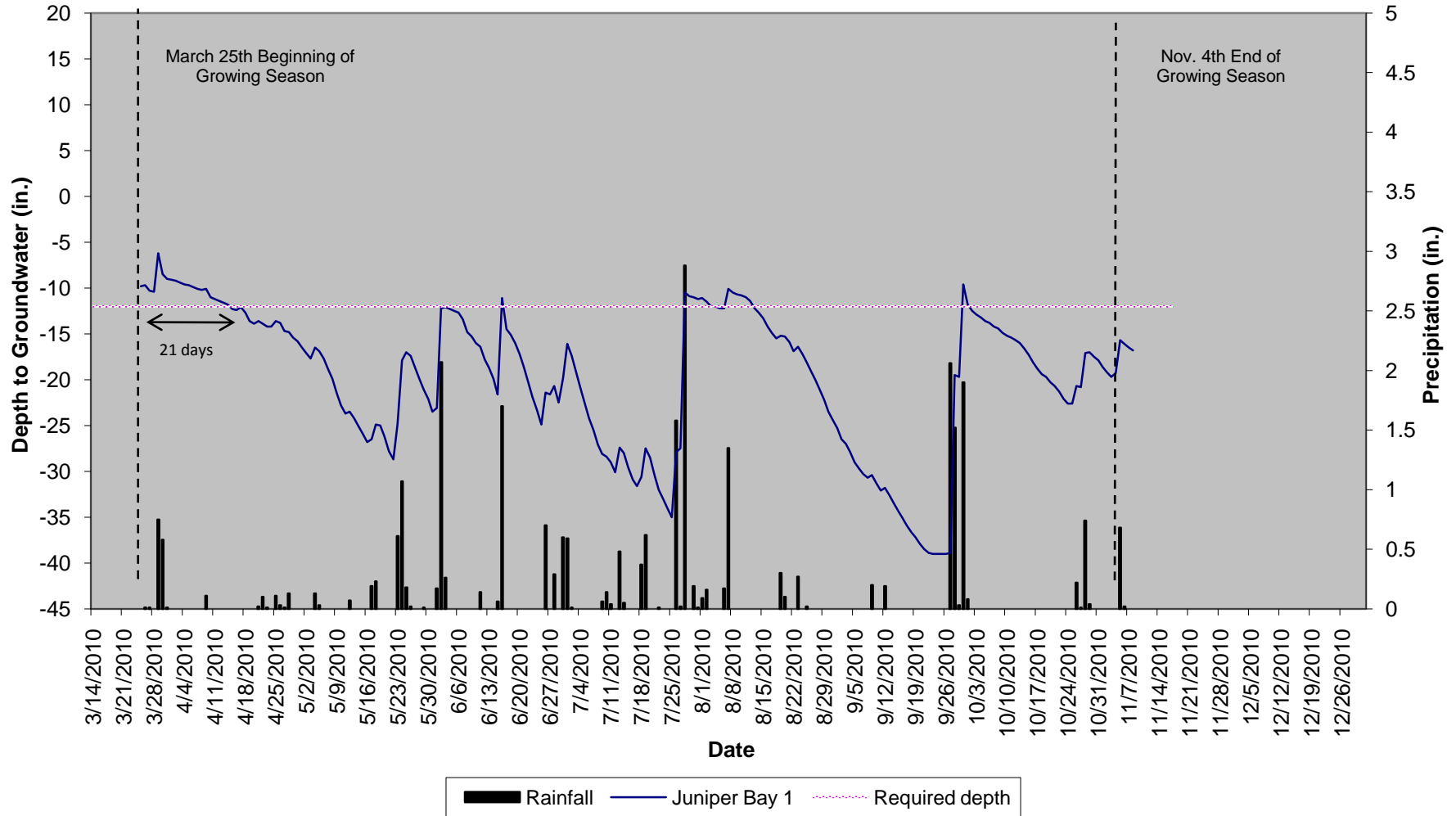
Appendix D

Hydrologic Data

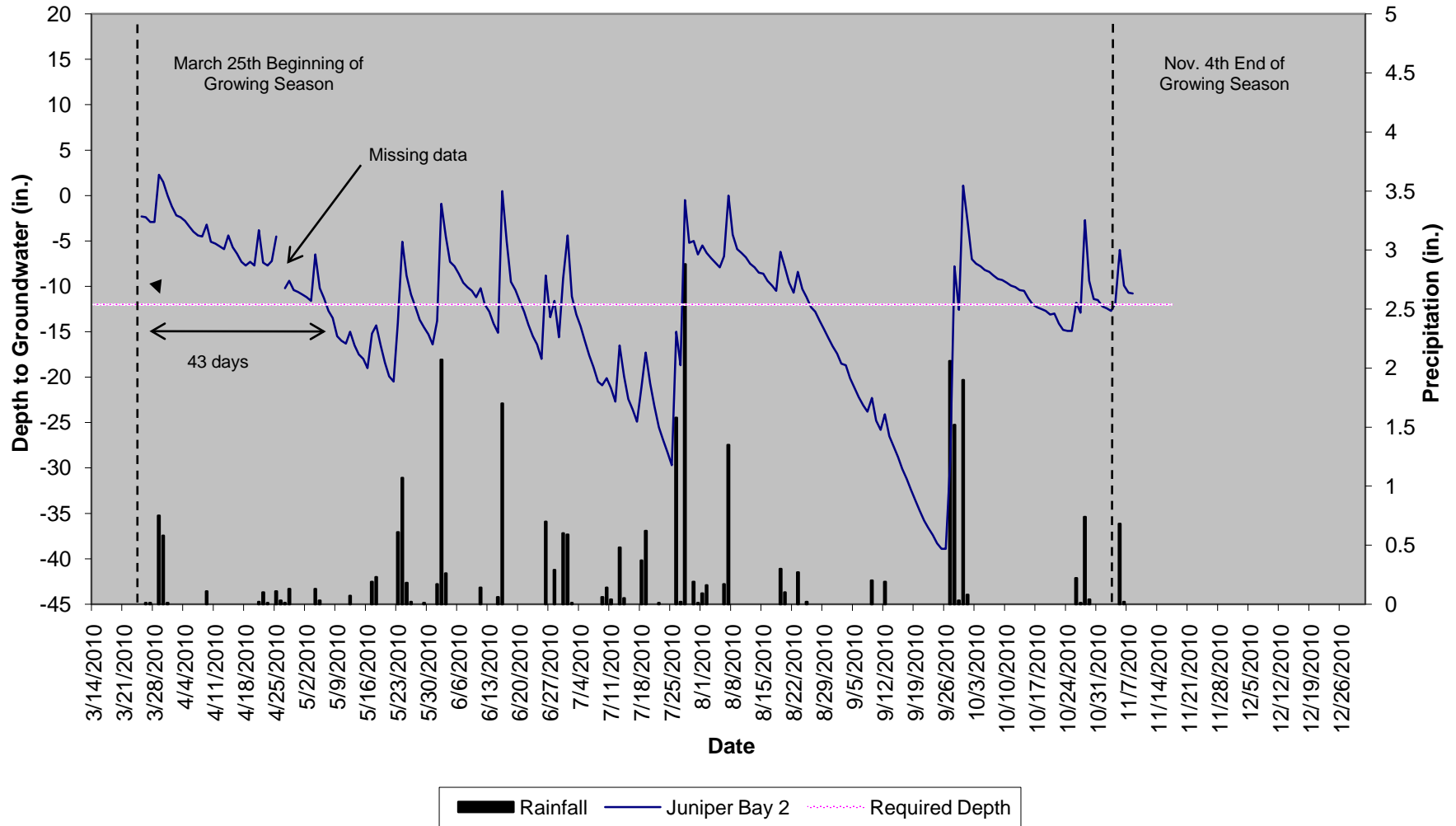
Figure 3. Juniper Bay 30-70 Percentile Graph for Rainfall in 2010



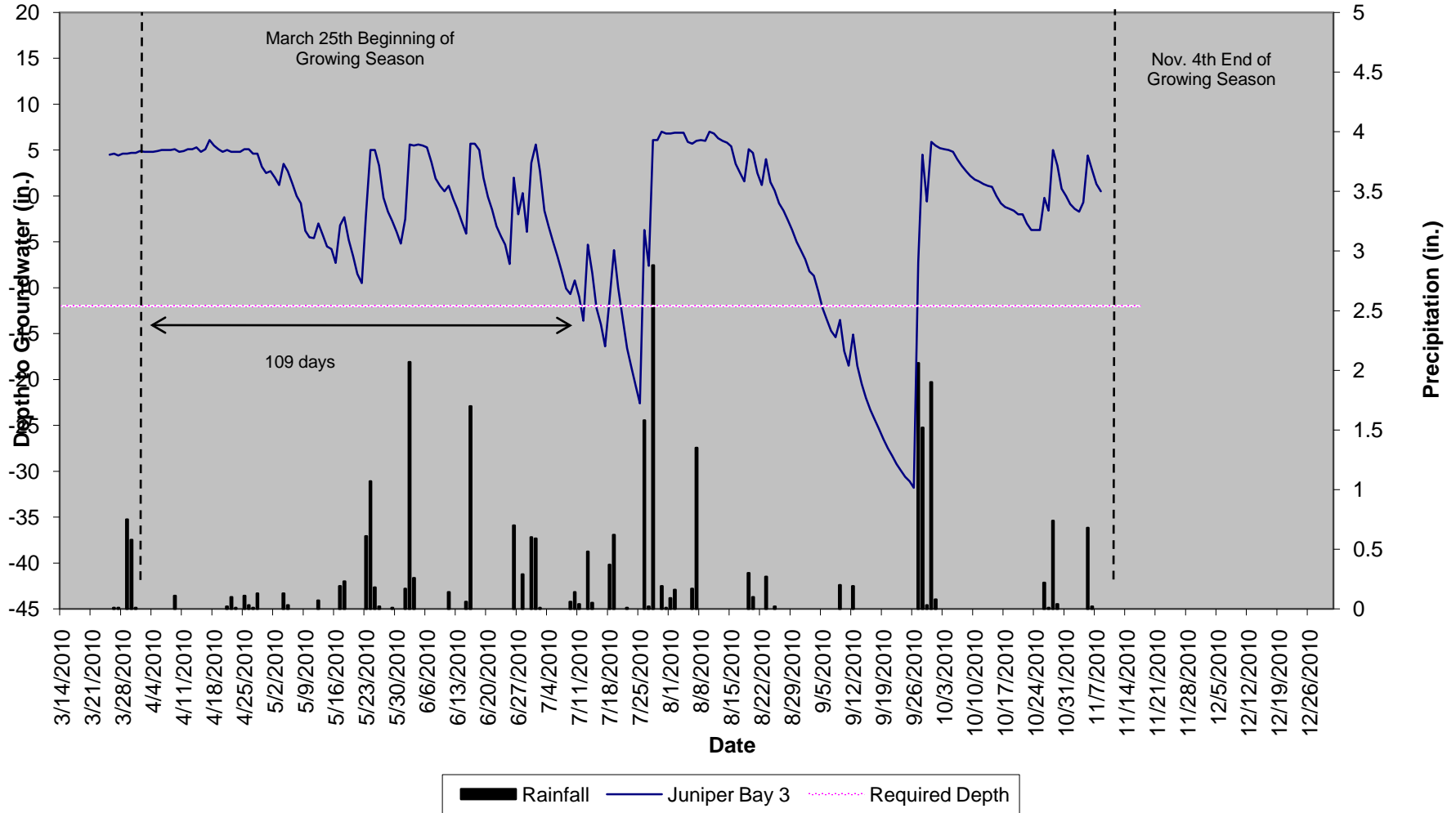
Juniper Bay 1 40" Groundwater



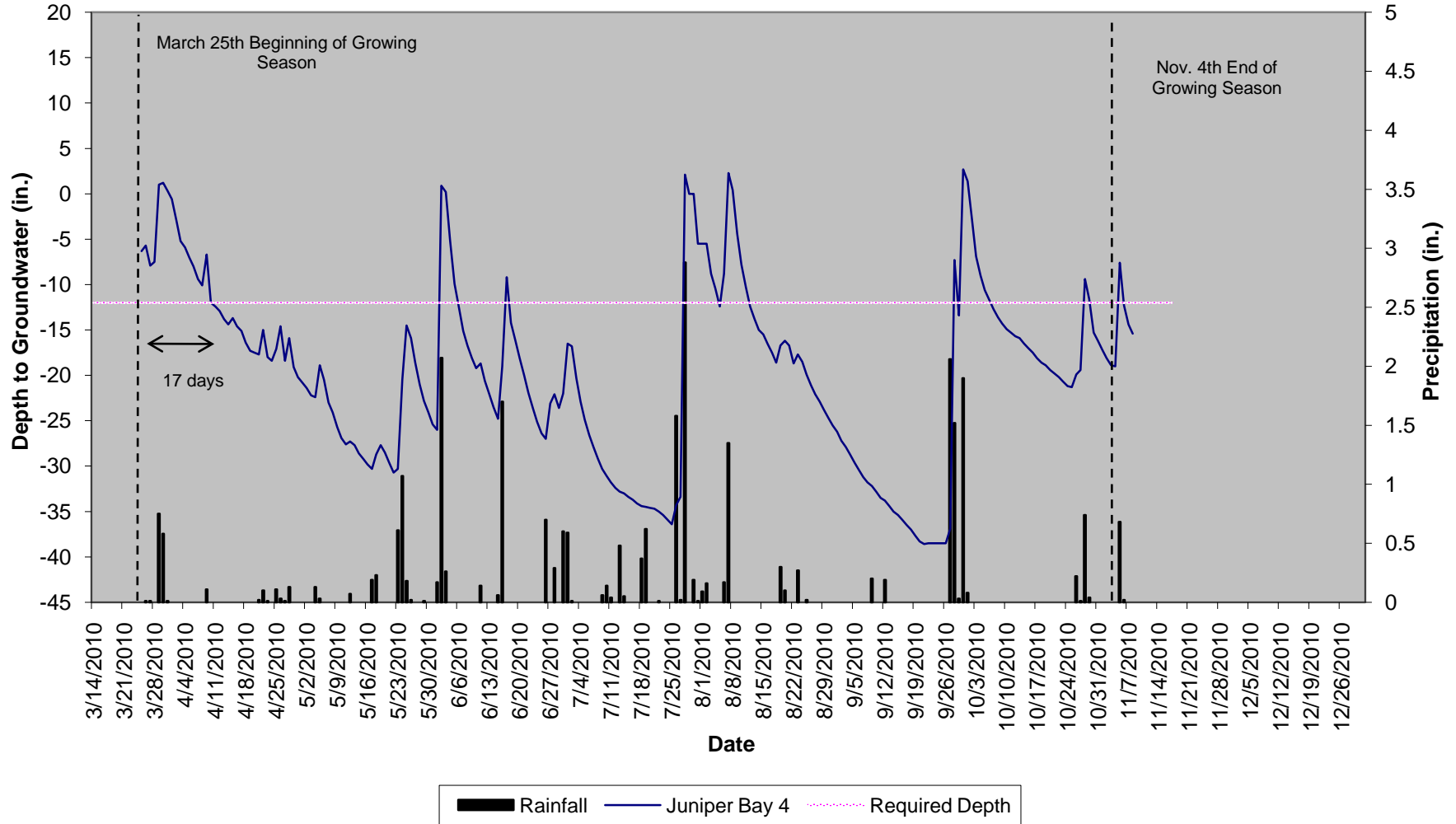
Juinper Bay 2 40" Groundwater



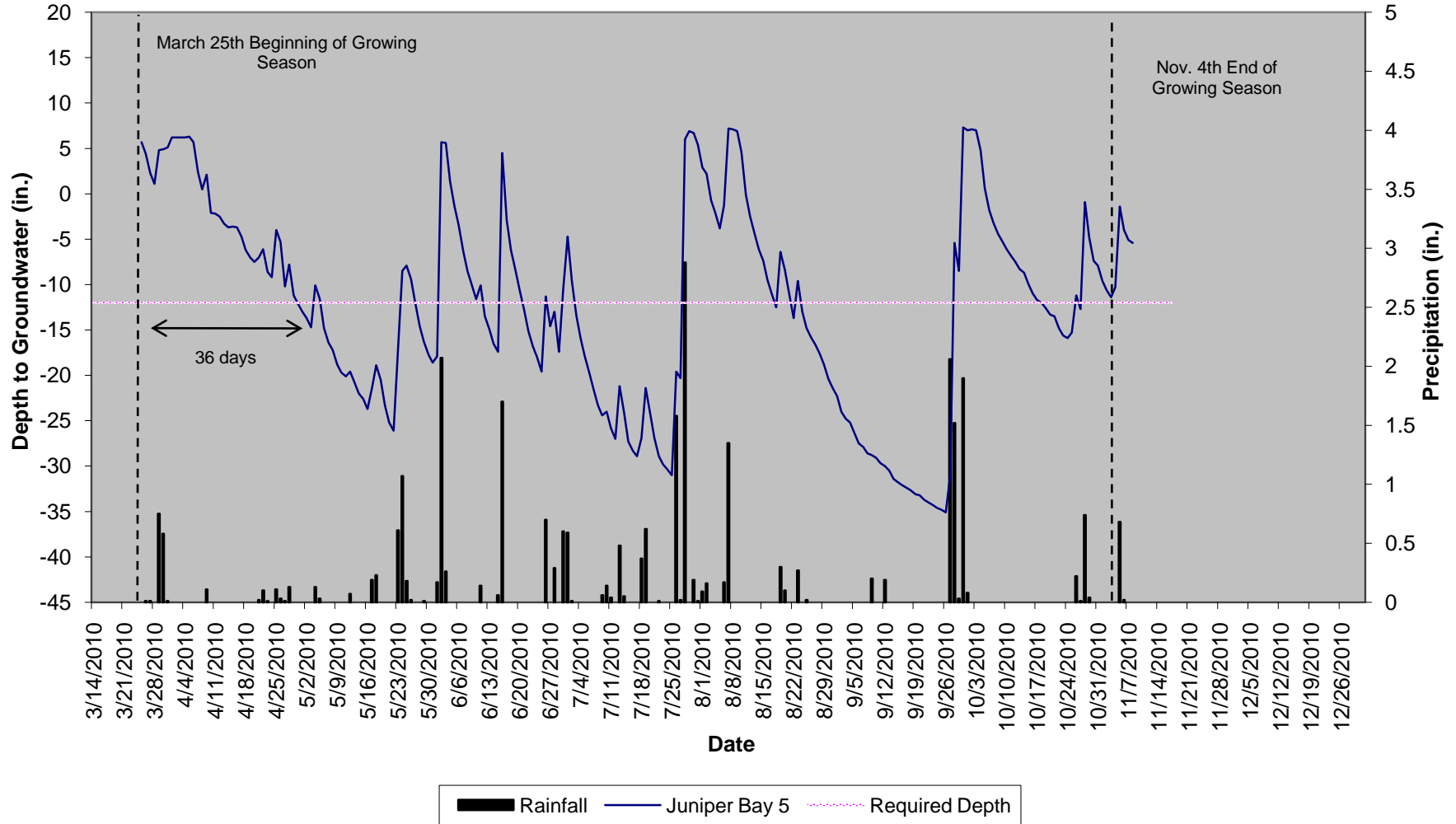
Juniper Bay 3 40" Groundwater



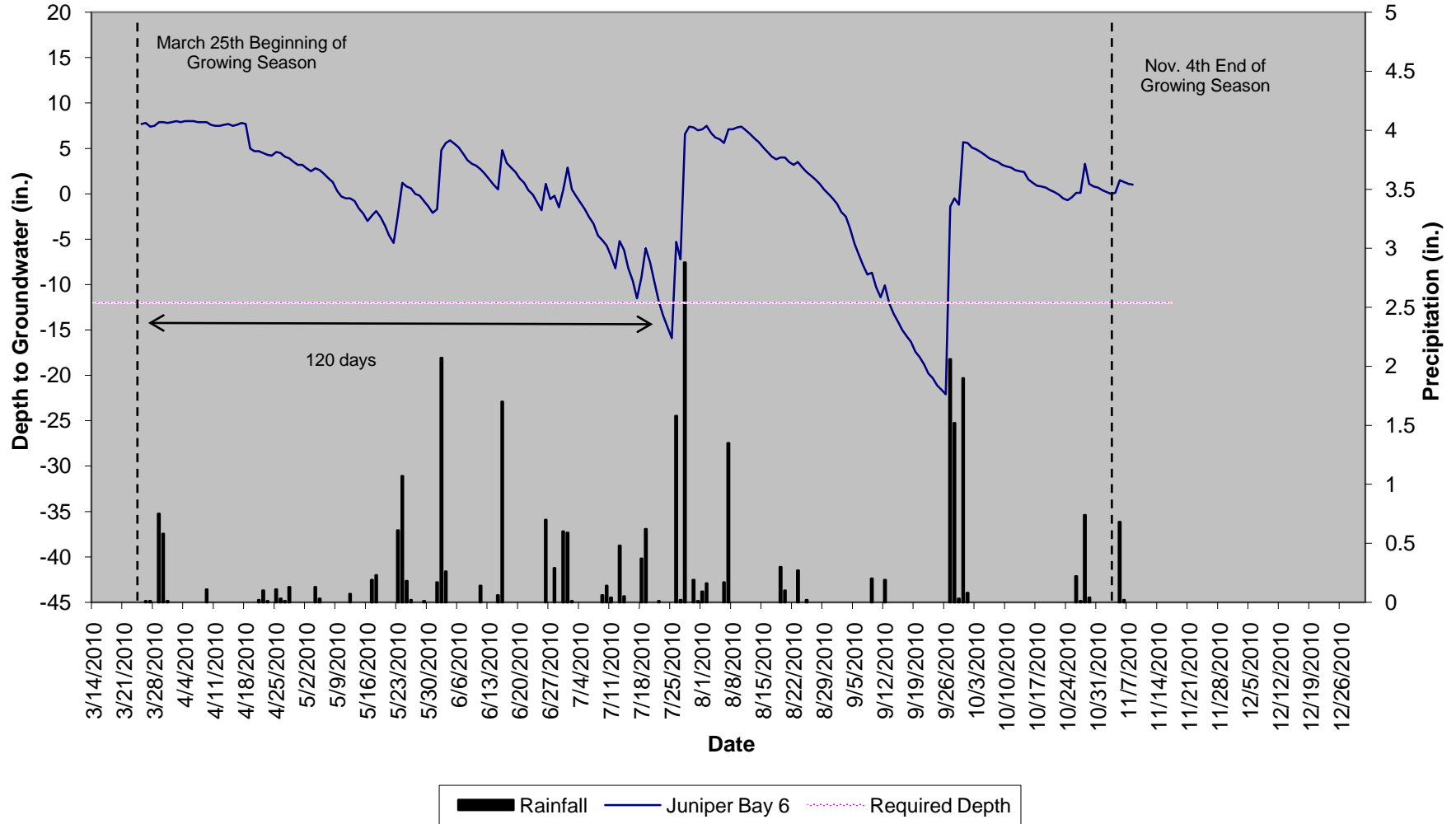
**Juniper Bay
4
40" Groundwater**



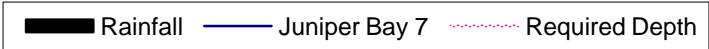
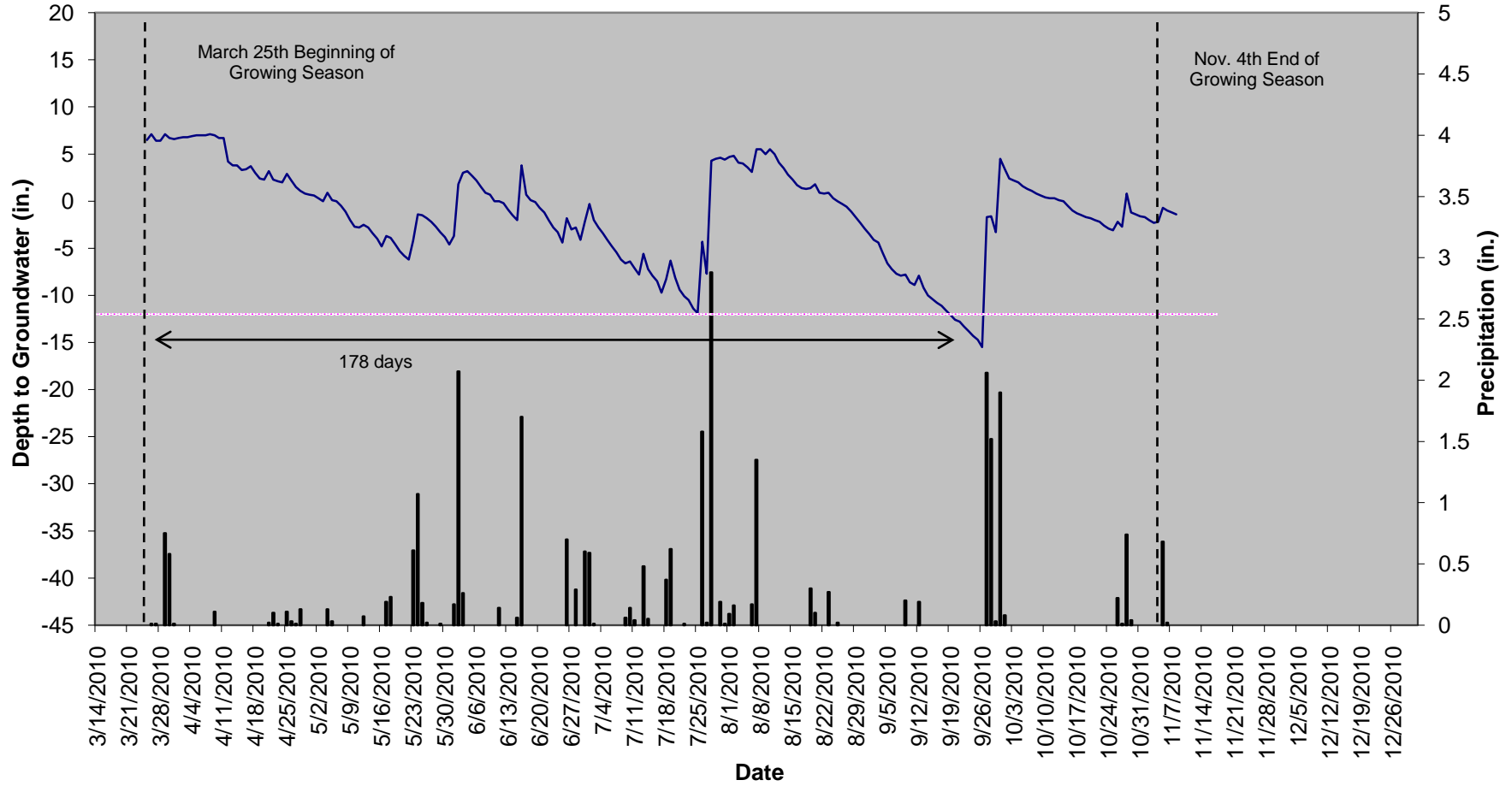
Juniper Bay 5 40" Groundwater



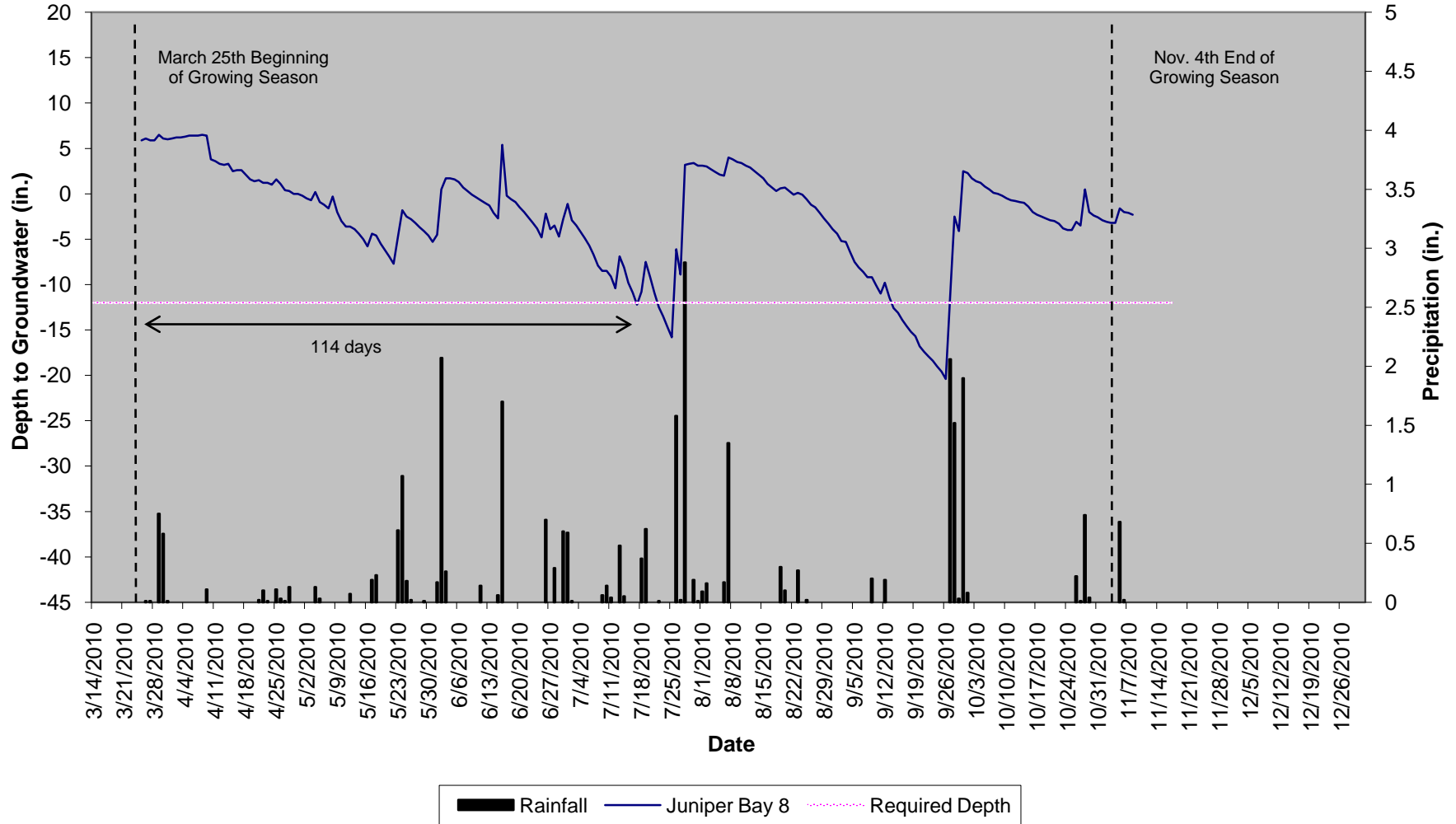
Juniper Bay 6 40" Groundwater



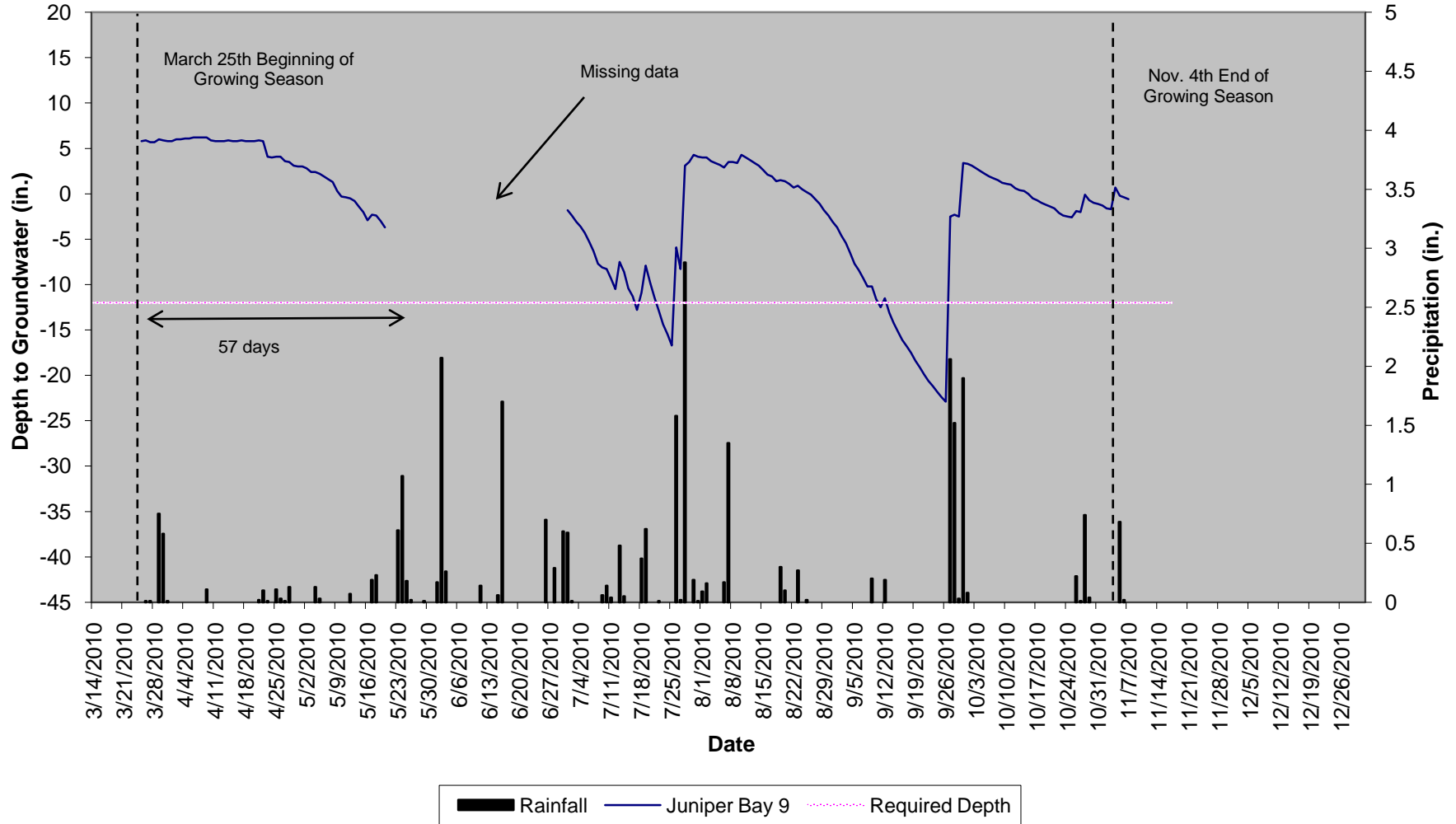
Juniper Bay 7 40" Groundwater



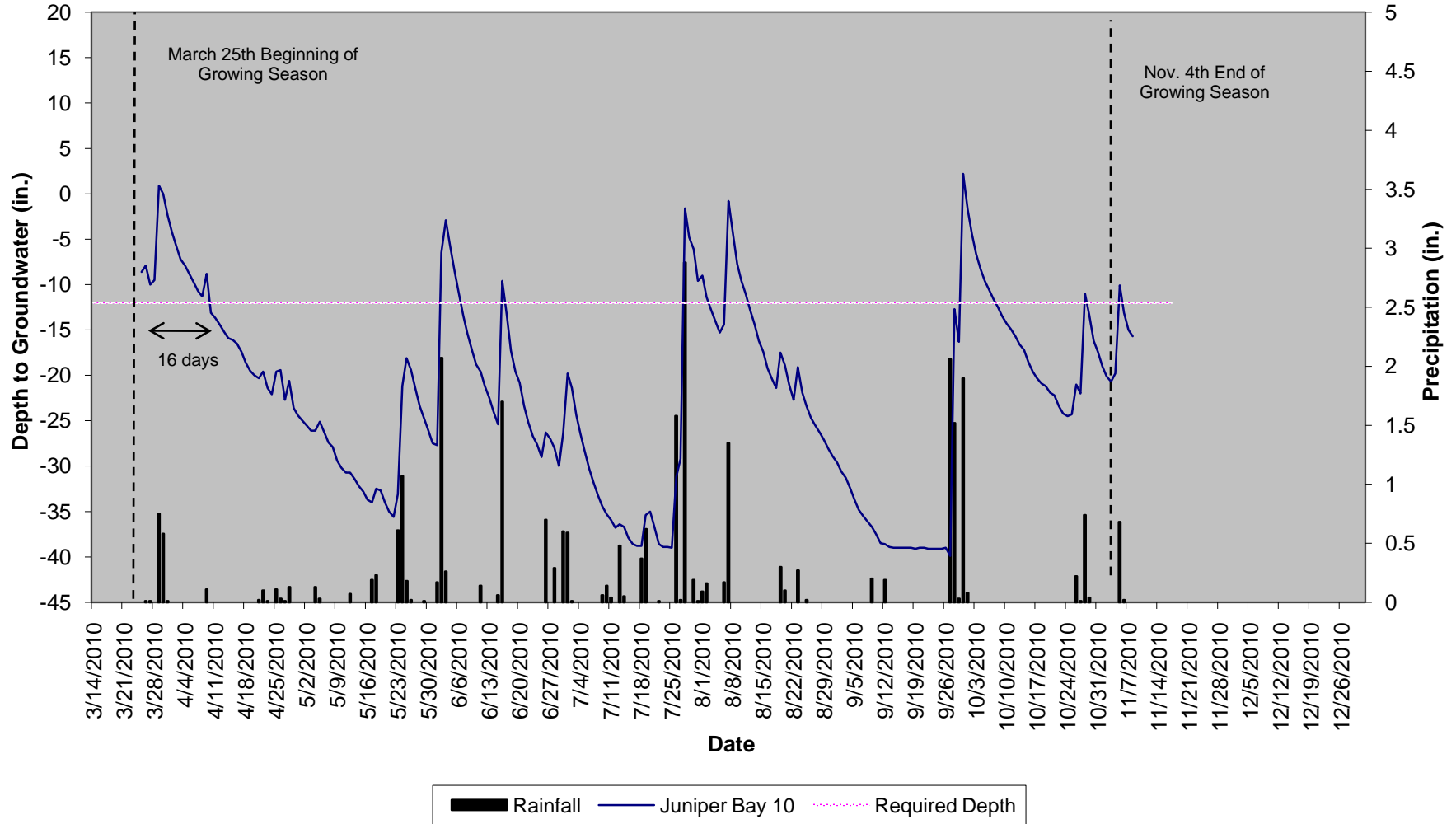
**Juniper Bay
8
40" Groundwater**



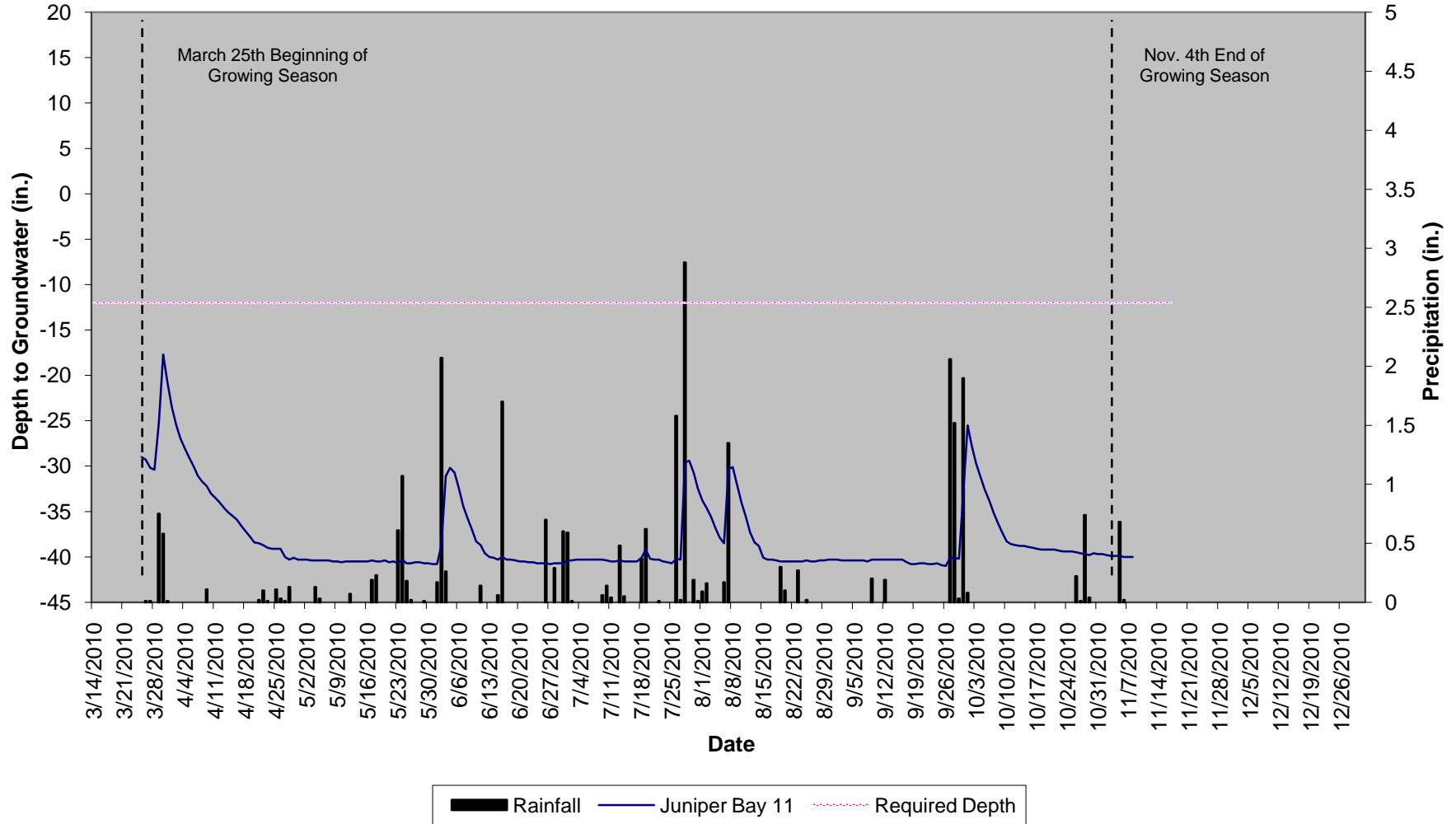
Juniper Bay 9 40" Groundwater



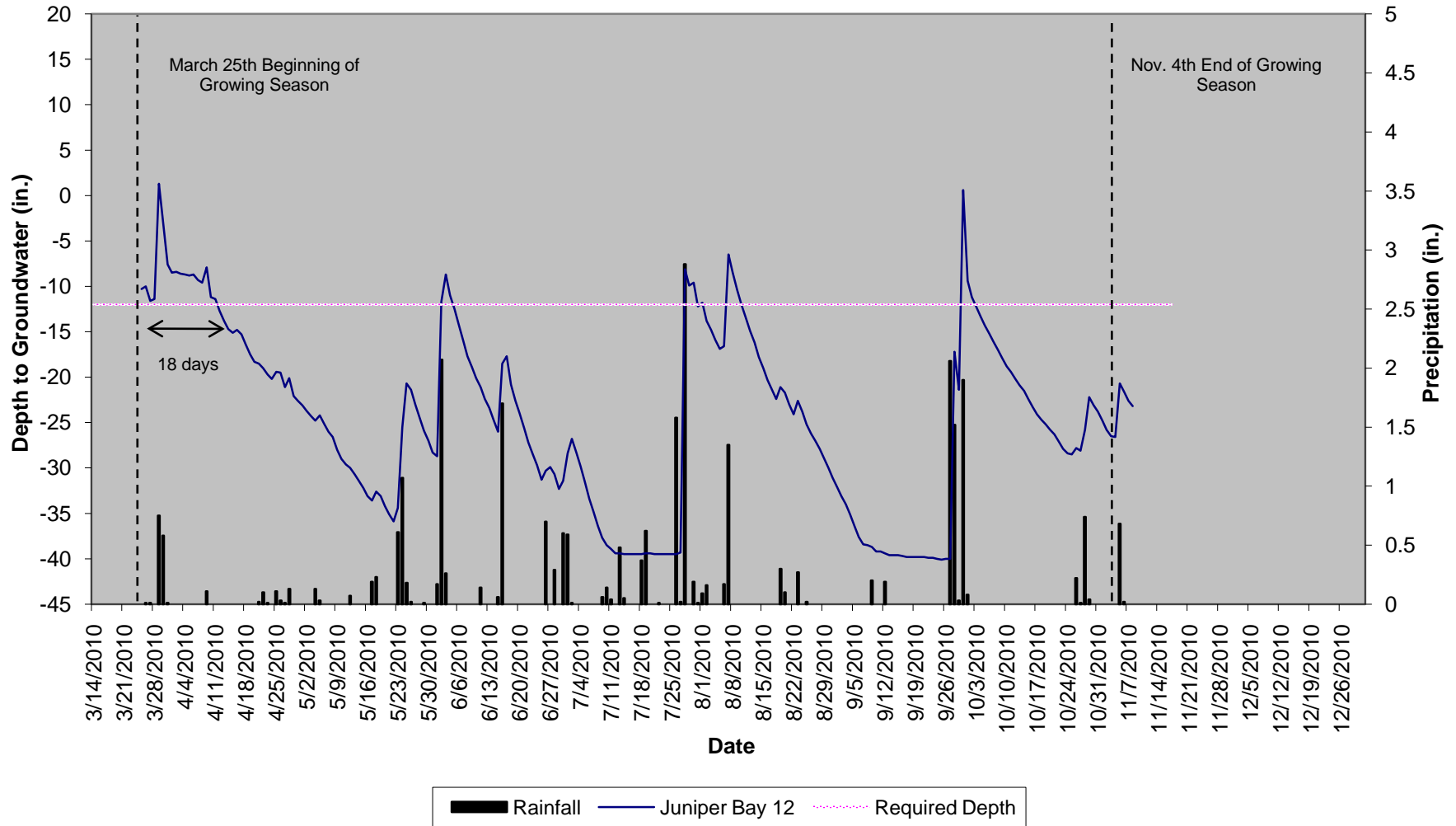
Juniper Bay 10 40" Groundwater



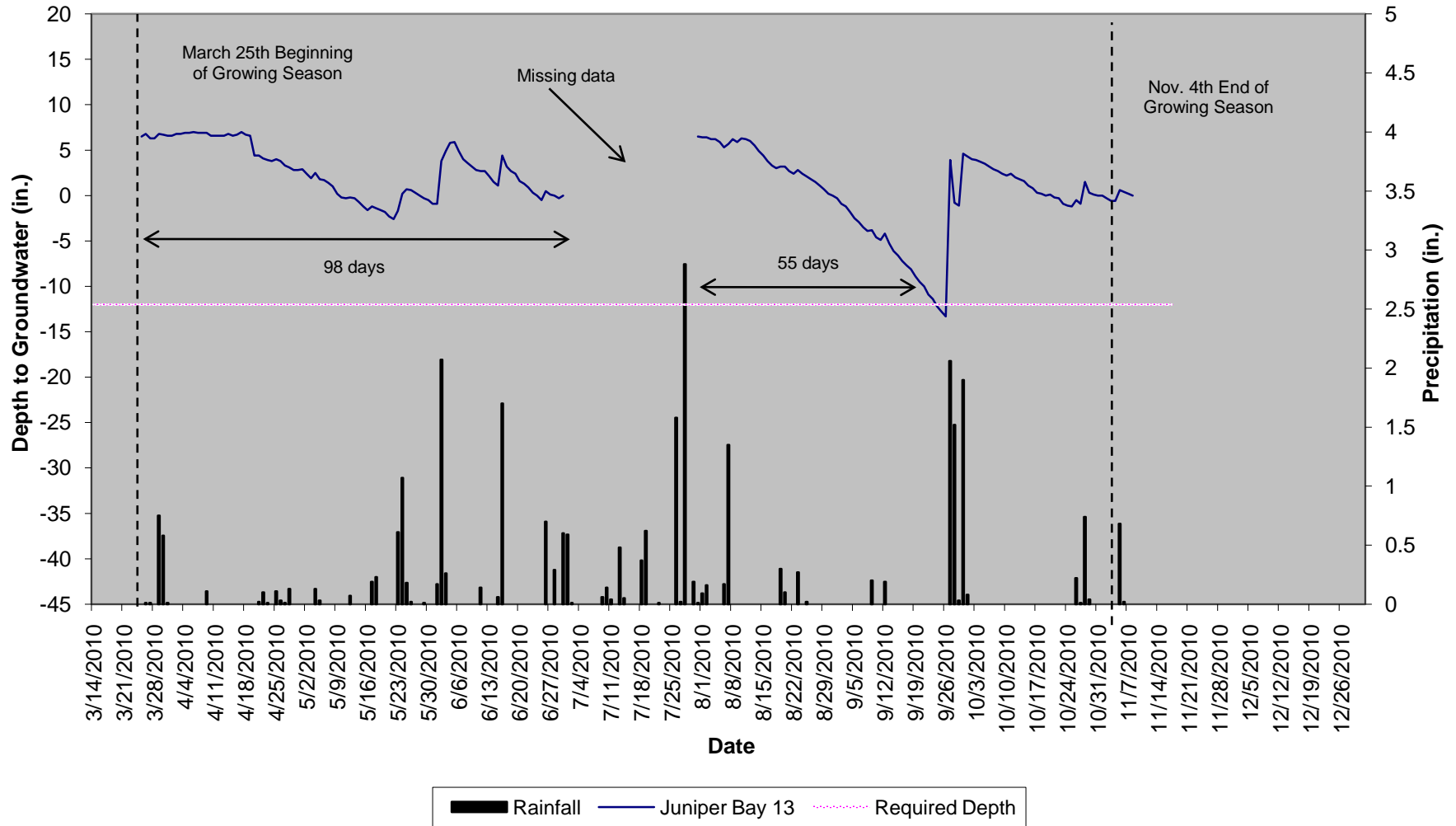
Juniper Bay
11
40" Groundwater



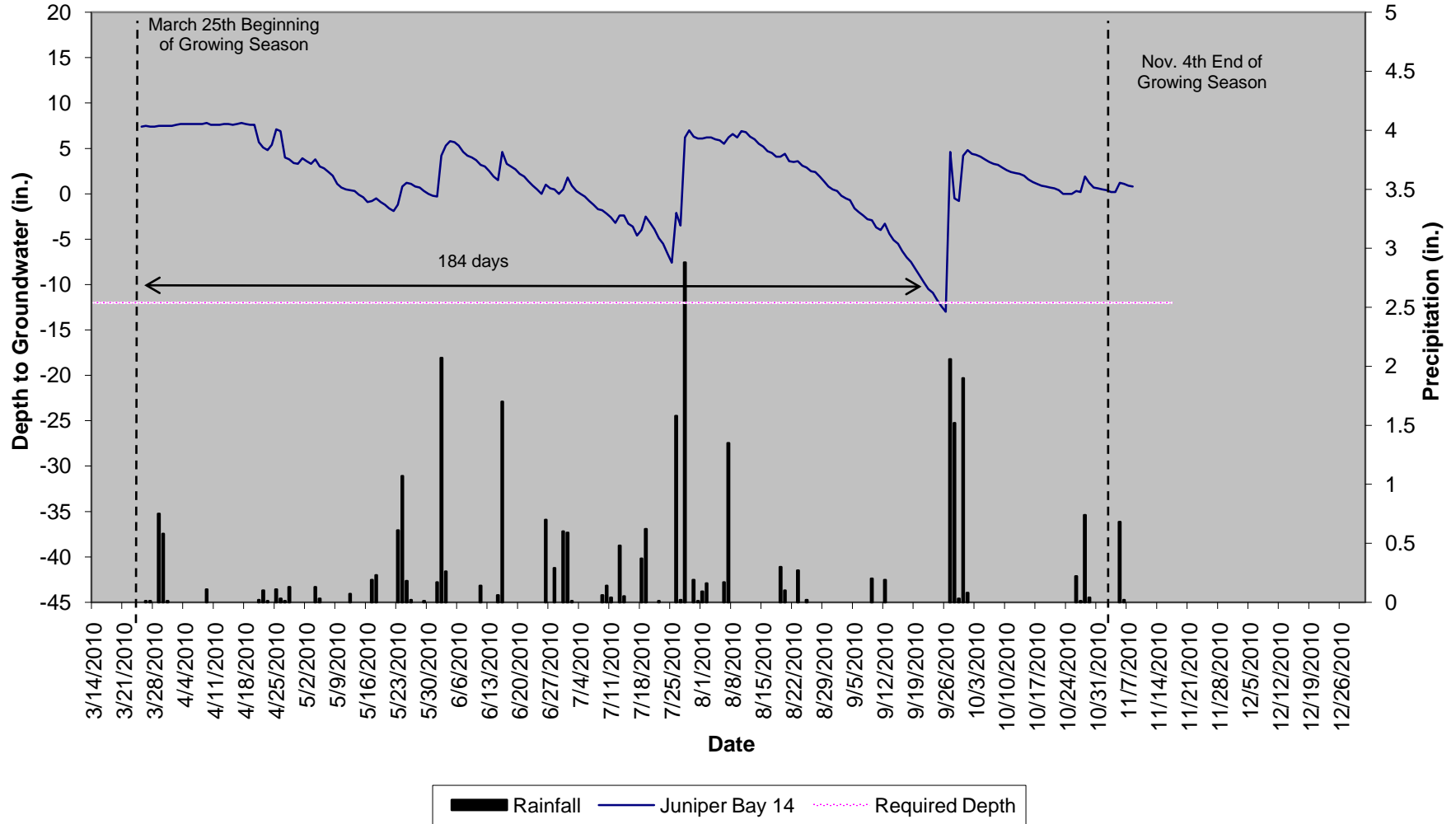
Juniper Bay
12
40" Groundwater



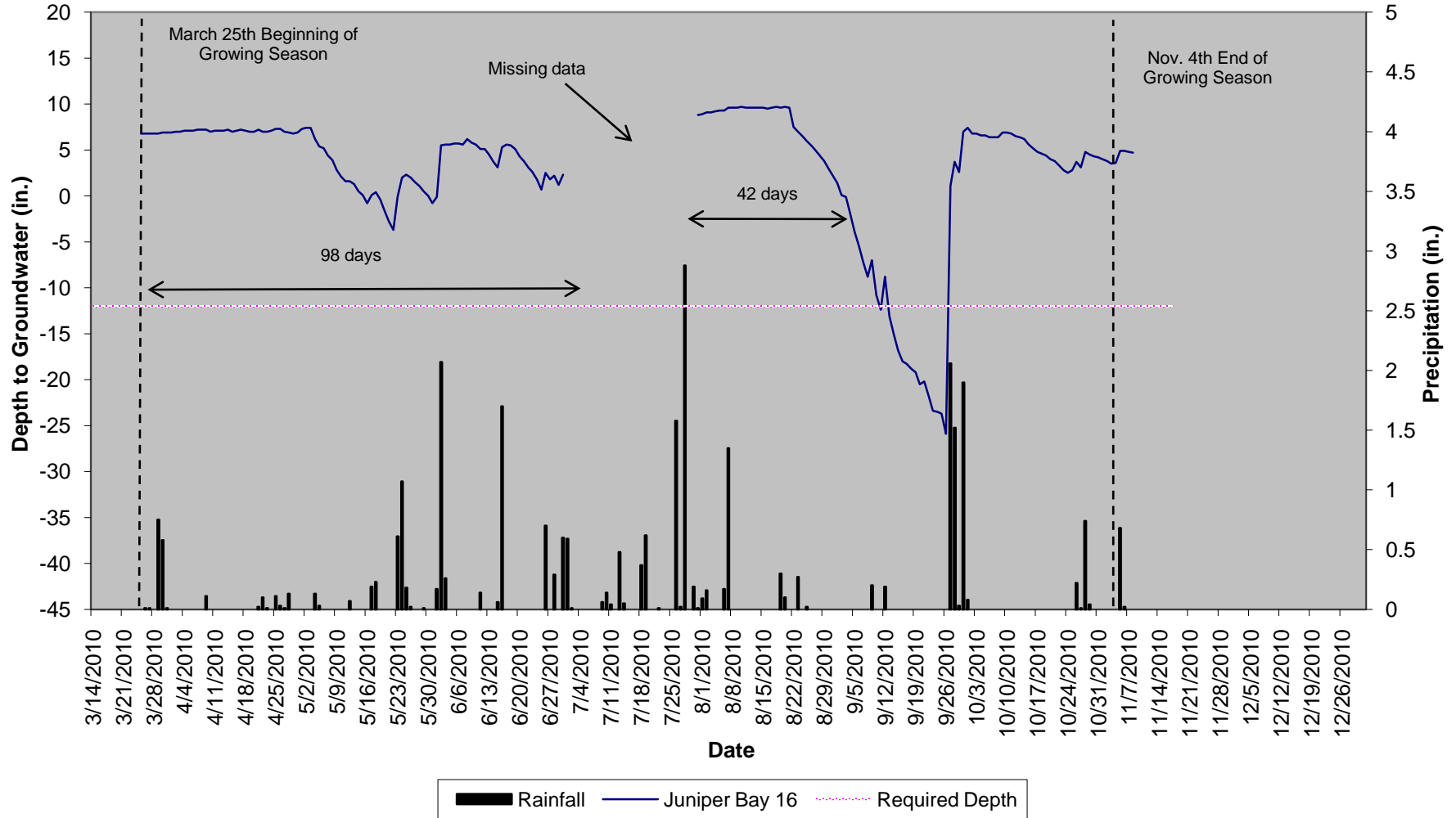
Juniper Bay 13 40" Groundwater



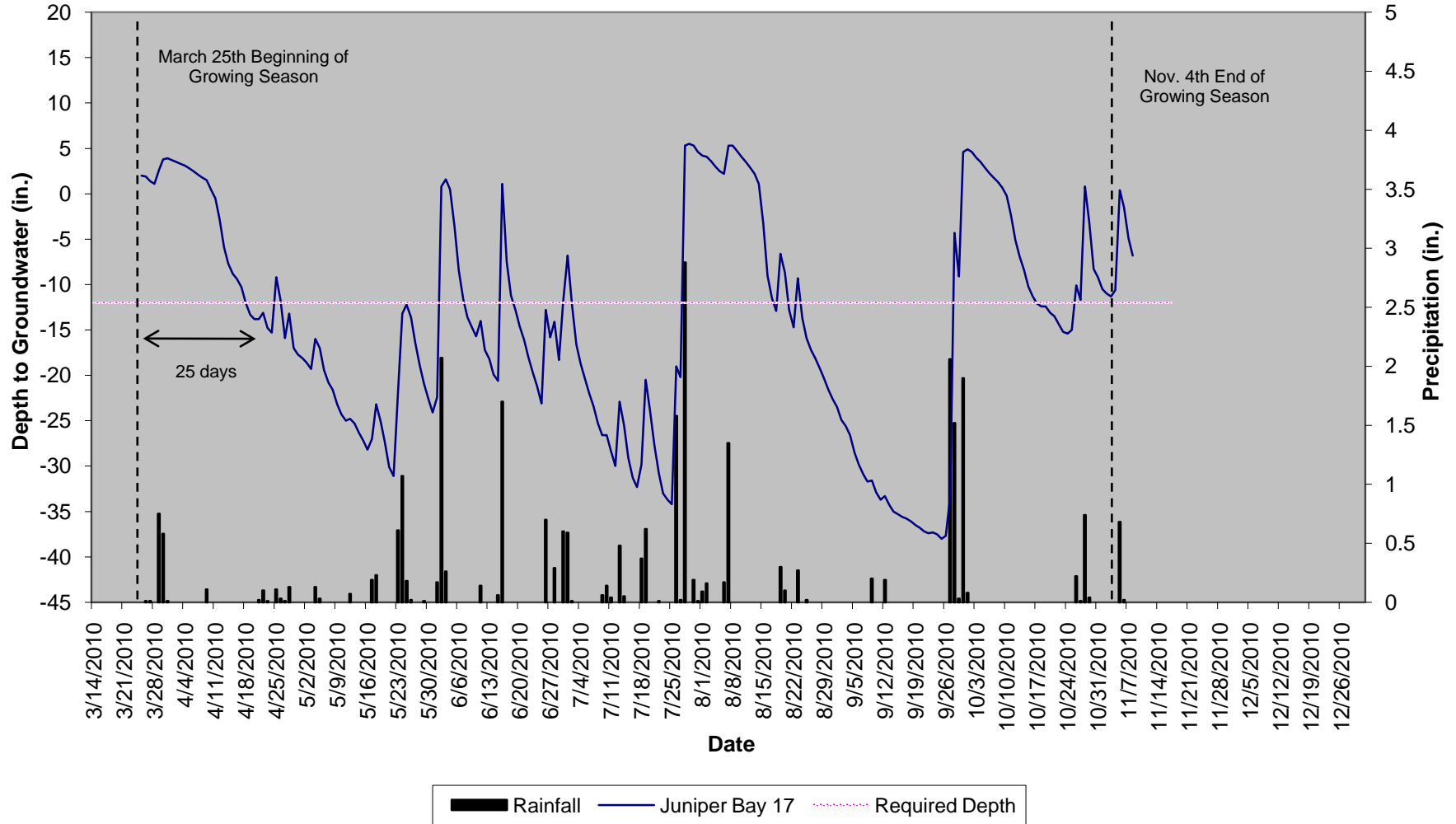
**Juniper Bay
14
40" Groundwater**



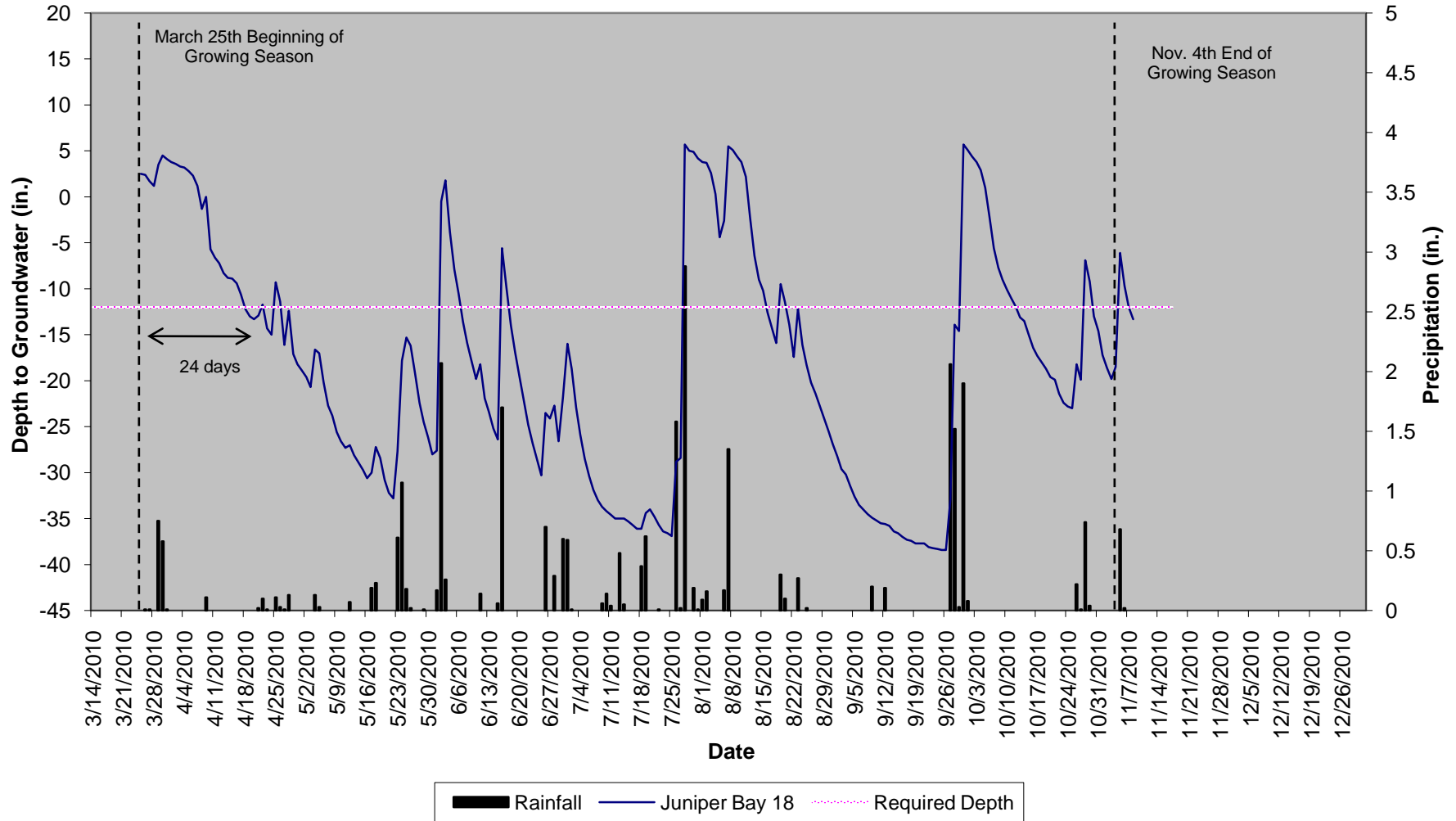
Juniper Bay 16 40" Groundwater



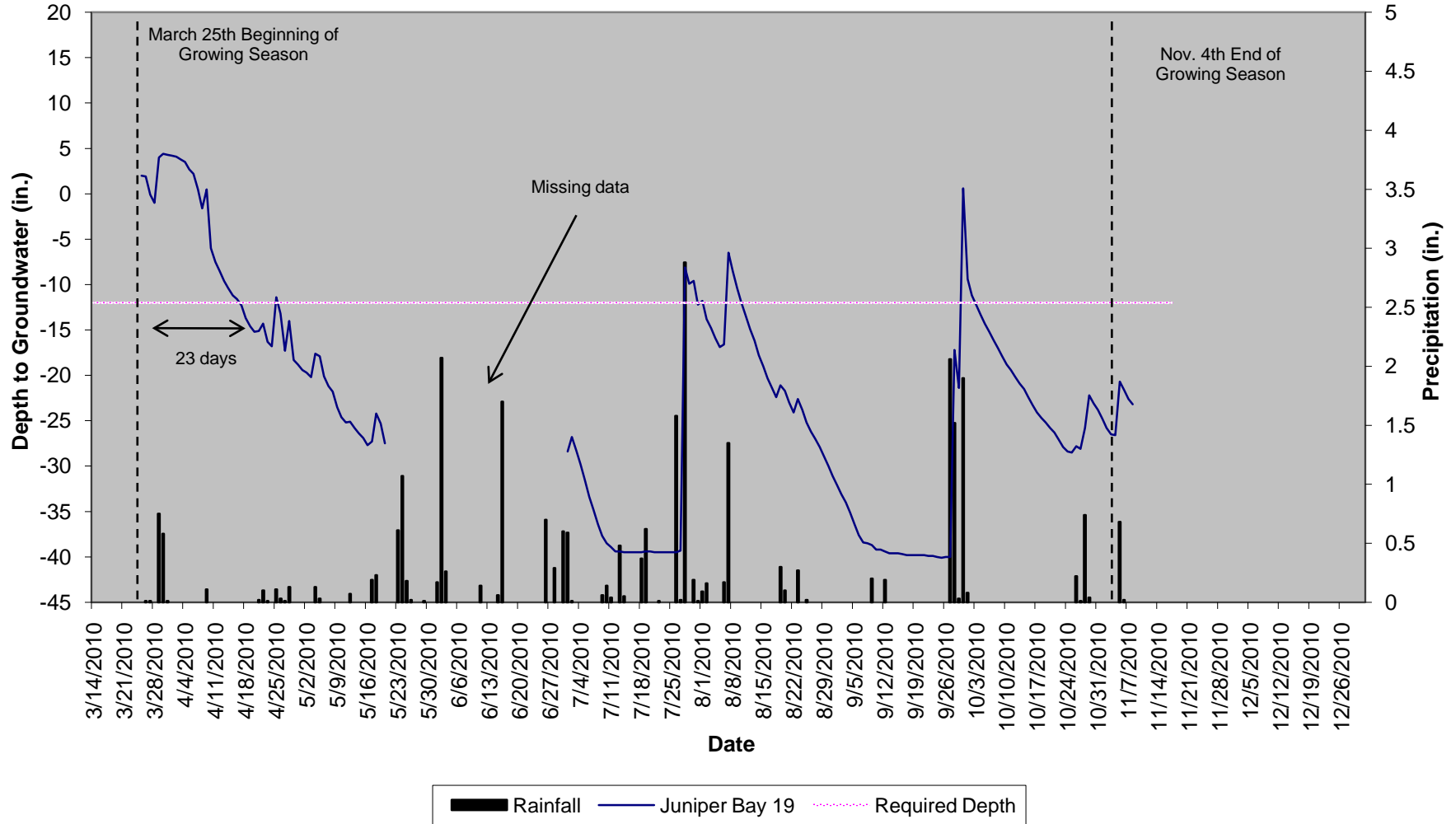
**Juniper Bay
17
40" Groundwater**



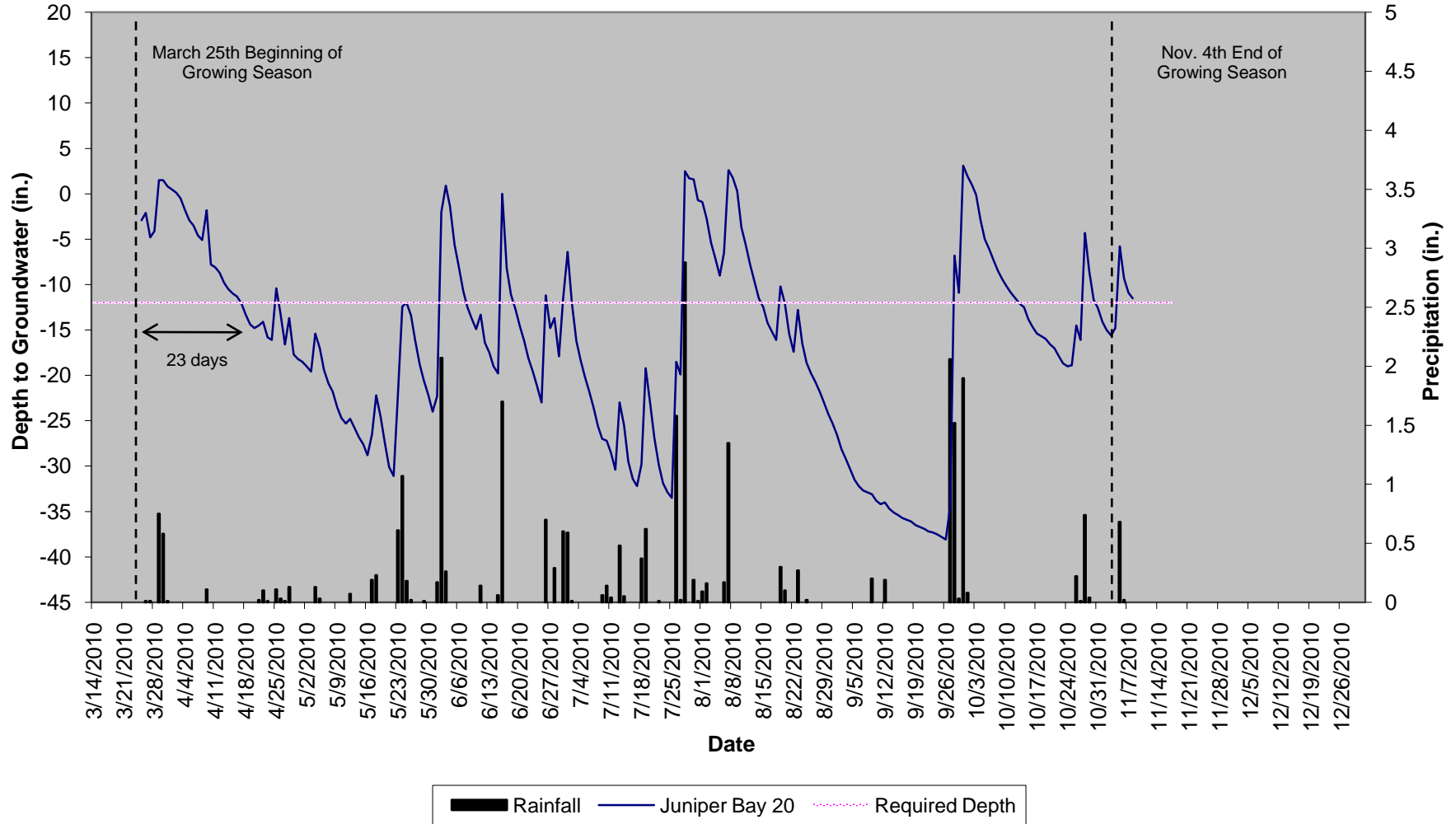
Juniper Bay 18 40" Groundwater



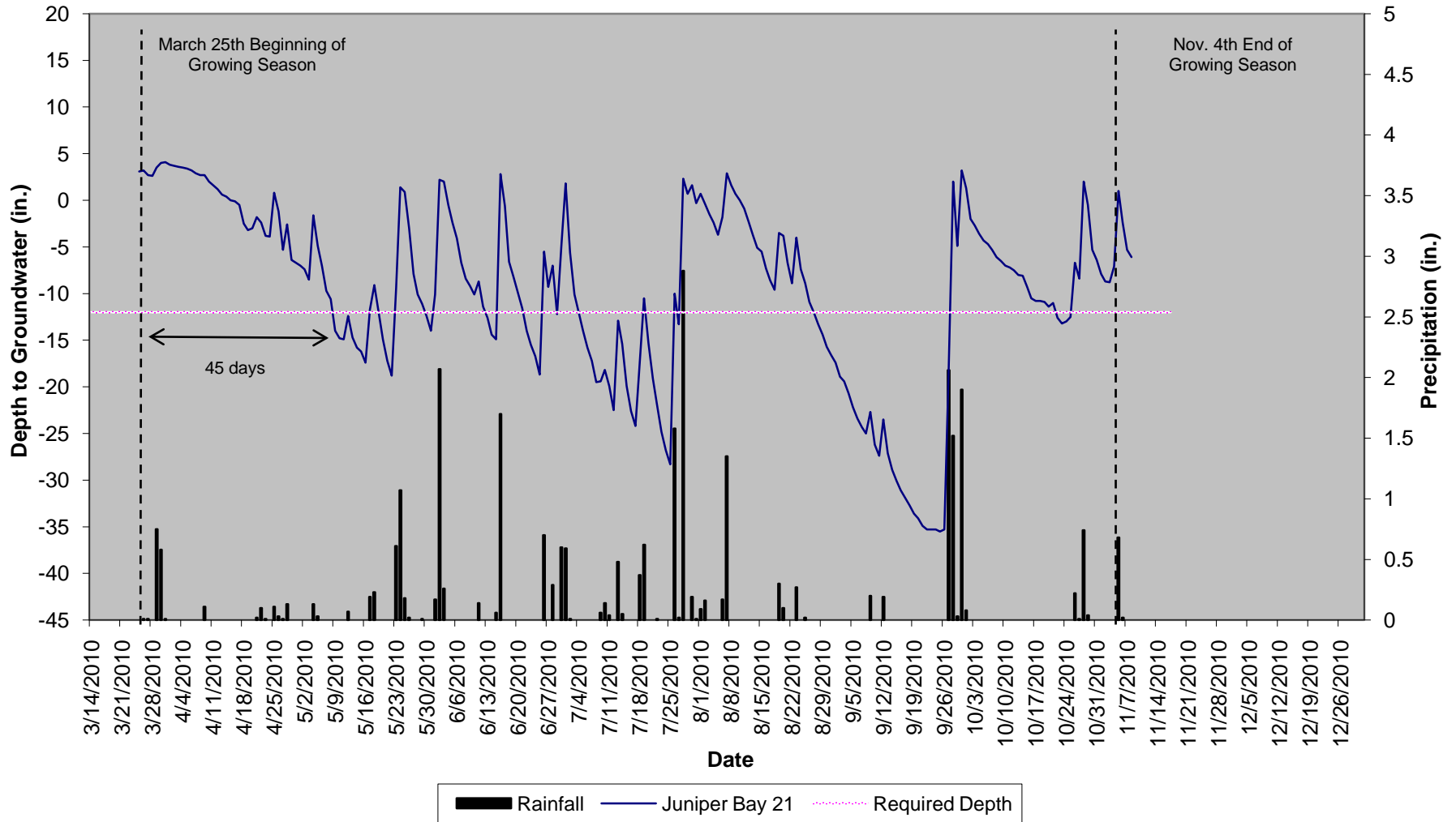
Juniper Bay 19 40" Groundwater



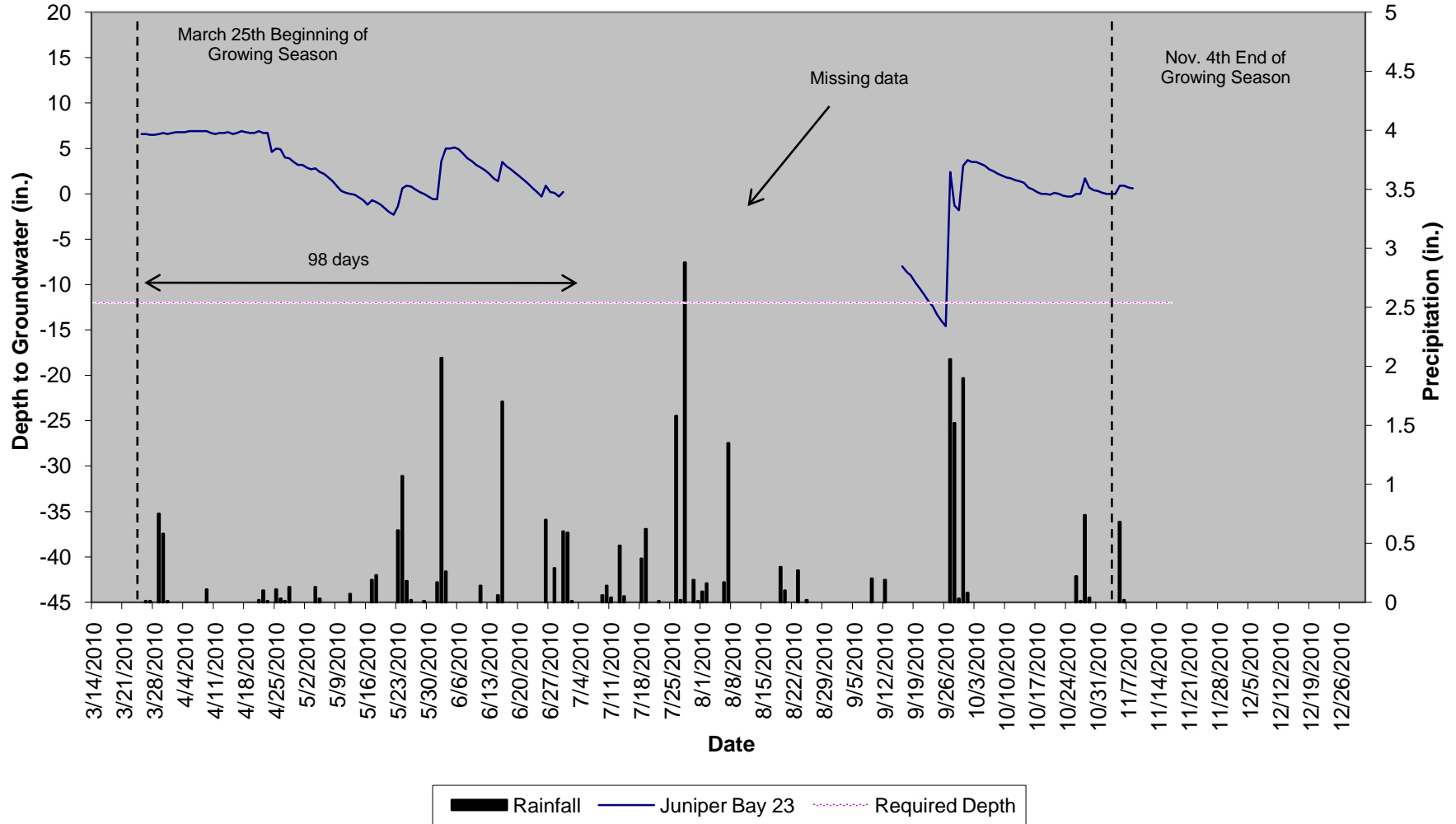
Juniper Bay 20 40" Groundwater



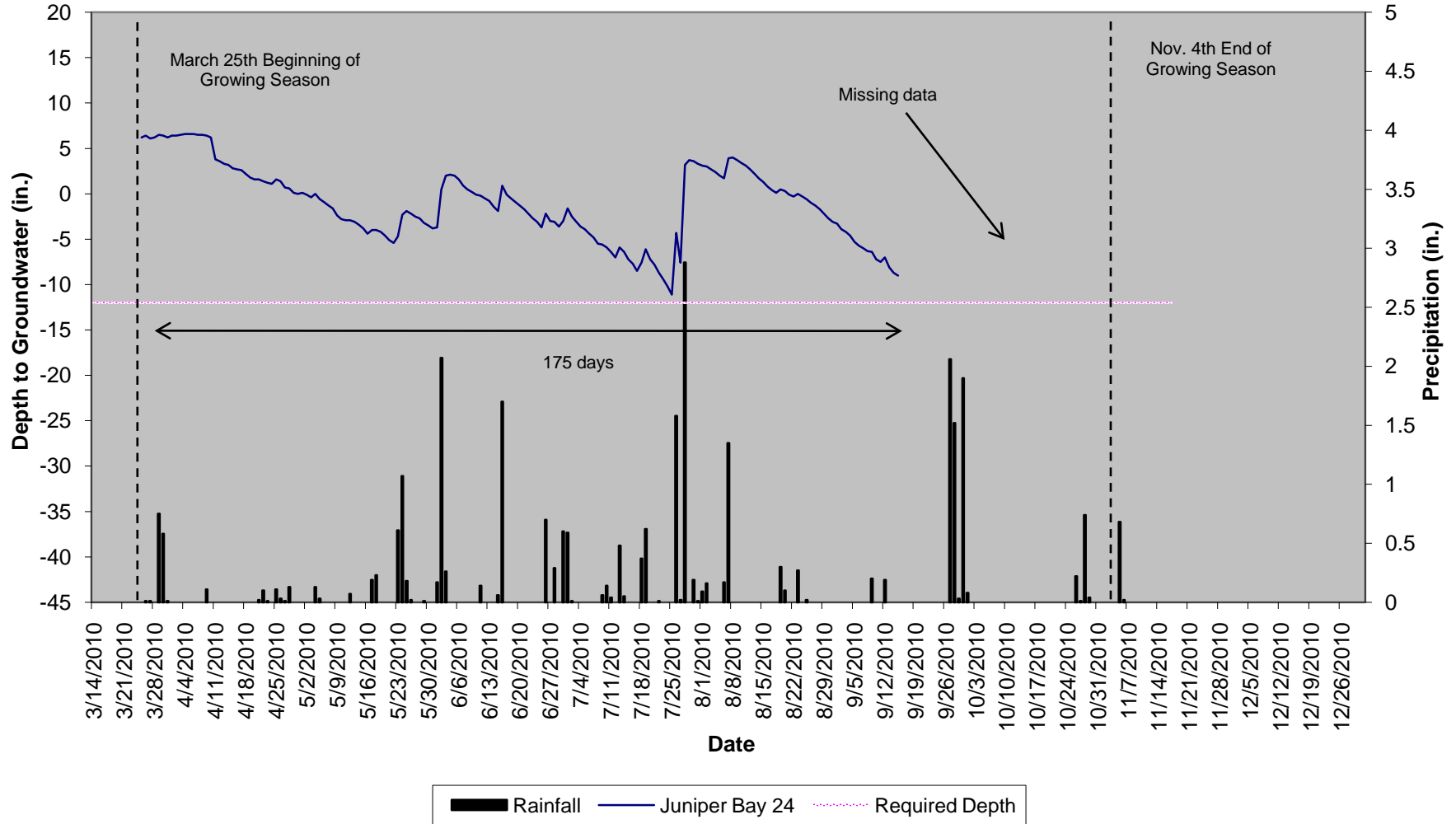
**Juniper Bay
21
40" Groundwater**



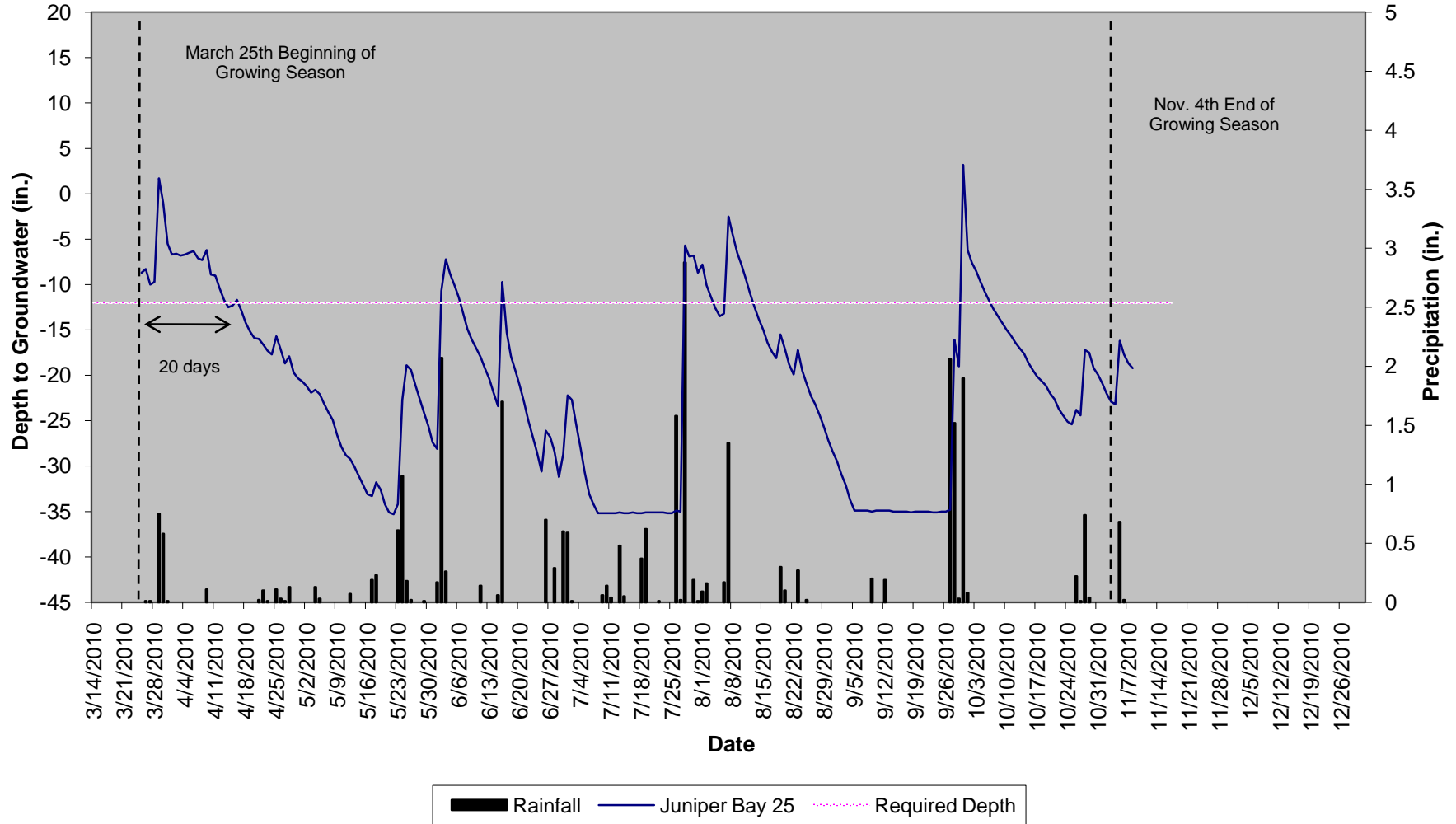
**Juniper Bay
23
40" Groundwater**



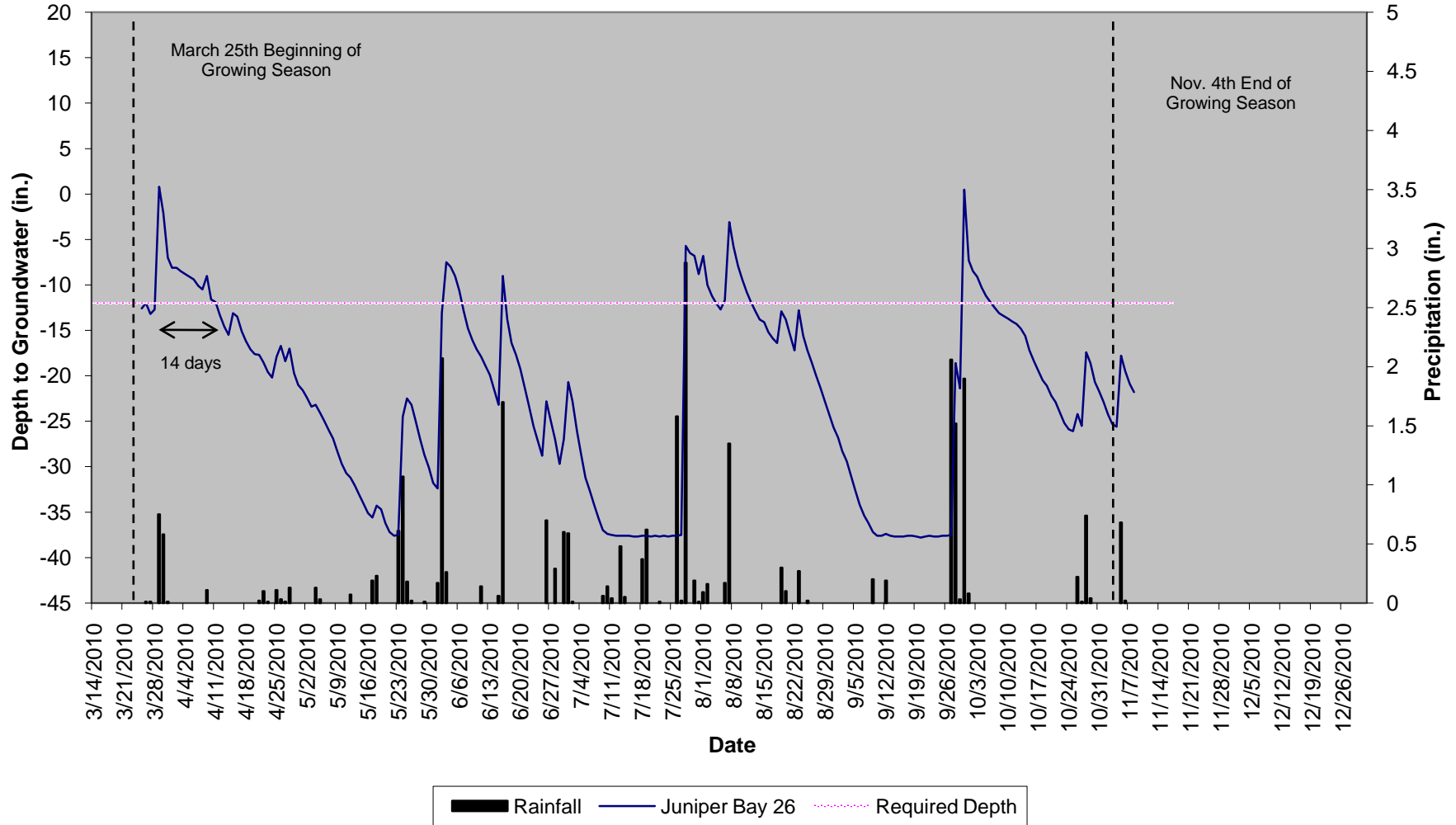
Juniper Bay 24 40" Groundwater



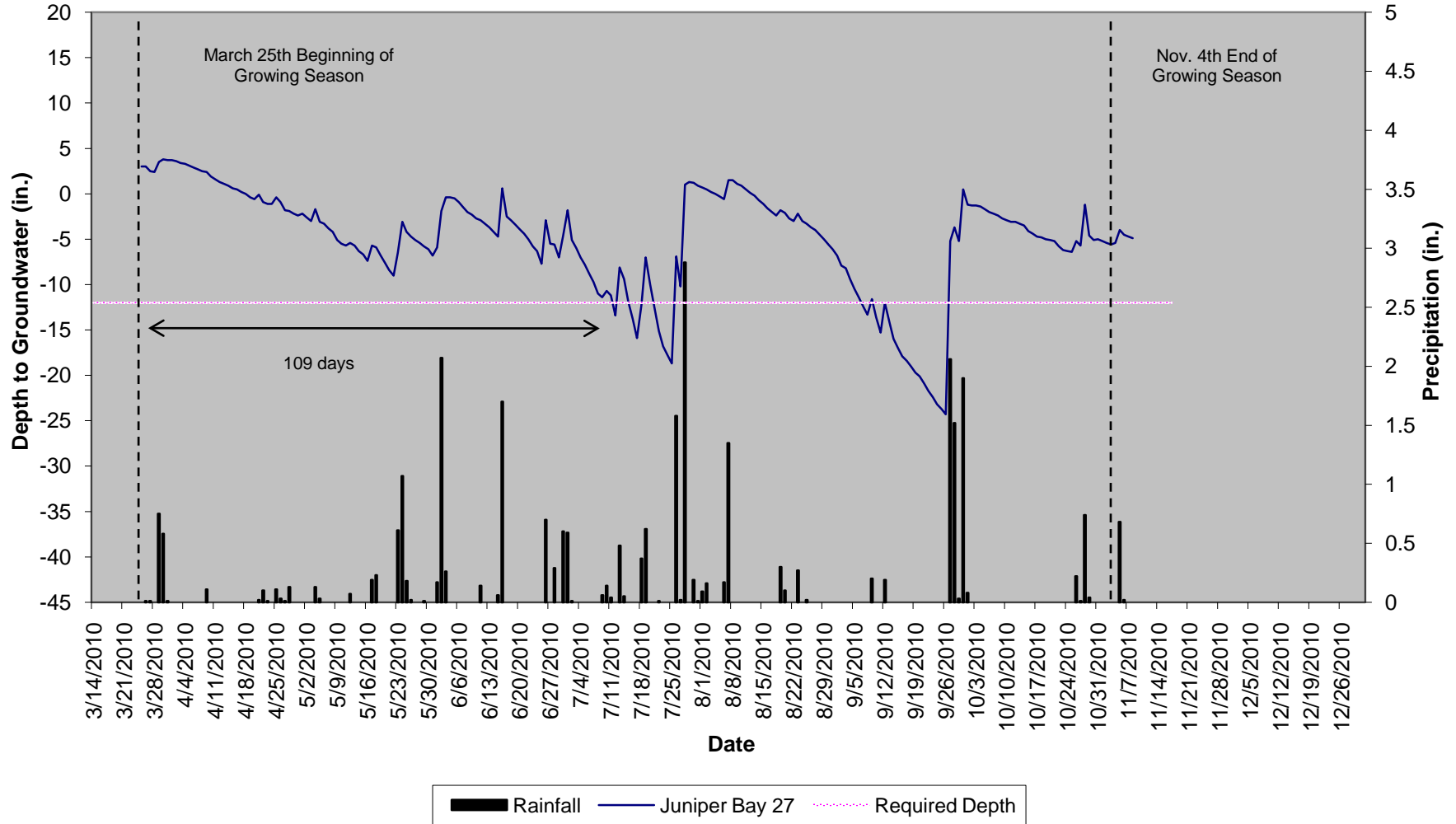
Juniper Bay 25 40" Groundwater



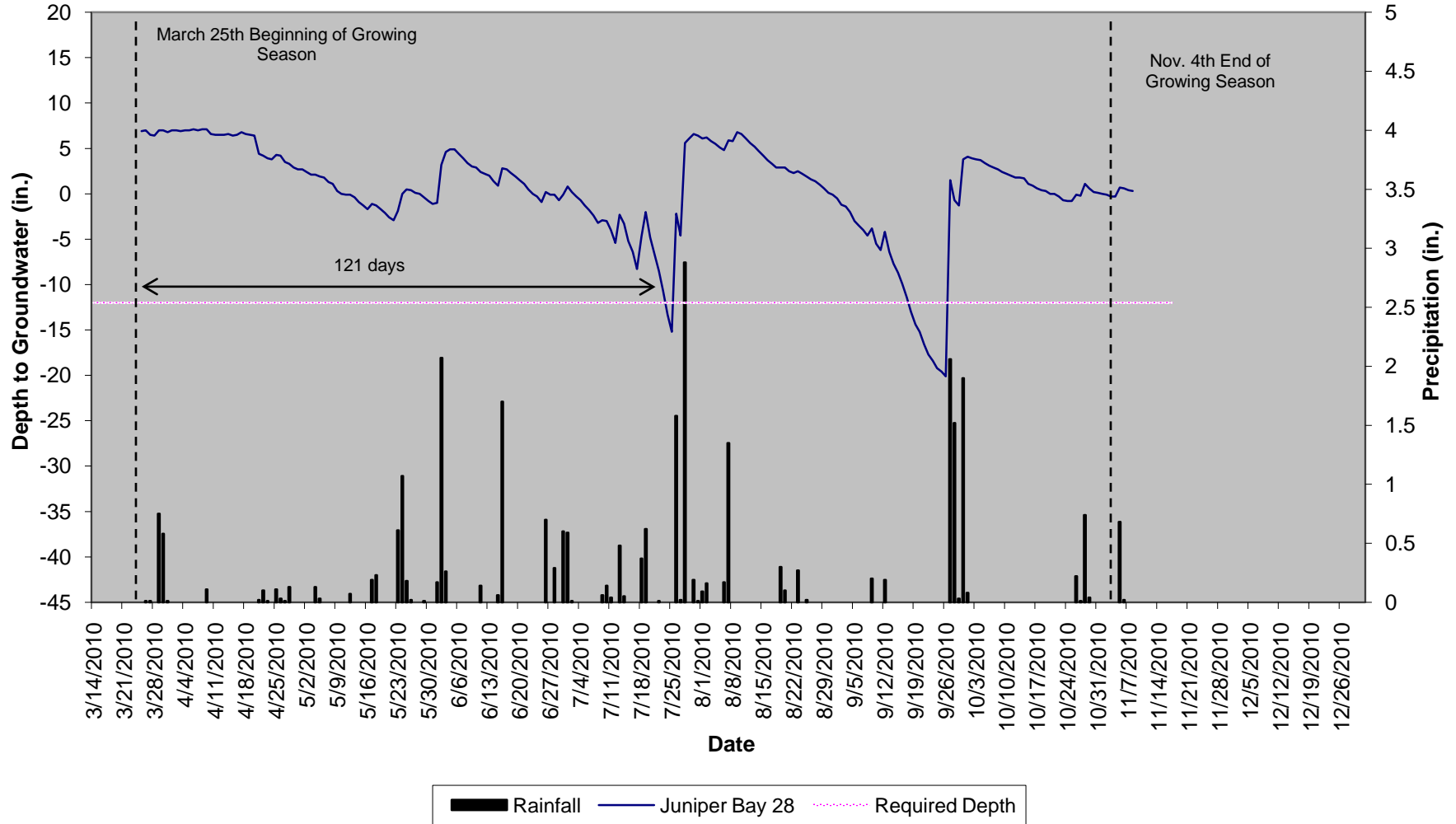
**Juniper Bay
26
40" Groundwater**



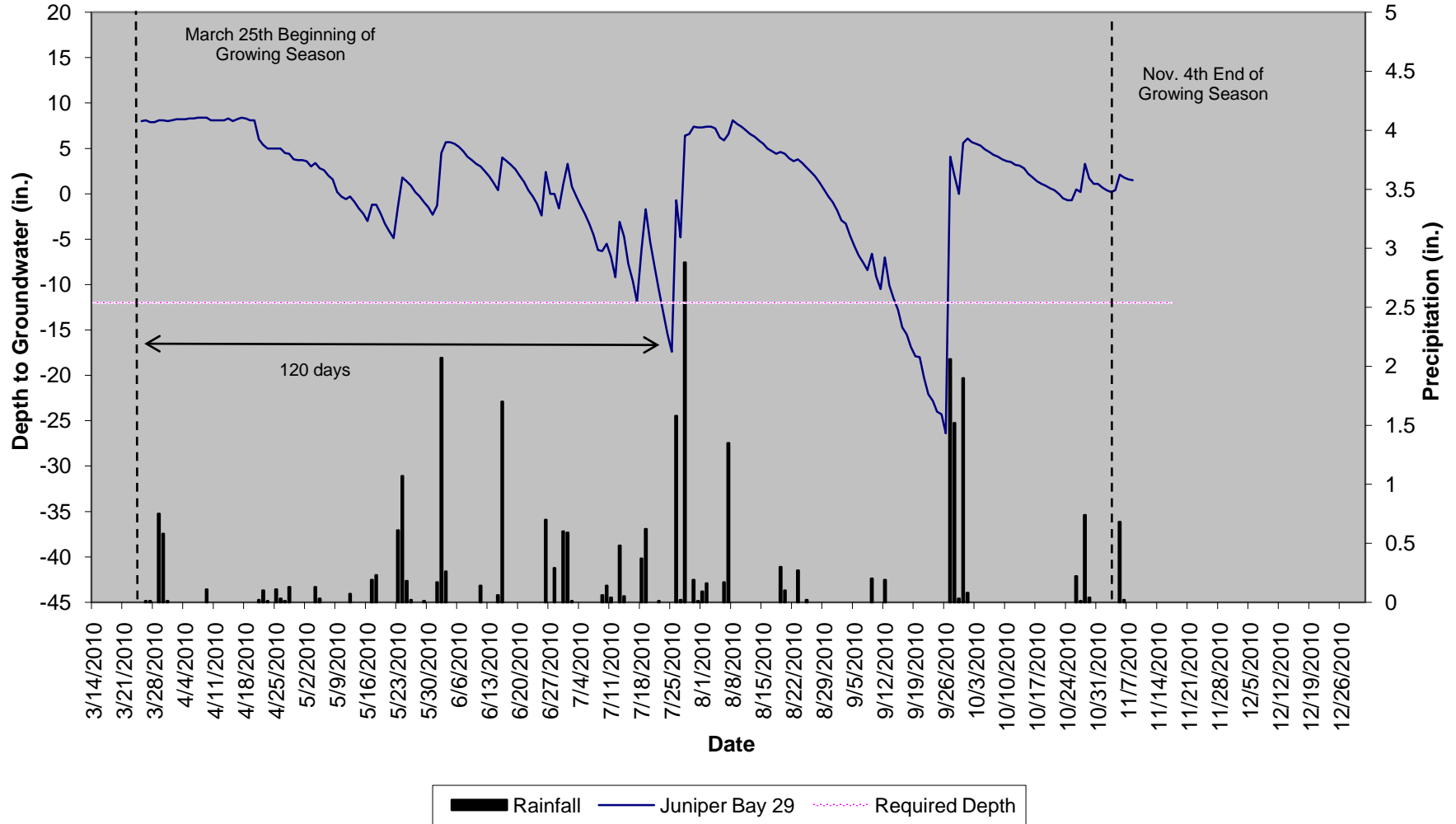
**Juniper Bay
27
40" Groundwater**



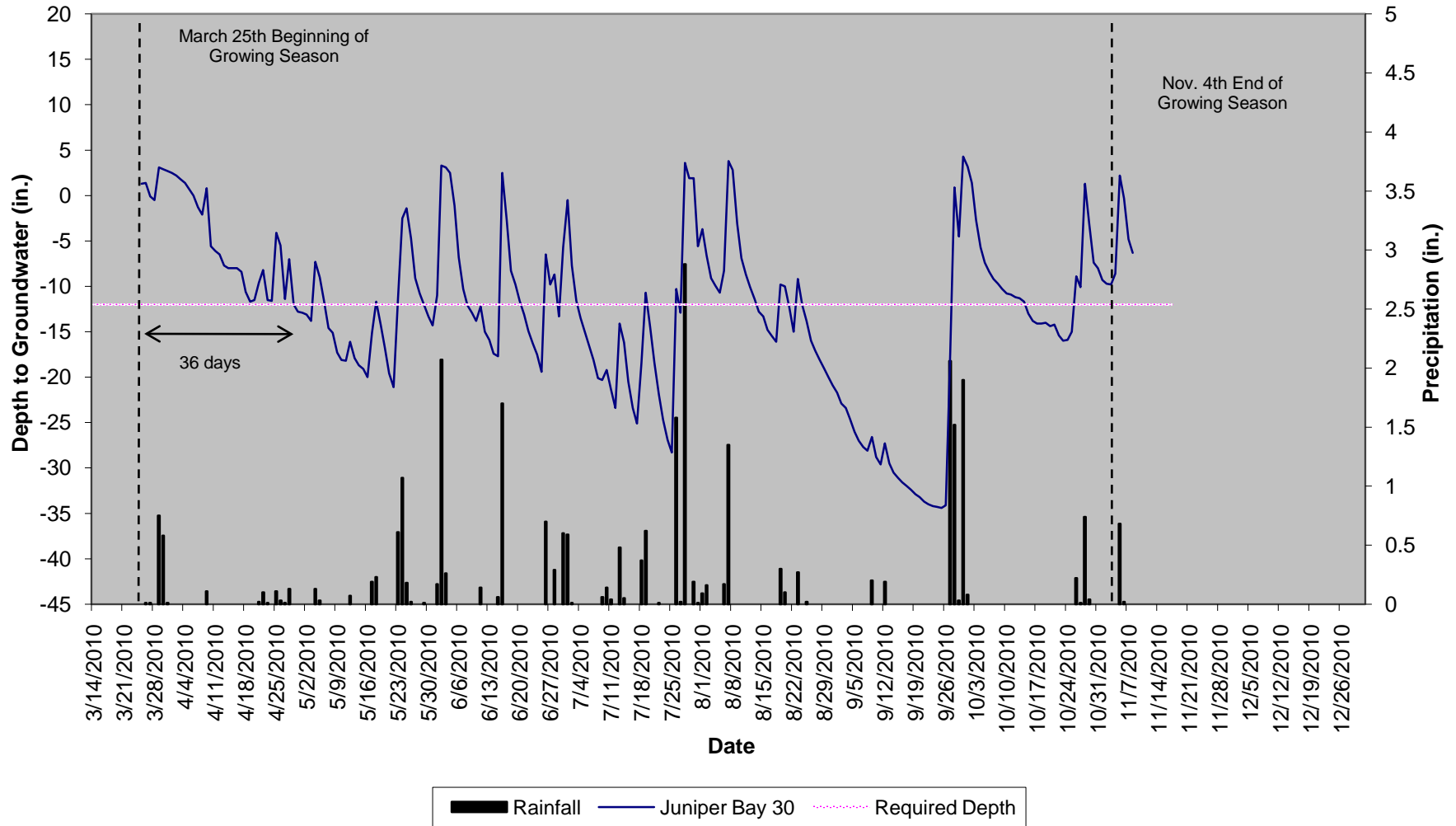
Juniper Bay 28 40" Groundwater



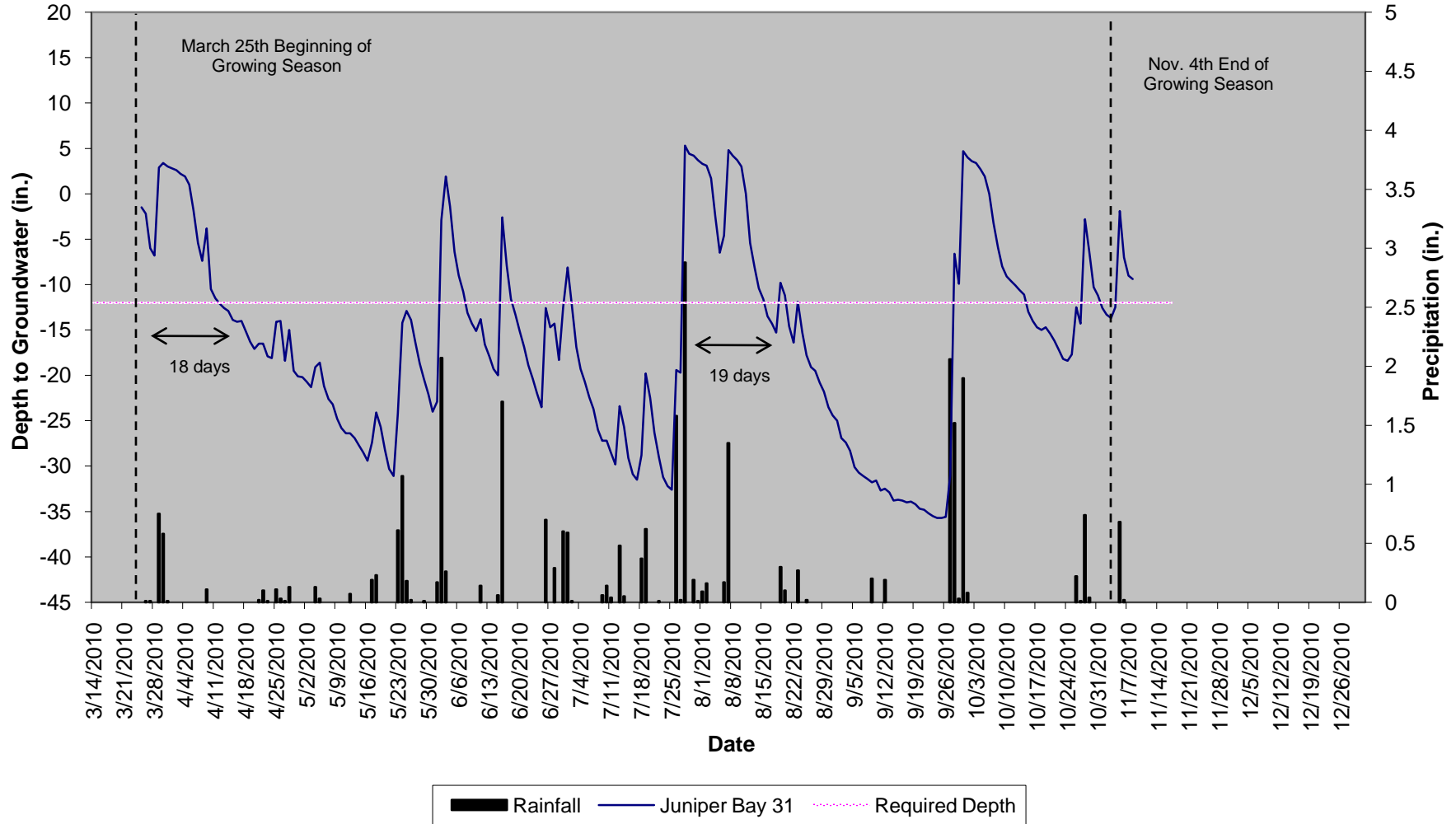
**Juniper Bay
29
40" Groundwater**



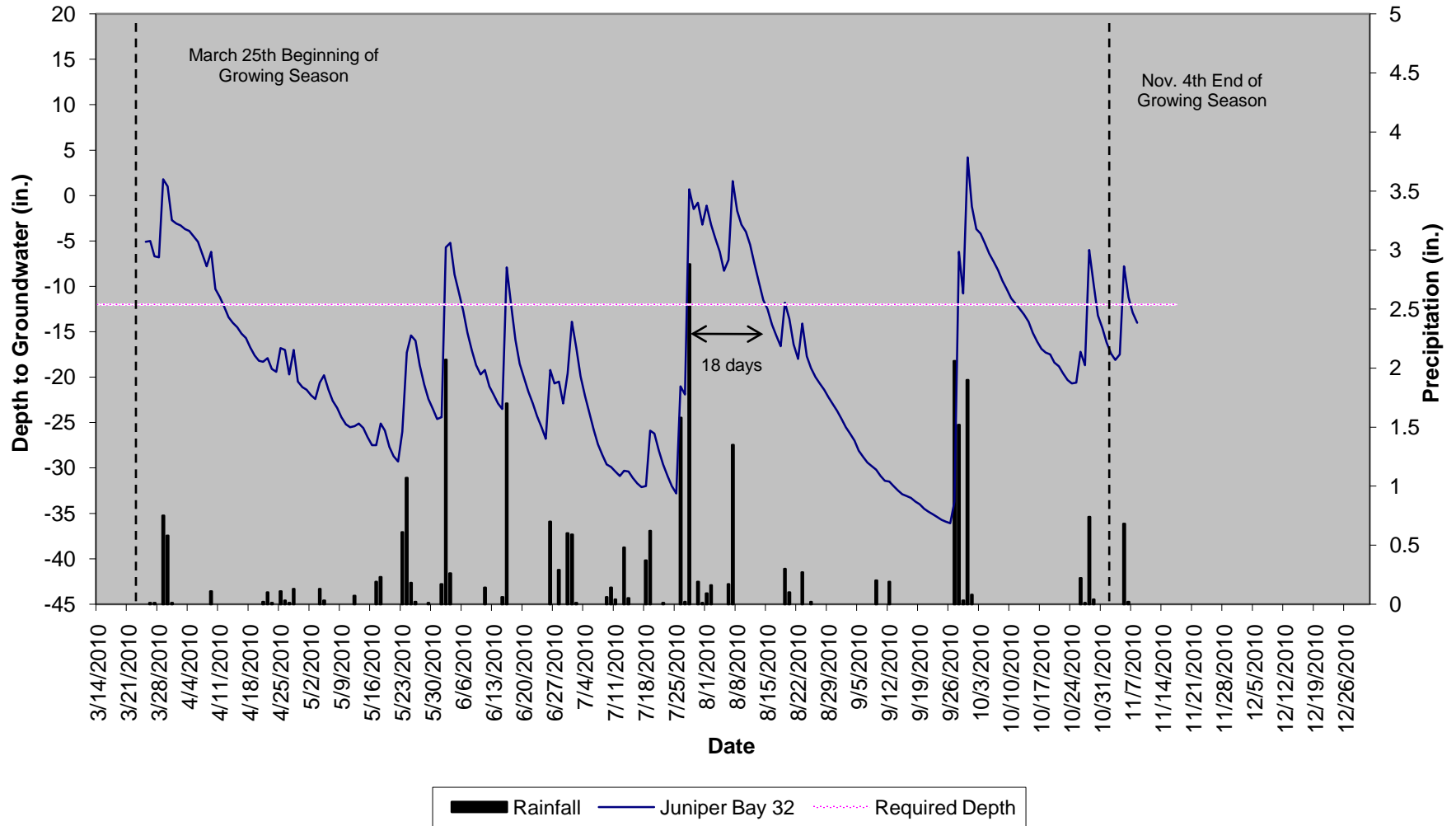
**Juniper Bay
30
40" Groundwater**



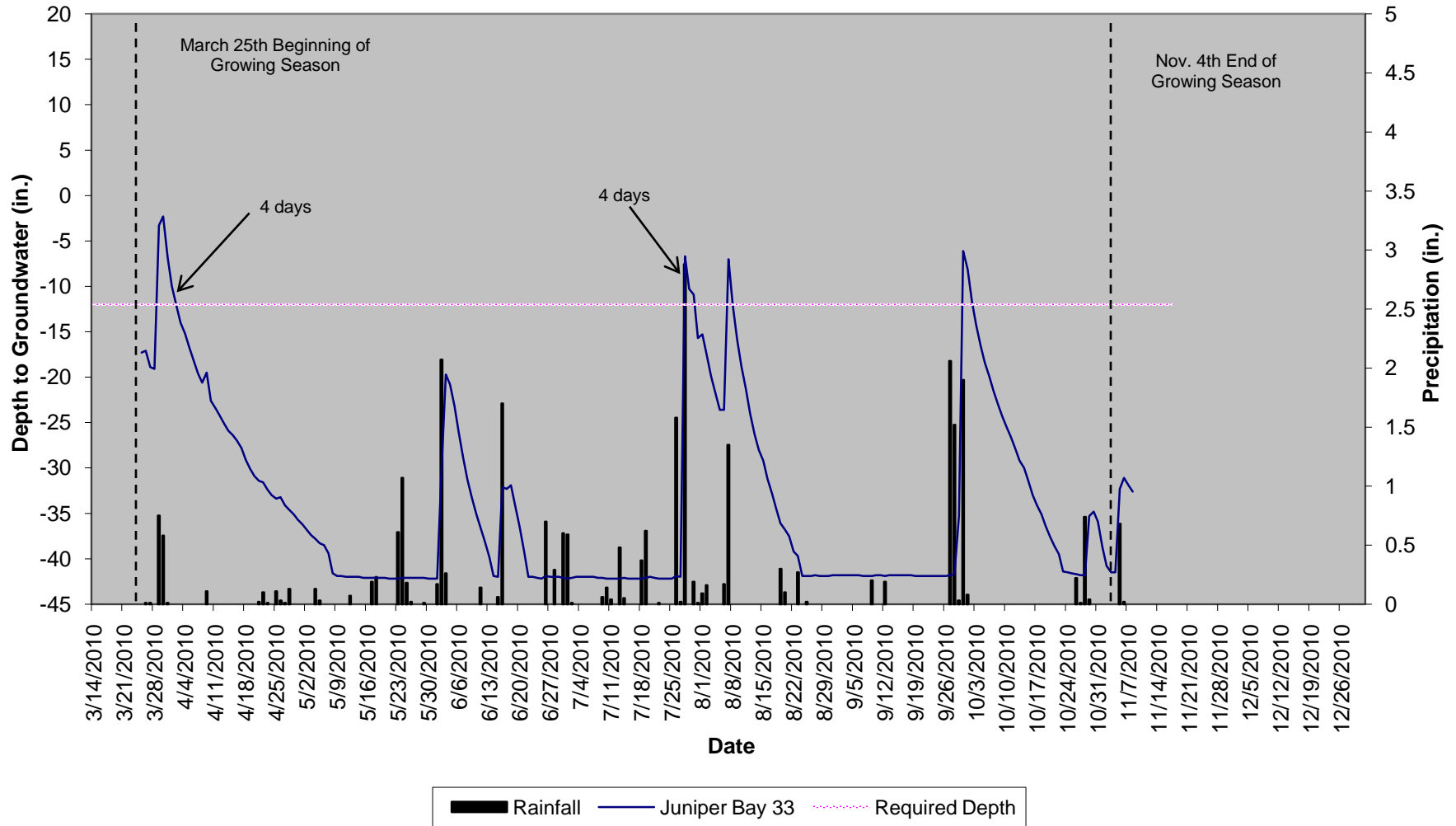
**Juniper Bay
31
40" Groundwater**



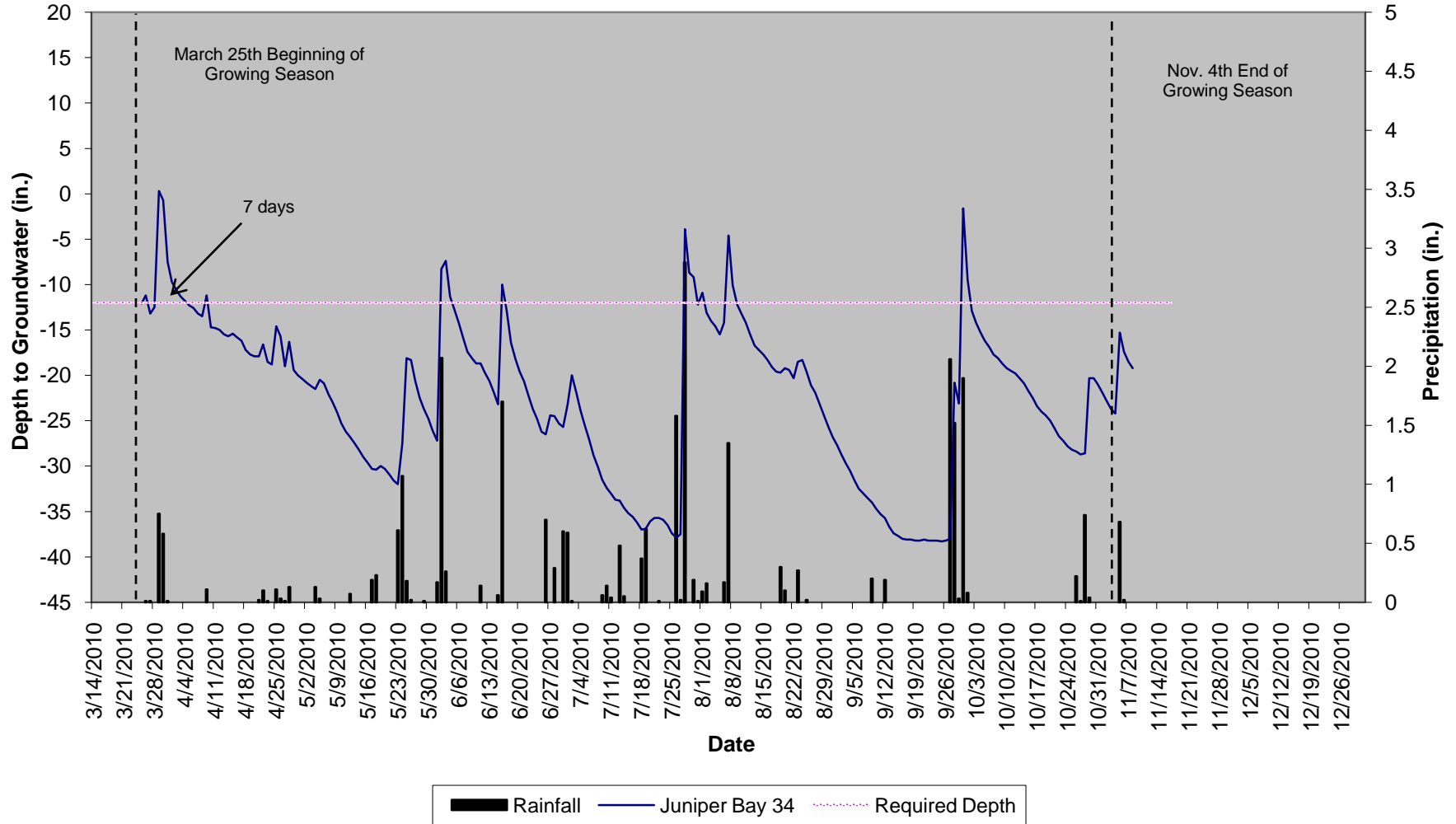
**Juniper Bay
32
40" Groundwater**



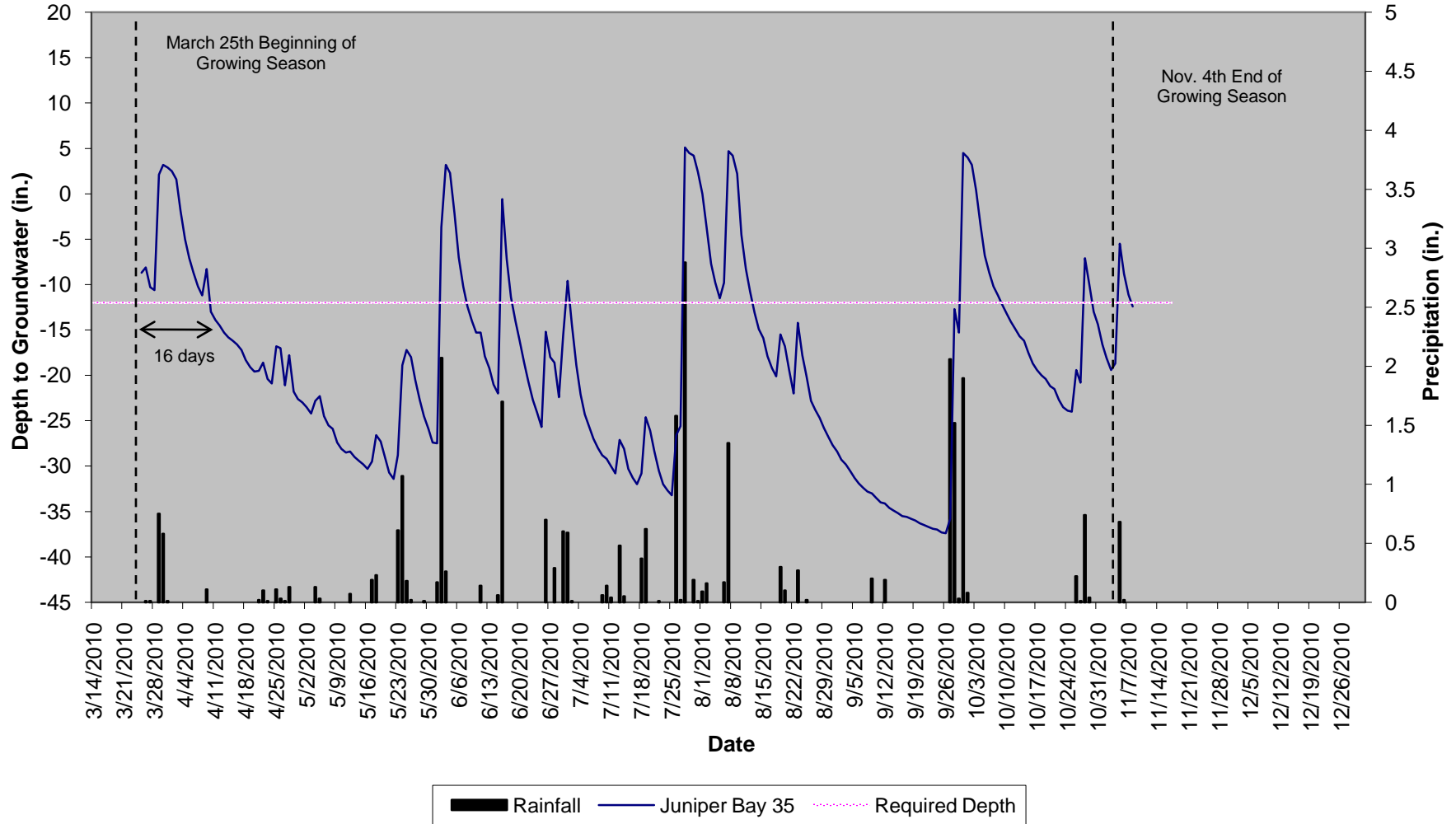
**Juniper Bay
33
40" Groundwater**



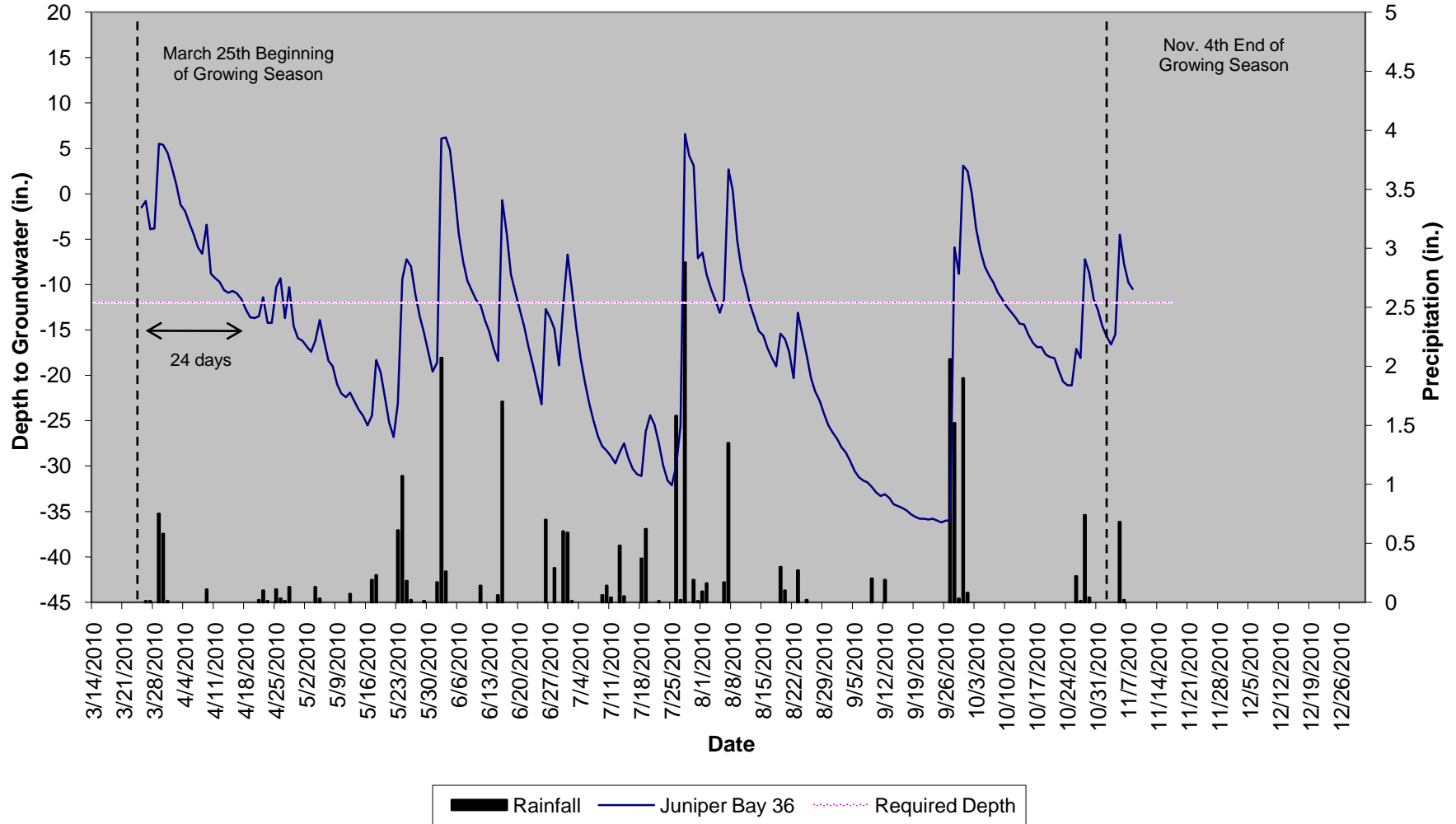
**Juniper Bay
34
40" Groundwater**



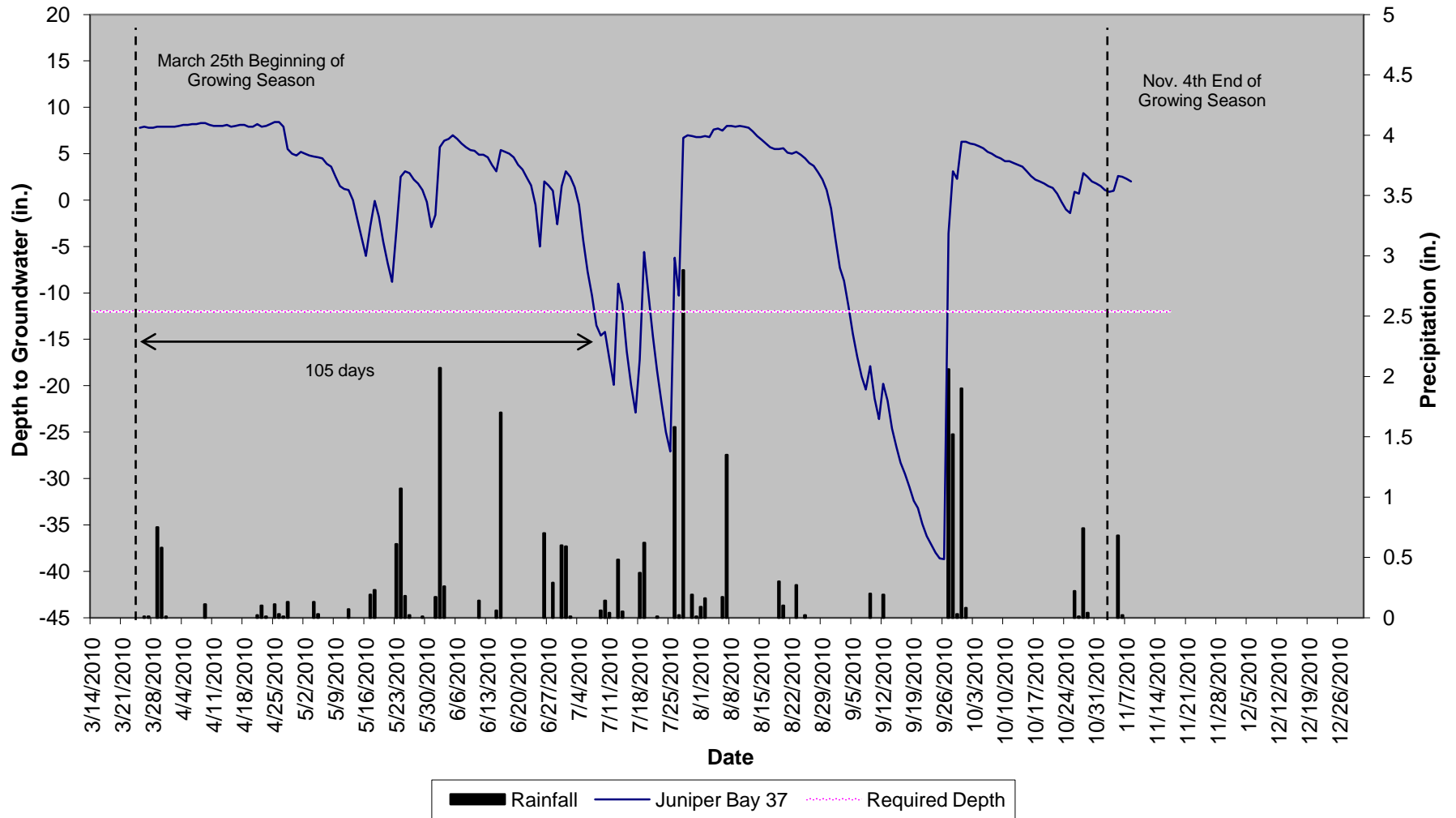
**Juniper Bay
35
40" Groundwater**



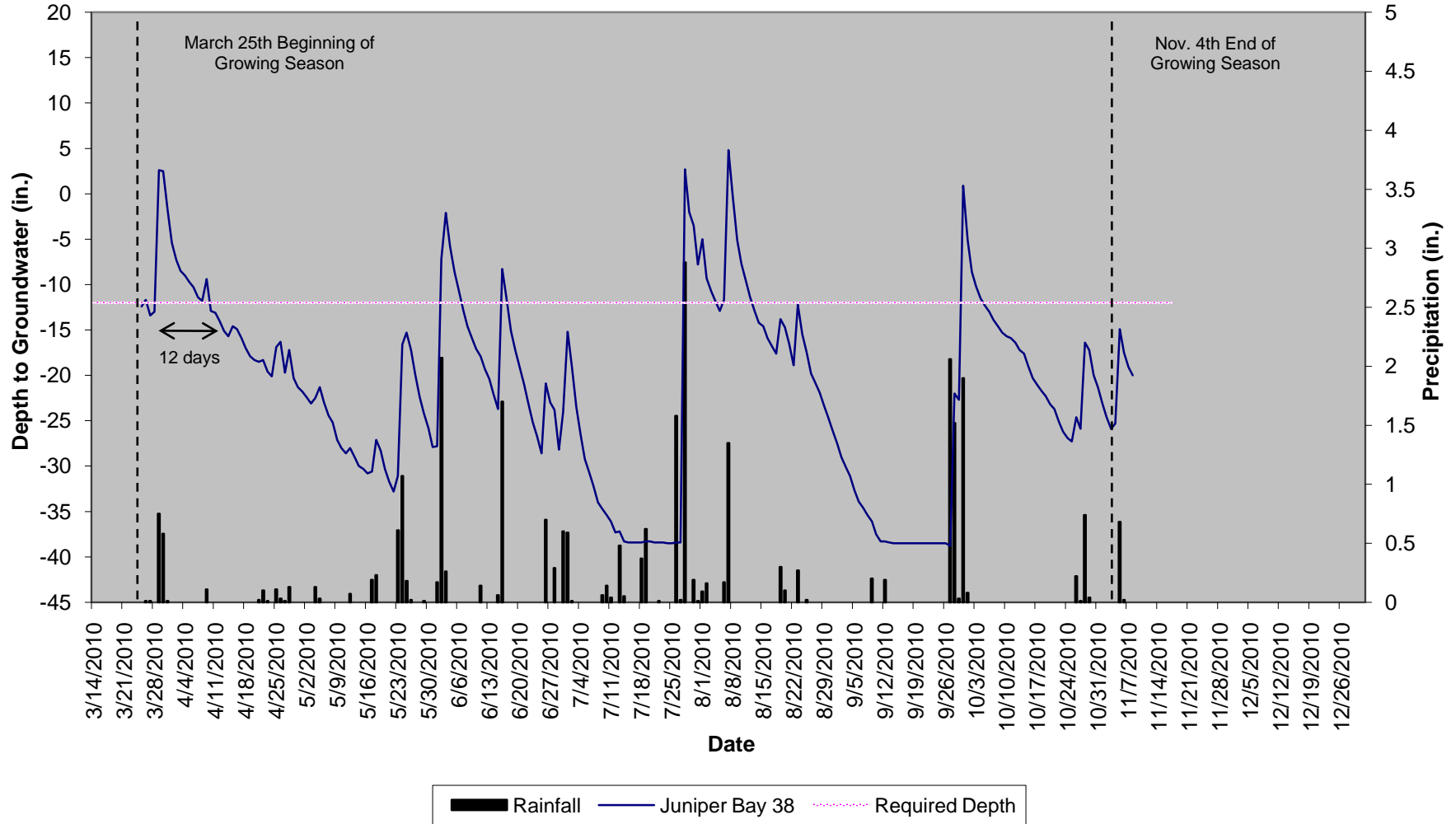
**Juniper Bay
36
40" Groundwater**



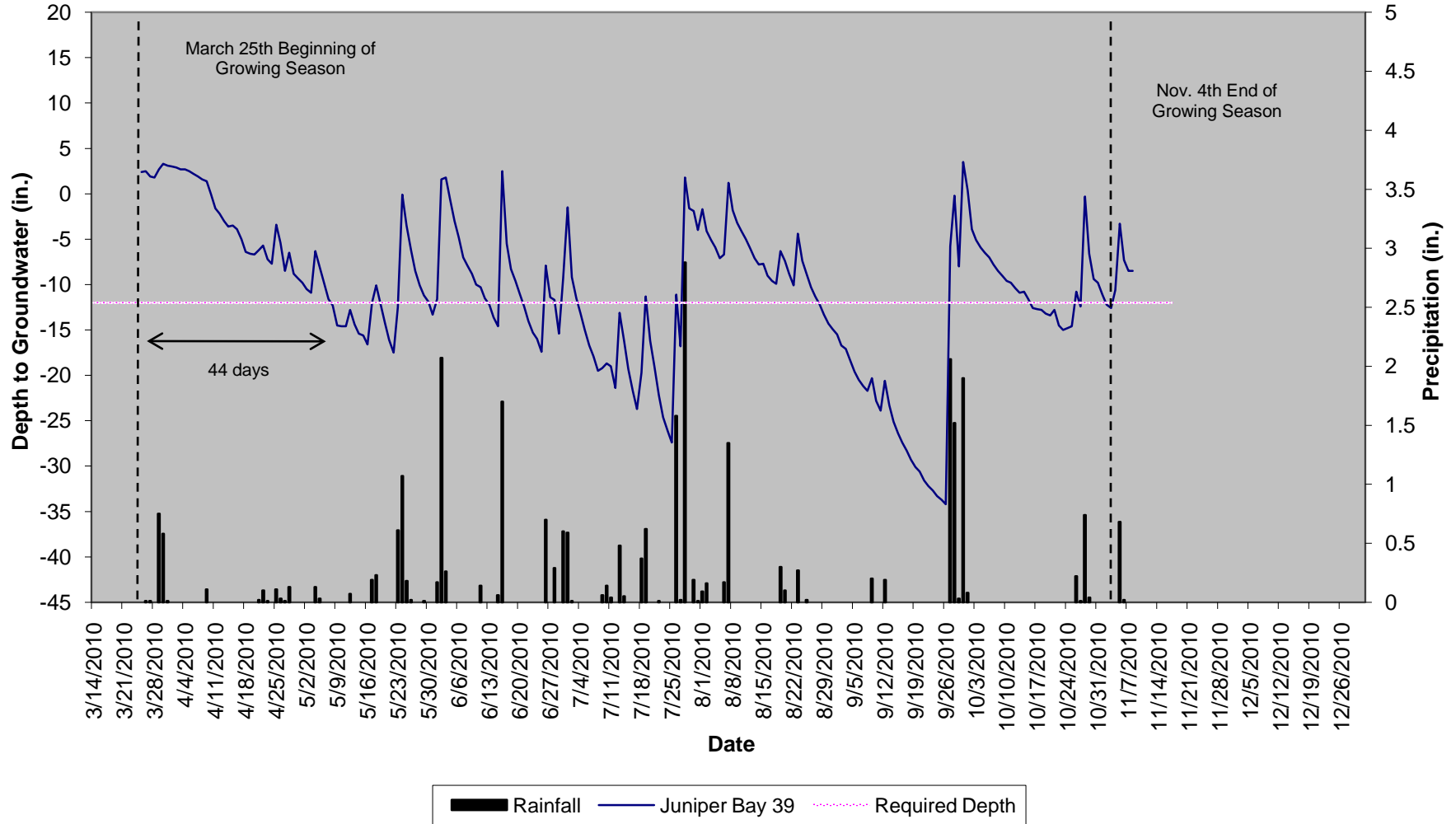
**Juniper Bay
37
40" Groundwater**



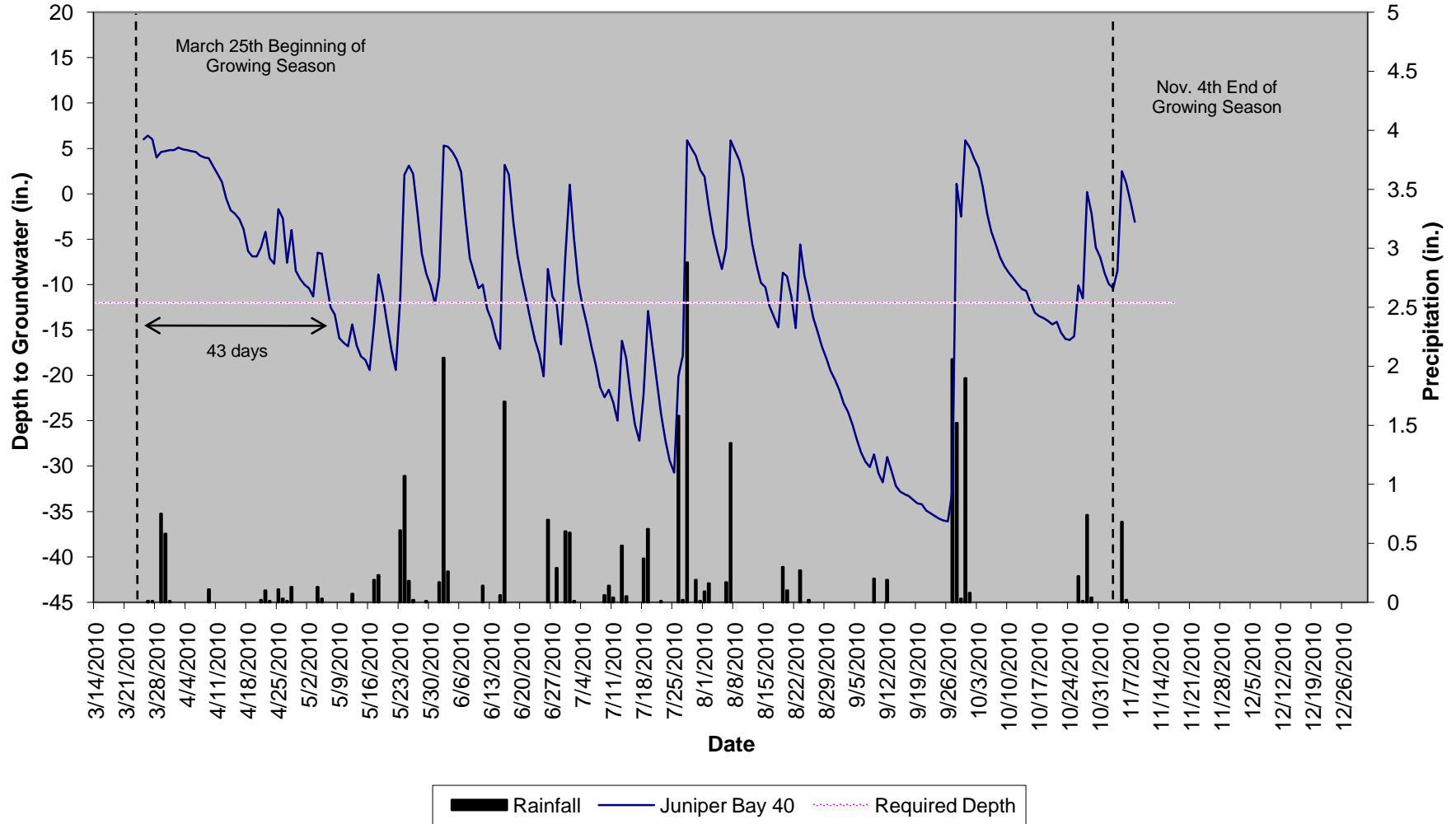
**Juniper Bay
38
40" Groundwater**



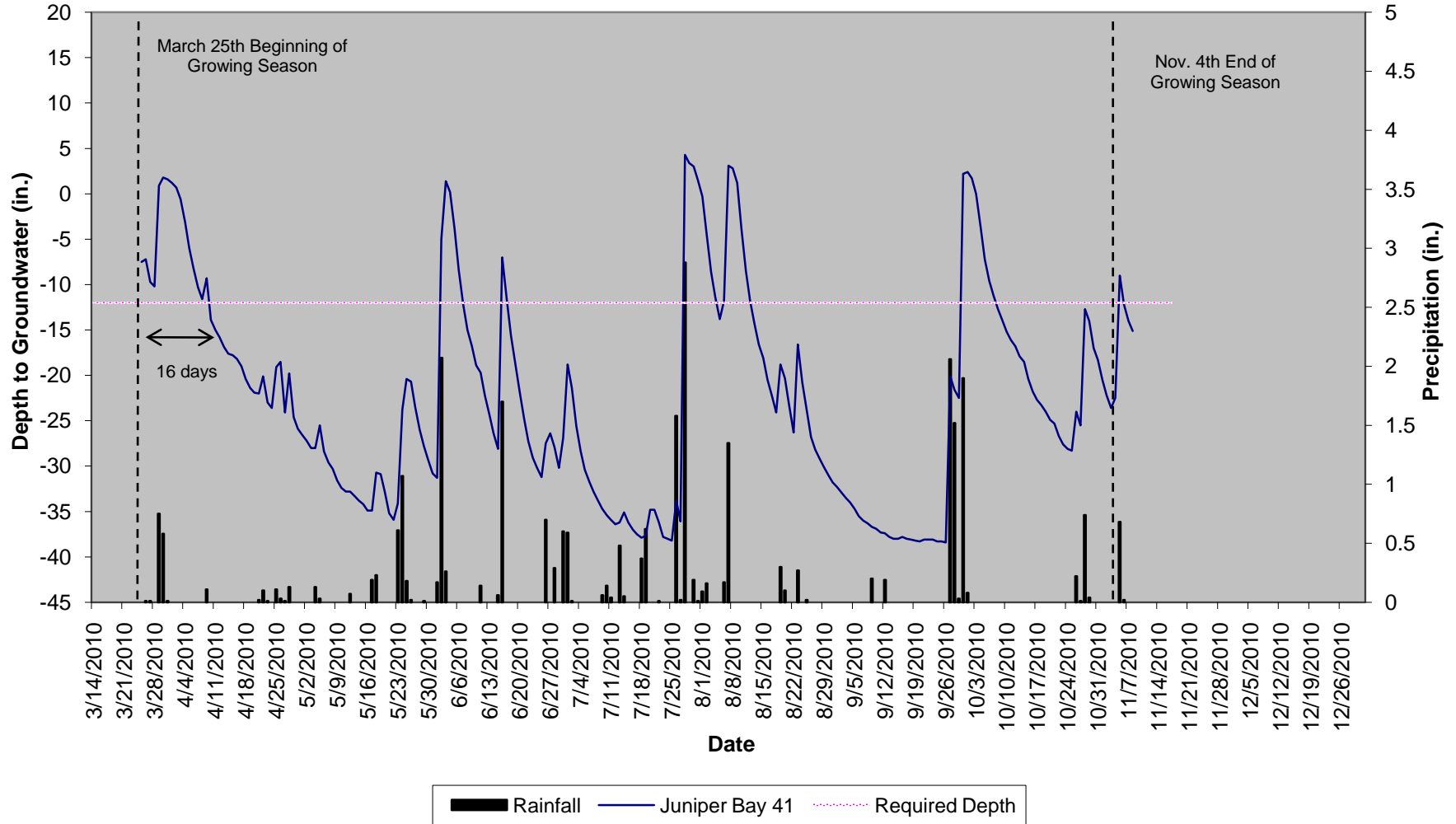
**Juniper Bay
39
40" Groundwater**



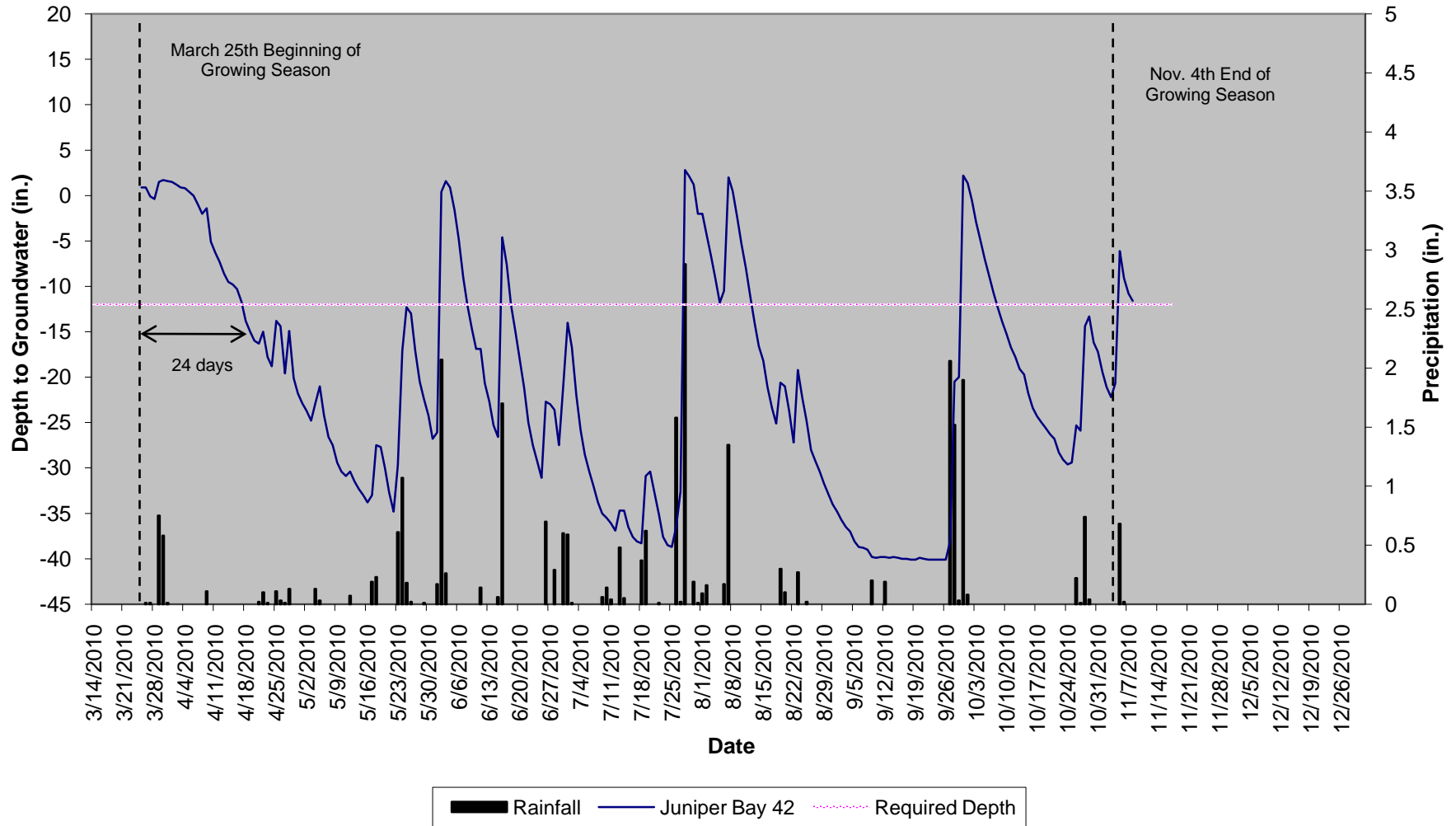
Juniper Bay 40 40" Groundwater



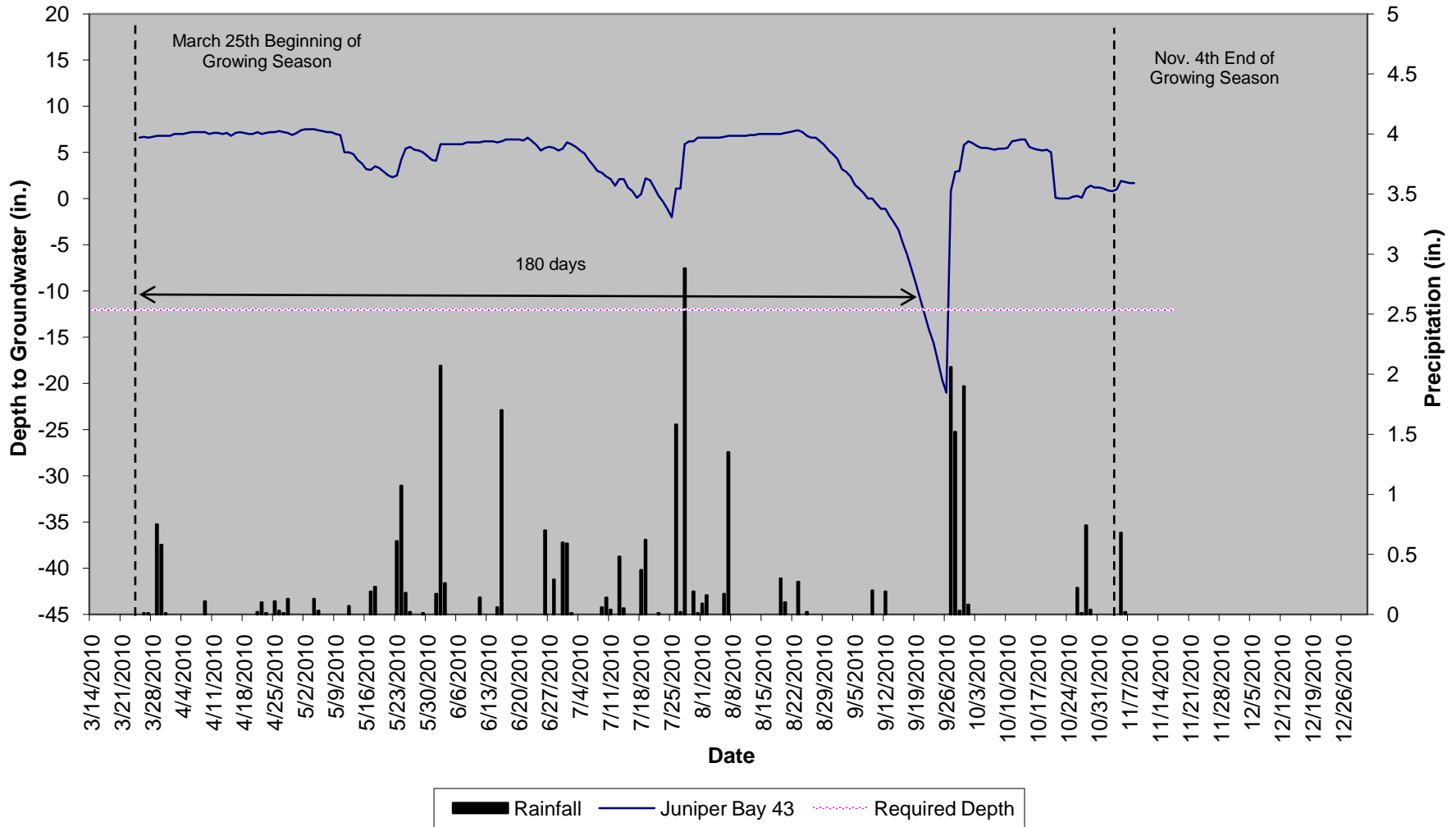
**Juniper Bay
41
40" Groundwater**



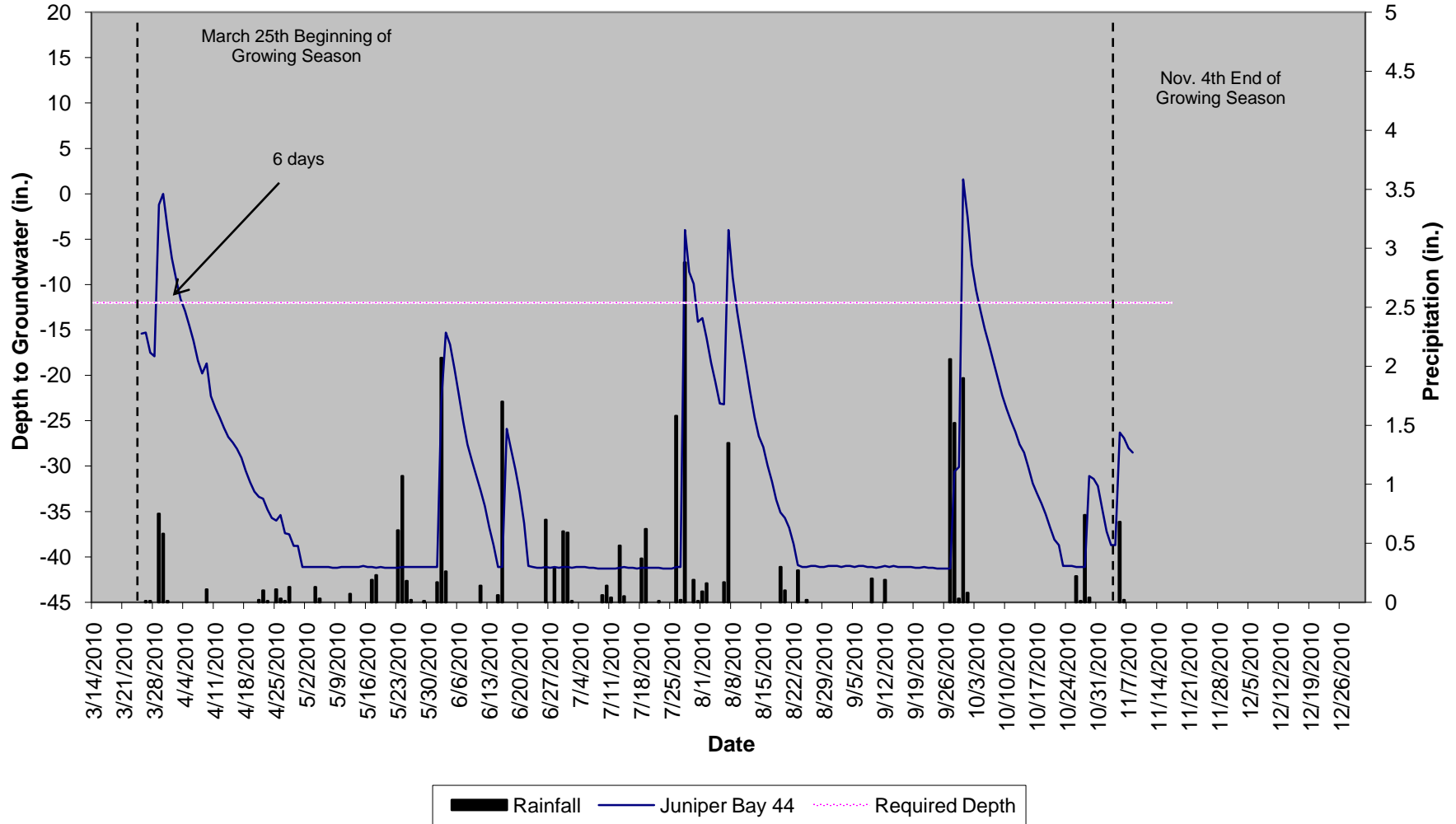
**Juniper Bay
42
40" Groundwater**



**Juniper Bay
43
40" Groundwater**



Juniper Bay 44 40" Groundwater



**Juniper Bay
45
40" Groundwater**

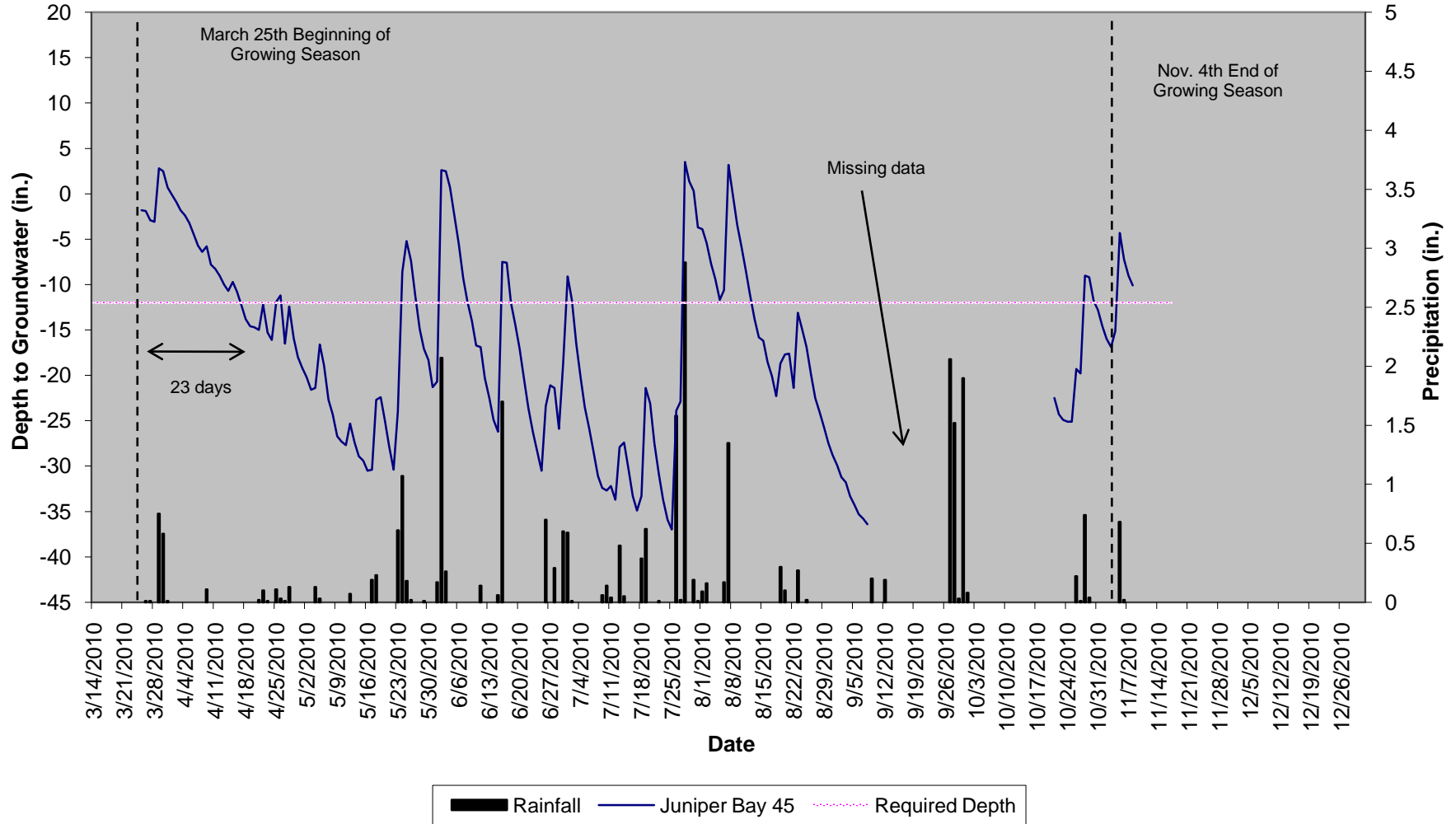


Table 9. Wetland Hydrology Criteria Attainment Summary of Groundwater Gauge Results for Year 1 through Year 5																
Gauge	Community Type ^a	Year 1 (2006)			Year 2 (2007)			Year 3 (2008)			Year 4 (2009)			Year 5 (2010)		
		Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success
GW-1 ^d	PPW/BF	<5%	2	No	>12.5%	80 ^b	Yes	5-12.5%	19	No	>12.5%	29	Yes	5-12.5%	21	No
GW-2	PPW/BF	>12.5%	71	Yes	>12.5%	97	Yes	>12.5%	71	Yes	>12.5%	59	Yes	>12.5%	43	Yes
GW-3	PPW/BF	>12.5%	116	Yes	>12.5%	117	Yes	>12.5%	72(79) ^c	Yes	>12.5%	139	Yes	>12.5%	109	Yes
GW-4 ^d	PPW/BF	5-12.5%	18	No	5-12.5%	20	No	>12.5%	39	Yes	>12.5%	29	Yes	5-12.5%	17	No
GW-5	PPW/BF	>12.5%	112 ^b	Yes	>12.5%	97	Yes	>12.5%	72	Yes	>12.5%	56	Yes	>12.5%	36	Yes
GW-6	PAWCF/BF	>12.5%	225	Yes	>12.5%	117	Yes	>12.5%	84	Yes	>12.5%	169	Yes	>12.5%	120	Yes
GW-7	PAWCF/BF	>12.5%	225	Yes	>12.5%	119	Yes	>12.5%	87	Yes	>12.5%	173	Yes	>12.5%	178	Yes
GW-8	PAWCF/BF	>12.5%	225	Yes	>12.5%	118	Yes	>12.5%	82	Yes	>12.5%	168	Yes	>12.5%	114	Yes
GW-9	PAWCF/BF	>12.5%	225	Yes	>12.5%	117	Yes	>12.5%	82	Yes	>12.5%	169	Yes	>12.5%	57	Yes
GW-10	PPW/BF	<5%	10	No	>12.5%	58	Yes	5-12.5%	19	No	5-12.5%	27	No	5-12.5%	16	No
GW-11 ^d	PPW/BF	<5%	1	No	<5%	1	No	<5%	4	No	<5%	2	No	<5%	0	No
GW-12 ^d	PPW/BF	<5%	1	No	>12.5%	68	Yes	>12.5%	16(30) ^c	Yes	5-12.5%	26	No	5-12.5%	18	No
GW-13	PAWCF/BF	>12.5%	196	Yes	>12.5%	133	Yes	>12.5%	118	Yes	>12.5%	173	Yes	>12.5%	98	Yes
GW-14	PAWCF/BF	>12.5%	156 (225) ^c	Yes	>12.5%	130	Yes	>12.5%	115	Yes	>12.5%	175	Yes	>12.5%	184	Yes
GW-15	PAWCF/BF	N/A	Not Installed	N/A	N/A	Not Installed	N/A	N/A	Not Installed	N/A	N/A	Not Installed	N/A	N/A	Not Installed	N/A
GW-16	PAWCF/BF	>12.5%	225	Yes	>12.5%	121	Yes	>12.5%	82	Yes	>12.5%	168	Yes	>12.5%	98	Yes
GW-17	PPW/BF	>12.5%	83	Yes	>12.5%	62	Yes	>12.5%	72	Yes	>12.5%	55	Yes	5-12.5%	25	No
GW-18 ^d	PPW/BF	>12.5%	64	Yes	>12.5%	48	Yes	>12.5%	62	Yes	>12.5%	56	Yes	5-12.5%	24	No
GW-19	PPW/BF	>12.5%	81	Yes	>12.5%	43	Yes	>12.5%	64	Yes	>12.5%	56	Yes	5-12.5%	23	No
GW-20	PPW/BF	>12.5%	79	Yes	>12.5%	68 ^b	Yes	>12.5%	62	Yes	>12.5%	52	Yes	5-12.5%	23	No
GW-21	PPW/BF	>12.5%	83	Yes	>12.5%	116	Yes	>12.5%	73	Yes	>12.5%	56	Yes	>12.5%	45	Yes
GW-22	PAWCF/BF	N/A	Not Installed	N/A	N/A	Not Installed	N/A	N/A	Not Installed	N/A	N/A	Not Installed	N/A	N/A	Not Installed	N/A

Table 9. Wetland Hydrology Criteria Attainment Continues.

Gauge	Community Type ^a	Year 1 (2006)			Year 2 (2007)			Year 3 (2008)			Year 4 (2009)			Year 5 (2010)		
		Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success	Growing Season %	Days <12"	Hydrologic Success
GW-23	PAWCF/BF	>12.5%	225	Yes	>12.5%	208	Yes	>12.5%	115	Yes	>12.5%	174	Yes	>12.5%	98 (182) ^c	Yes
GW-24	PAWCF/BF	>12.5%	105	Yes	>12.5%	130	Yes	>12.5%	114	Yes	>12.5%	156	Yes	>12.5%	175 (225) ^c	Yes
GW-25 ^d	PPW/BF	<5%	4	No	>12.5%	88	Yes	>12.5%	63	Yes	>12.5%	29	Yes	5-12.5%	20	No
GW-26 ^d	PPW/BF	<5%	10	No	>12.5%	80	Yes	>12.5%	64	Yes	5-12.5%	27	No	5-12.5%	14	No
GW-27	PAWCF/BF	>12.5%	88	Yes	>12.5%	113	Yes	>12.5%	84	Yes	>12.5%	124	Yes	>12.5%	109	Yes
GW-28	PAWCF/BF	>12.5%	119	Yes	>12.5%	122	Yes	>12.5%	100	Yes	>12.5%	158	Yes	>12.5%	121	Yes
GW-29	PAWCF/BF	>12.5%	225	Yes	>12.5%	118	Yes	>12.5%	82	Yes	>12.5%	169	Yes	>12.5%	120	Yes
GW-30	PPW/BF	>12.5%	77	Yes	>12.5%	111	Yes	>12.5%	62	Yes	>12.5%	49	Yes	>12.5%	36	Yes
GW-31	PPW/BF	>12.5%	49	Yes	>12.5%	57	Yes	>12.5%	62	Yes	>12.5%	52	Yes	5-12.5%	19	No
GW-32 ^d	PPW/BF	>12.5%	50	Yes	5-12.5%	19	No	>12.5%	40	Yes	>12.5%	53	Yes	5-12.5%	18	No
GW-33 ^d	PPW/BF	<5%	10	No	5-12.5%	12	No	5-12.5%	17	No	5-12.5%	12	No	<5%	4	No
GW-34	PPW/BF	<5%	9	No	>12.5%	58	Yes	<5%	9	No	5-12.5%	16	No	<5%	7	No
GW-35	PPW/BF	>12.5%	36	Yes	>12.5%	38	Yes	>12.5%	32	Yes	>12.5%	41	Yes	5-12.5%	16	No
GW-36	PPW/BF	5-12.5%	22	No	>12.5%	62	Yes	>12.5%	61	Yes	>12.5%	49	Yes	5-12.5%	24	No
GW-37	PPW/BF	>12.5%	88	Yes	>12.5%	117	Yes	>12.5%	78	Yes	>12.5%	85 (124) ^c	Yes	>12.5%	105	Yes
GW-38 ^d	PPW/BF	>12.5%	35	Yes	>12.5%	89	Yes	>12.5%	62	Yes	5-12.5%	27	No	5-12.5%	12	No
GW-39 ^d	PPW/BF	5-12.5%	22	No	>12.5%	109	Yes	>12.5%	72	Yes	>12.5%	50	Yes	>12.5%	44	Yes
GW-40	PPW/BF	>12.5%	35	Yes	>12.5%	103	Yes	>12.5%	74	Yes	>12.5%	53	Yes	>12.5%	43	Yes
GW-41	PPW/BF	>12.5%	44	Yes	5-12.5%	19	No	>12.5%	32	Yes	>12.5%	42 ^b	Yes	5-12.5%	16	No
GW-42	PPW/BF	5-12.5%	20	No	>12.5%	66	Yes	>12.5%	31	Yes	>12.5%	45	Yes	5-12.5%	24	No
GW-43	PAWCF/BF	>12.5%	116	Yes	>12.5%	60 (129) ^c	Yes	>12.5%	118	Yes	>12.5%	183	Yes	>12.5%	180	Yes
GW-44 ^d	PPW/BF	<5%	10	No	5-12.5%	17	No	5-12.5%	18	No	5-12.5%	12	No	<5%	6	No
GW-45 ^d	PPW/BF	5-12.5%	20	No	>12.5%	62	Yes	>12.5%	32	Yes	>12.5%	41	Yes	5-12.5%	23 ^b	No

^a Community Types: PPW/BF-Pine Pond Woodland/Bay Forest, PAWCF/BF- Peatland Atlantic White Cedar Forest/Bay Forest.

^b Missing data: data does not affect longest hydroperiod.

^c Missing data: status shown in parenthesis was extrapolated from comparable gauges.

^d Gauges originally not expected to meet the jurisdictional hydrologic success criterion due to proximity to perimeter ditch