

**Roquist Wetland
Restoration Monitoring Report
EEP Project # 312
Monitoring Year – 03**



Submitted to:



NCDENR-EEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

Construction Completed: 2008

Data Collection: 2010

Submitted: December 2010

Monitoring Firm



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KCI Project No: 12071067C_RO10**

Design Firm



**HSMM of North Carolina, Inc.
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Cary, NC 27518**

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The North Carolina Ecosystem Enhancement Program (EEP) restored and preserved wetlands and preserved streams at the Roquist Wetland Site in Bertie County, North Carolina. The 3,926 acre site is located within the USGS 8-digit HUC 03010107 of the Roanoke River Basin. The project restored 45.2 acres of wetland and preserved an additional 3,776 acres of wetland and 3,660 linear feet of stream channel. Project construction was completed in 2008. The project objectives are listed below.

Project Objectives

- Restoration of 45.2 acres of previously ditched and filled non-riparian wetlands.
- Preservation of 3,366 acres of non-riparian wetlands.
- Preservation of 390 acres of high quality non-riparian wetlands.
- Preservation of 20 acres of riparian wetlands.
- Preservation of 3,660 linear feet of stream channel.

The restored wetlands were planted with fifteen different species of bare root trees and shrubs. Baseline vegetation monitoring was delayed until the end of the first growing season. Ten vegetation monitoring plots were established during the first monitoring year, following the CVS-EEP protocol. Because of this, the data reported in the *Roquist Wetland Restoration Site Phase I Mitigation Report* is first-year monitoring data and not baseline data as would typically be found in the baseline report. The third year of monitoring found a site average of 113 planted stems/acre. Nine plots had less than 320 planted stems/acre, which is the third year monitoring success criterion, and eight of the plots had planted stem densities less than the five year success criterion of 260 stems/acre. The site's average stem density including volunteers is 550 stems/acre, with seven of the ten vegetation plots having densities less than 260 stems/acre. There are plans to supplementally plant the site with additional trees before the 2011 growing season. The first year of monitoring also reported that wild hogs significantly damaged the planted vegetation, resulting in increased mortality.

To monitor wetland hydrology, 12 gauges were established. Seven of these gauges (2, 3b, 5, 9, 11b, 14, and 15) were installed in restored wetlands. The remaining five gauges (1, 4, 6, 13, and 12) are reference gauges that were installed in existing wetlands, and are paired with a gauge in an adjacent restoration area. Two of the restoration gauges (14 and 15) are not paired with reference gauges. During the third growing season, all of the restoration gauges met the success criteria of having saturated soil conditions occurring within 12 inches of the ground surface for a minimum of 12.5% (29 consecutive days) of the 231-day growing season (March 22 to November 8) during average climatic conditions, or having the hydroperiod in the restoration areas be within 20% of the corresponding reference hydroperiod during drought conditions. The daily rainfall data obtained from a local weather station shows that the area had average rainfall during the 2010 growing season.

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 Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on the EEP's website. All raw data supporting the tables and figures in the appendices are available from EEP upon request.

2.0 METHODOLOGY

Level 2 of the CVS-EEP protocol (<http://cvs.bio.unc.edu/methods.htm>) was used to collect vegetation data from the Roquist Site this year, the third year of monitoring.

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>)

Weakley, A. S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas. (http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf)

Appendix A

Project Vicinity Map and Background Tables

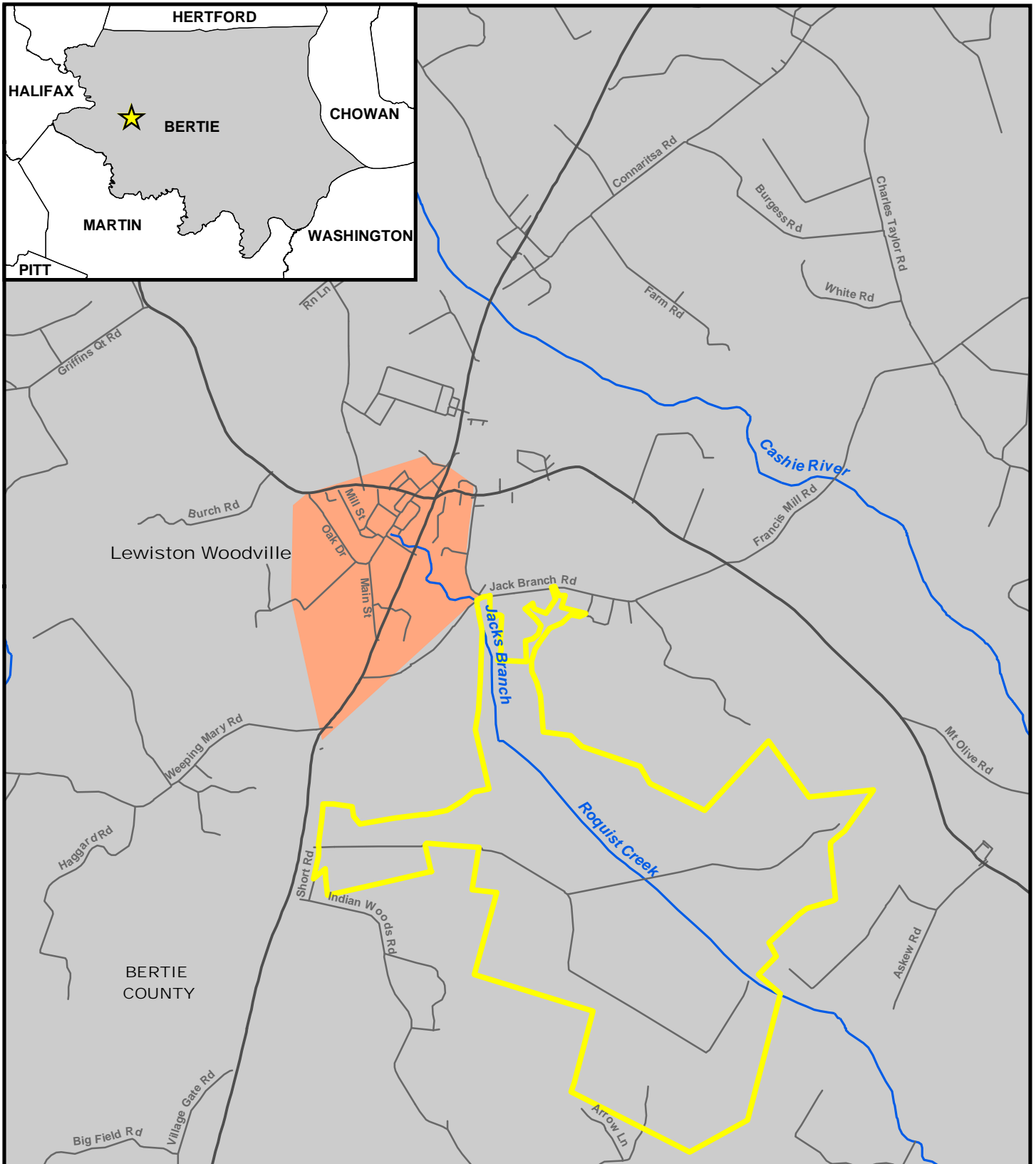


Figure 1. Vicinity Map


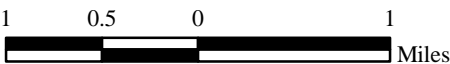

	<ul style="list-style-type: none"> — Project Property Boundary Major Roads Other Roads — Major Rivers Cities and Towns <div style="text-align: center; margin-top: 10px;">   </div>	
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Table 1a. Project Restoration Components						
Project Number and Name: 312 - Roquist Wetland						
Project Component	Existing Linear Feet / Acreage	Restoration Level	Linear Feet / Acreage	Mitigation Ratio	Mitigation Units	Comment
Non-Riparian Restored Wetlands	0.0	R	45.2	1:1	45.2	Restored wetland hydrology and planted native trees and shrubs.
Riparian Preserved Wetlands	20.0	P	20.0	5:1	4	In conservation easement
Non-Riparian Preserved Wetlands	3,366.0	P	3,366.0	5:1	673.2	In conservation easement
Non-Riparian Preserved High Quality Wetlands	390.0	P	390.0	5:1	78	In conservation easement
Jack's Branch Stream	3,660	P	3,660	5:1	732	In conservation easement

R - Restoration P - Preservation

Table 1b. Component Summations							
Project Number and Name: 312 - Roquist Wetland							
Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration				45.2			
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation	3,660		20	3,366			
HQ Preservation				390			
		0	20				
Totals (Feet/Acres)	3,660	20		3,801	0	0	
MU Totals	732	4		796.4	0	0	

 Non-Applicable

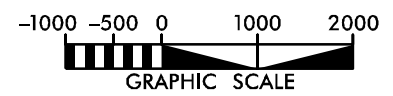
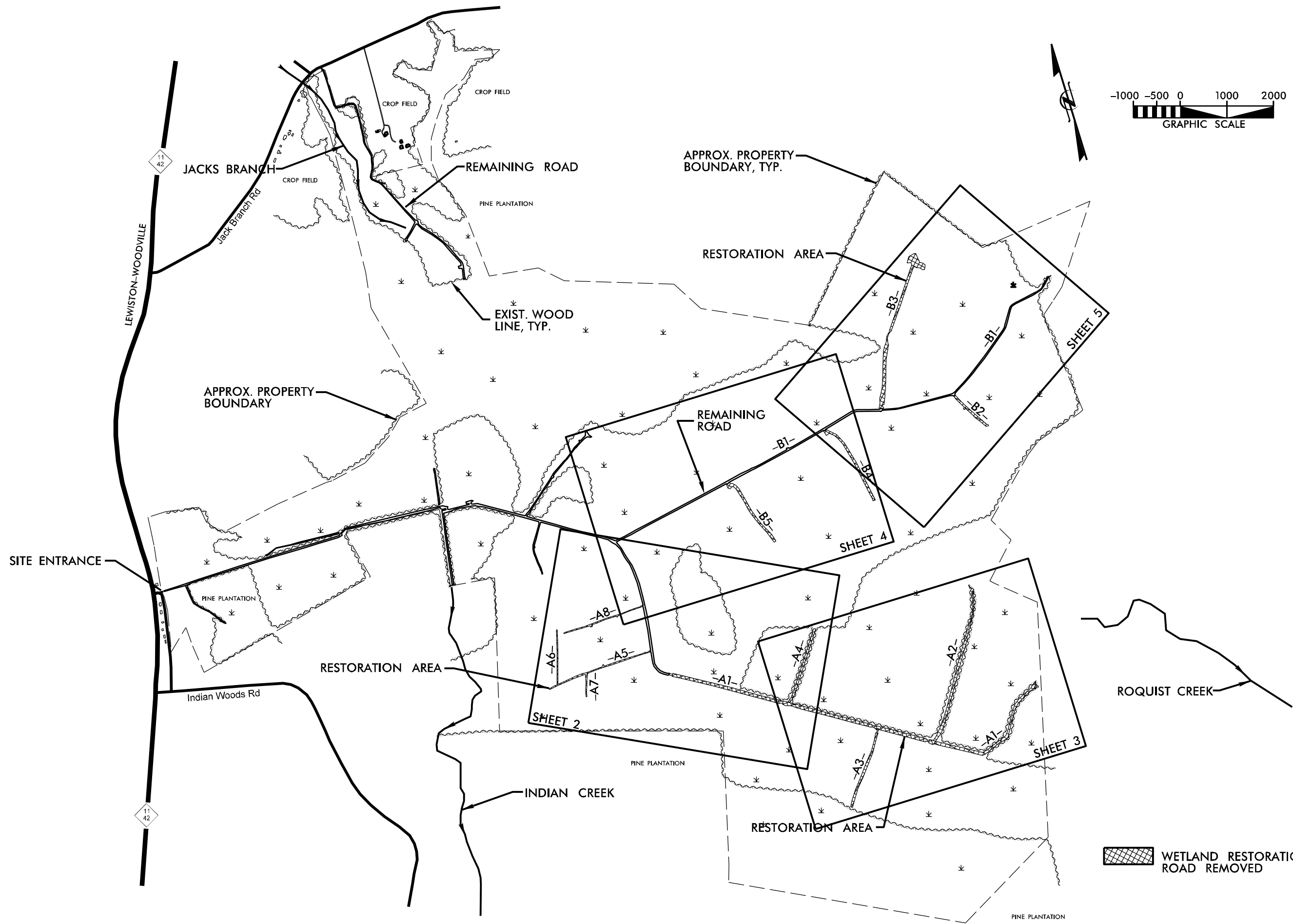
Table 2. Project Activity and Reporting History		
Project Number and Name: 312 - Roquist Wetland		
Elapsed Time Since Grading Complete: 2 yr 11 months		
Elapsed Time Since Planting Complete: 2 yr 11 months		
Number of Reporting Years: 3		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	N/A	Aug 05
Final Design - 90%	N/A	Jul 06
Construction	N/A	Jan 08
Permanent Seeding	N/A	Jun 08
Bare Root Planting	N/A	Jan 08
Mitigation Plan / Record Drawings (Year 1 Veg Monitoring Data)	Oct 08	Nov 08
Year 2 Monitoring	Oct 09	Dec 09
Year 3 Monitoring	Oct 10	Dec 10

Table 3. Project Contacts Table	
Project Number and Name: 312 - Roquist Wetland	
Design Firm	HSM of North Carolina, Inc. 3333 Regency Parkway, Suite 120 Cary, North Carolina 27518 Contact: Mr. Rick Prosser Phone: (919) 460-6895
Construction Contractor	Sawyer's Land Developing, Inc. 275 Higginsport Road Belhaven, North Carolina 27810 Contact: Mr. Len Hunt Phone: (252) 943-2154
Aggregate Supplier	Hanson Rocky Mount Quarry #017 10471 NC-97 West Rocky Mount, North Carolina 27801 Phone: (252) 977-1611
Seeding Contractor	Holland Landscaping, Inc. 953 Blackrock Road Merry Hill, North Carolina 27957 Contact: Mr. Randy Holland Phone: (252) 856-4163
Planting Contractor / Bare-Root Plant Supplier	Emerald Forest, Inc. 4651 Black Woods Road Chesapeake, Virginia 23322 Contact: Mr. Peter McClintock Phone: (757) 421-0929
Bare-Root Plant Supplier	Int'l Paper SC Super Tree Nursery 5594 Highway 38 S Blenheim, South Carolina 29516 Phone: (843) 528-3203
Survey Contractor	H.C.Harris, Jr., Engineering & Surveying, P.A. 216 Main Street Winterville, North Carolina 28590 Contact: Mr. Cliff Harris, Jr. Phone: (252) 321-5607
Monitoring Performers	
MY-01	HSM of North Carolina, Inc. 3333 Regency Parkway, Suite 120 Cary, North Carolina 27518 Contact: Mr. Rick Prosser Phone: (919) 460-6895
MY-02 - MY-03	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table	
Project Number and Name: 312 – Roquist Wetland	
Project County	Bertie County
Drainage Area	21.4 mi ²
Drainage Impervious Cover Estimate (%)	<5%
Physiographic Region	Inner Coastal Plain
Ecoregion	Mid-Atlantic Floodplains and Low Terraces
Plant Communities	Nonriverine Swamp Forest and Nonriverine Wet Hardwood Forest
Dominant Soil Types	Leaf Sandy Loam
Reference Site ID	On Site
USGS HUC for Project and Reference	03010107
Any portion of the project segment 303d listed?	No - not rated
Any portion of the project segment upstream of a 303d listed segment?	No
Reasons for 303d Listing or Stressor	N/A
% of Project Fenced	0%

Appendix B

Visual Assessment Data



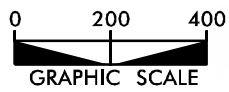
NO.	DATE	DESCRIPTION	BY	APP'D



KCI
ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

ROQUIST WETLAND SITE
BERTIE COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 312 - MY03

DATE: DEC 2010
SCALE: 1" = 2000'
CURRENT CONDITION
PLAN VIEW
SHEET 1 OF 5



MATCHLINE - SEE SHEET 4

PROJECT CONDITION	
VEG PLOT ACHIEVING DENSITY CRITERION	■
VEG PLOT BELOW DENSITY CRITERION	■
WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION	●
WETLAND GAUGE BELOW HYDROLOGIC CRITERION	●

PROJECT CONDITION DETAILS	
VEG PLOT TOTAL / PLANTED STEM DENSITY	890/423

NO.	DATE	DESCRIPTION	BY	CHKD	APPROVED



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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

ROQUIST WETLAND SITE
BERTIE COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 312 - MY03
B1, B2, B3

DATE: DEC 2010
SCALE: 1"= 400'
CURRENT CONDITION PLAN VIEW
SHEET 5 OF 5

Table 5. Vegetation Condition Assessment						
Project Number and Name: 312 - Roquist Wetland						
Planted Acreage 45.2			Easement Acreage 3,926			
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	45.20	100.0%
Total				0	45.20	100.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
Cumulative Total				0	45.20	100.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. 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%

Vegetation Monitoring Plot Photos



Plot 1 Photo – 10/28/10 - MY 03



Plot 2 Photo – 10/28/10 - MY 03



Plot 3 Photo – 10/28/10 - MY 03



Plot 4 Photo – 10/28/10 - MY 03



Plot 5 Photo – 10/28/10 - MY 03



Plot 6 Photo – 10/28/10 - MY 03



Plot 7 Photo – 10/28/10 - MY 03



Plot 8 Photo – 10/28/10 - MY 03



Plot 9 Photo – 10/28/10 - MY 03



Plot 10 Photo – 10/28/10 - MY 03

Appendix C

Vegetation Assessment Data

Table 6. Vegetation Plot Mitigation Success Summary Table

Project Number and Name: 312 - Roquist Wetland

Vegetation Plot ID	Monitoring Year 03 Planted Stem Density (stems/acre)	Vegetation Survival Threshold Met? (320 planted stems/acre after MY03)
1	81	No
2	364	Yes
3	0	No
4	0	No
5	0	No
6	0	No
7	283	No
8	40	No
9	162	No
10	202	No

Table 7. CVS Vegetation Plot Metadata	
Project Number and Name: 312 - Roquist Wetland	
Report Prepared By	Adam Spiller
Date Prepared	12/28/2010 11:54
database name	KCI-2010-A.mdb
database location	M:\2007\12071067_2007 EEP OPEN END\Veg_database
computer name	12-CSPV0M1
file size	50630656
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	312
project Name	Roquist Wetland
Description	Wetland Restoration Site in Bertie County, NC.
River Basin	Roanoke
length(ft)	N/A
stream-to-edge width (ft)	N/A
area (sq m)	35,000
Required Plots (calculated)	10
Sampled Plots	10

Table 8. Planted Stem Count by Plot and Species
Project Number and Name: 312 – Roquist Wetland

Scientific Name	Common Name	Species Type	Current Plot Data (MY3 2010)																								Annual Means																										
			312-A-0001			312-A-0002			312-A-0003			312-A-0004			312-A-0005			312-A-0006			312-A-0007			312-A-0008			312-A-0009			312-A-0010			MY3 (2010)			MY2 (2009)			MY1 (2008)														
			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	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	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T												
Acer rubrum	red maple	Tree			1			2			2															12															17			54			19						
Baccharis	baccharis	Shrub Tree																																							4												
Clethra alnifolia	coastal sweetpepperbush	Shrub																																							1			1			1			1			
Diospyros virginiana	common persimmon	Tree																																							36			43									
Fraxinus pennsylvanica	green ash	Tree		2	3		1	1																		8												3			12			3			15			3			3
Itea virginica	Virginia sweetspire	Shrub																																													1			1			
Leucothoe axillaris	coastal doghobble	Shrub																																													1			1			
Liquidambar styraciflua	sweetgum	Tree									1									1																					2			11			12						
Nyssa biflora	swamp tupelo	Tree																		1			1															1			1			1			1						
Nyssa sylvatica	blackgum	Tree					5	5												1			1						1			1						7			7			9			9			12			12
Quercus	oak	Shrub Tree																								76															76												
Quercus laurifolia	laurel oak	Tree																								1			1			2			2			3			3			3			3			3			
Quercus michauxii	swamp chestnut oak	Tree					1	1												1			1						1			1						4			4			4			4			4			
Quercus pagoda	cherrybark oak	Tree																																										1			1						
Quercus phellos	willow oak	Tree			2		1	1																		1			1									2			6			2			2			3			3
Quercus rubra	northern red oak	Tree																																																115			
Quercus shumardii	Shumard's oak	Shrub Tree																								1			1			1			1			2			2			2			59			3			3
Rhus copallinum	flameleaf sumac	Shrub Tree																																													13			5			
Salix nigra	black willow	Tree																																													1			1			
Taxodium distichum	bald cypress	Tree																								1			1									1			1			1			1			1			
Ulmus americana	American elm	Tree																								4			4									4			4			5			5			4			4
Vaccinium corymbosum	highbush blueberry	Shrub					1	1																														1			1			5			3			3			
Stem count			0	2	6	0	9	11	0	0	3	0	0	0	0	0	0	0	0	0	0	7	21	0	1	2	0	4	88	0	5	5	0	28	136	0	33	225	0	39	234												
size (ares)			1			1			1			1			1			1			1			1			1			1			10			10			10														
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.25			0.25			0.25																	
Species count			0	1	3	0	5	6	0	0	2	0	0	0	0	0	0	0	0	0	0	4	7	0	1	2	0	4	6	0	4	4	0	10	13	0	12	18	0	12	18												
Stems per ACRE			0	80.9	243	0	364	445	0	0	121	0	0	0	0	0	0	0	283	850	0	40.5	80.9	0	162	3561	0	202	202	0	113	550	0	134	911	0	158	947															

P-LS – Planted Live Stake Stems

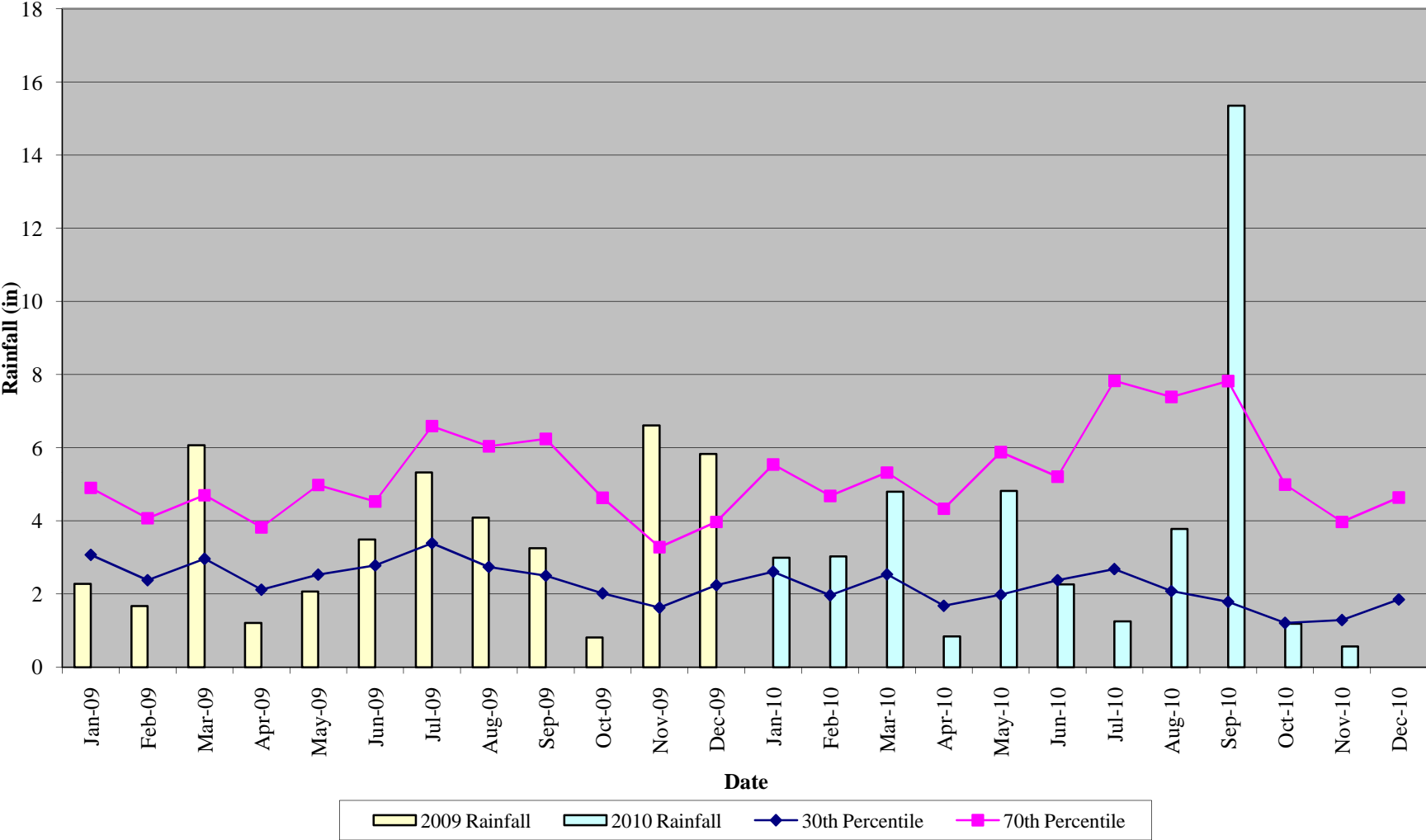
P-all – Planted Stems Total (with Live Stakes)

T – Total (Planted Including Live Stakes and Volunteers)

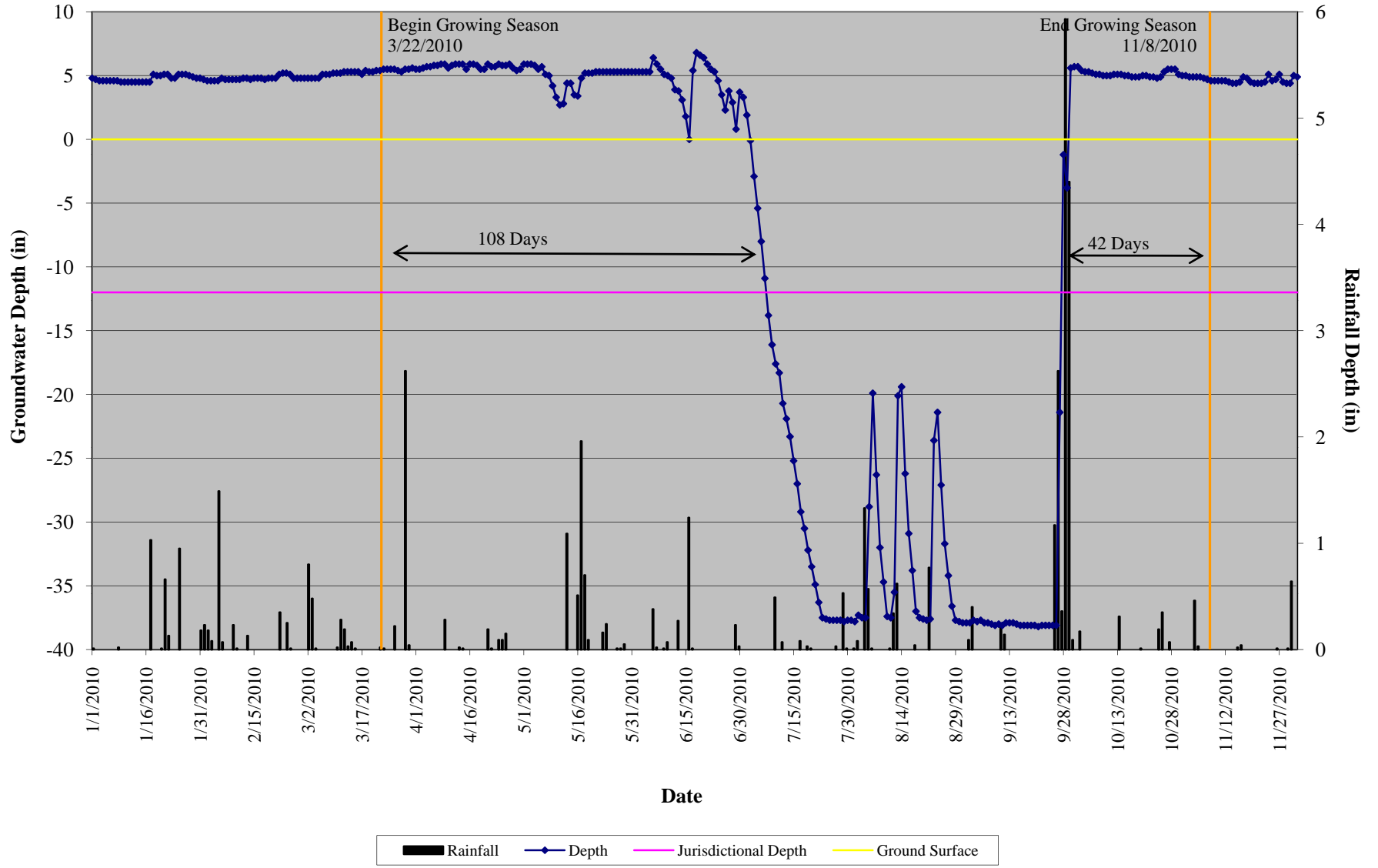
Appendix D

Hydrologic Data

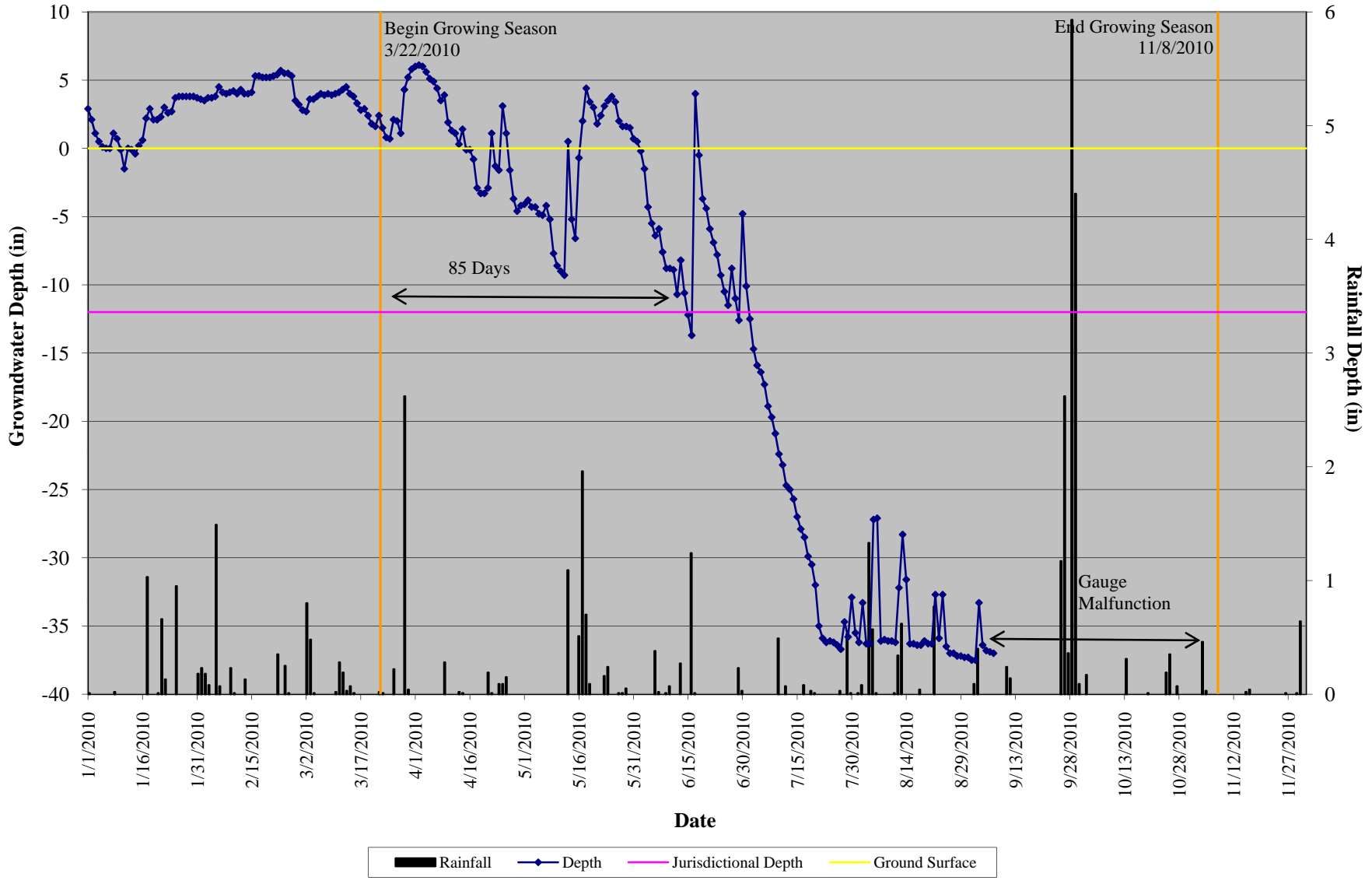
Roquist 30-70 Percentile Graph 2009-2010
Lewiston-Woodville, NC Monthly Rainfall



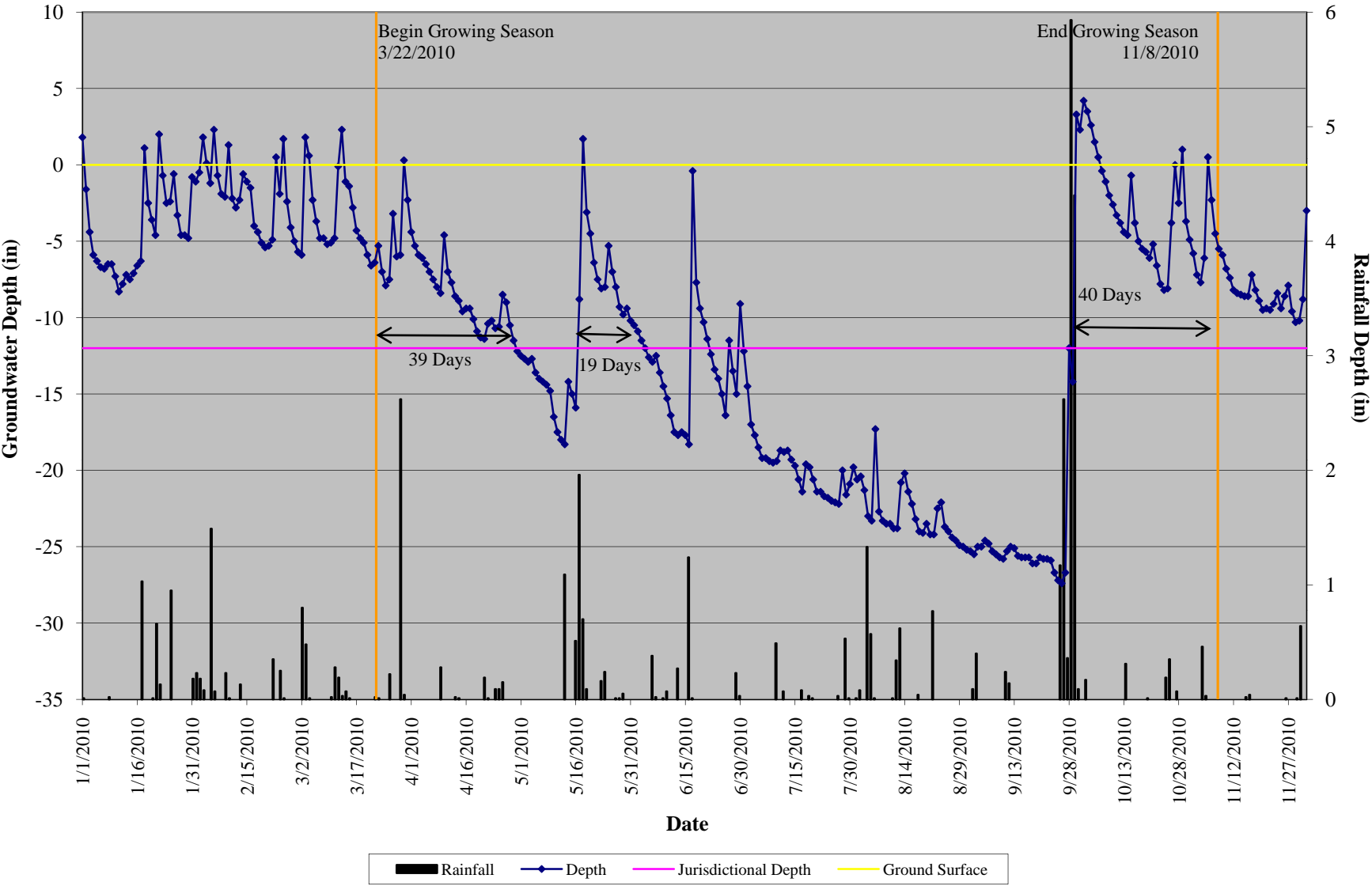
Roquist MY03 Groundwater Monitoring Gauge #1 (Reference for Gauge #2)



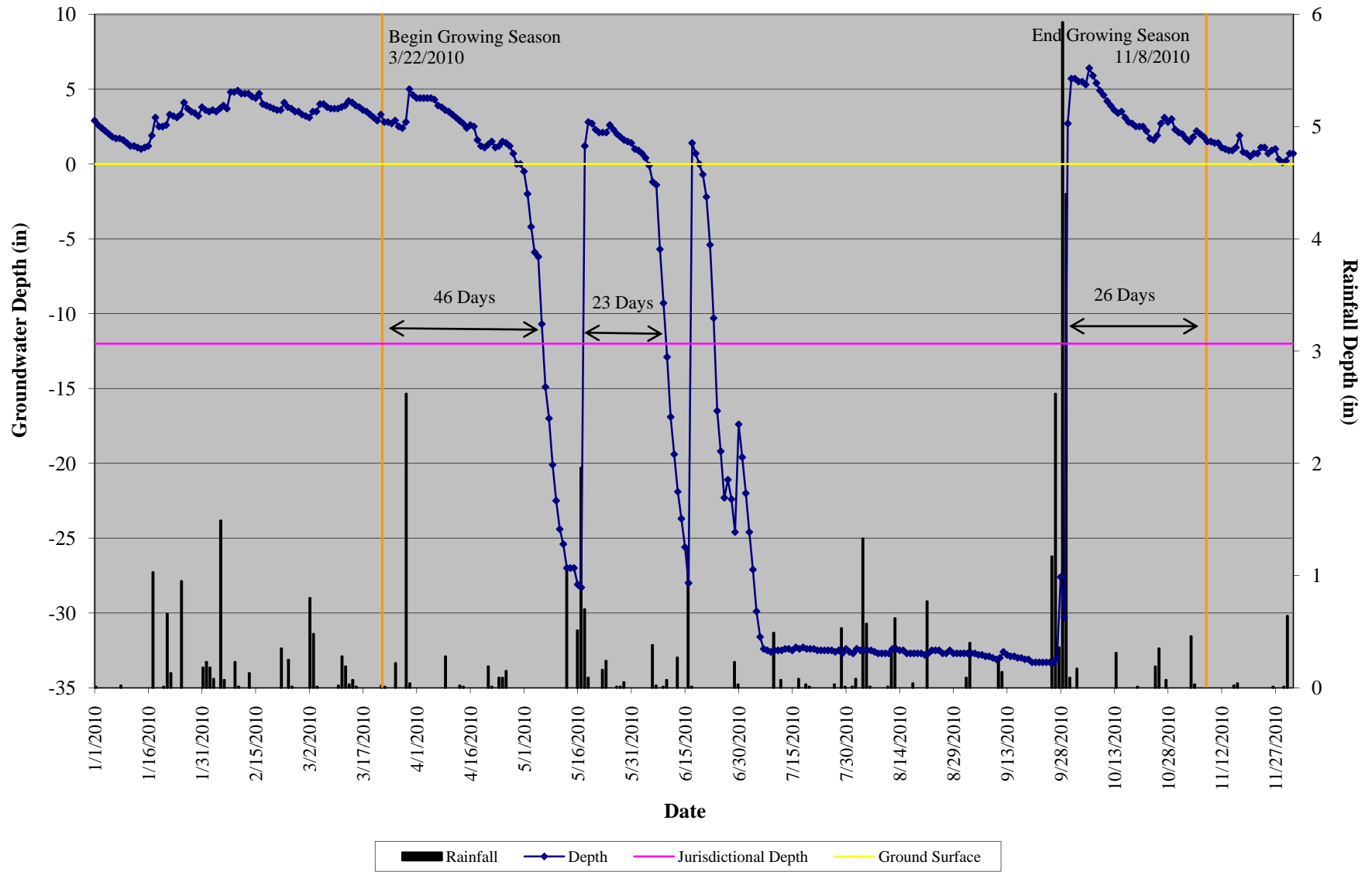
Roquist MY03 Groundwater Monitoring Gauge #2



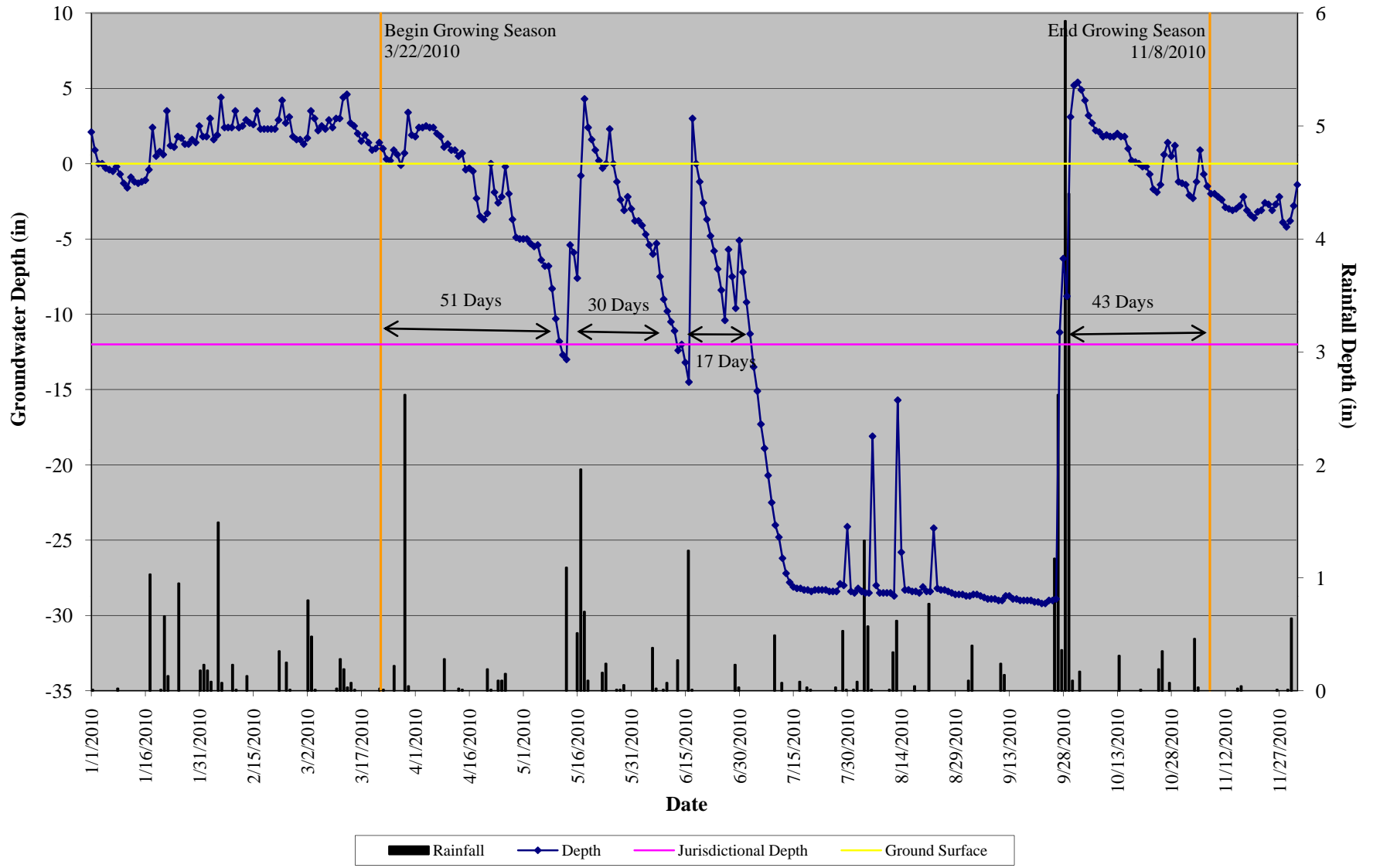
Roquist MY03 Groundwater Monitoring Gauge #3b



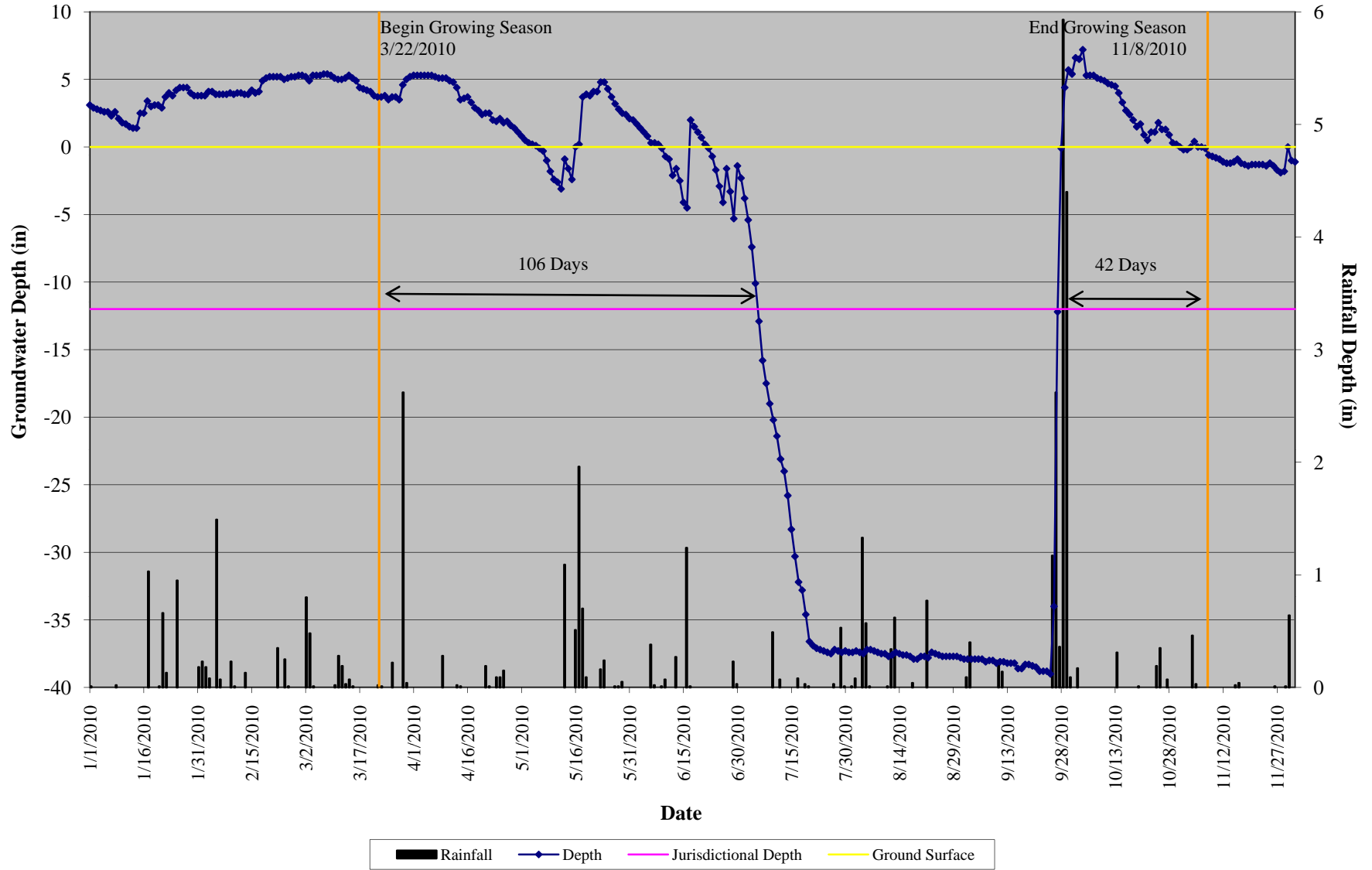
Roquist MY03 Groundwater Monitoring Gauge #4 (Reference for Gauge #3b)



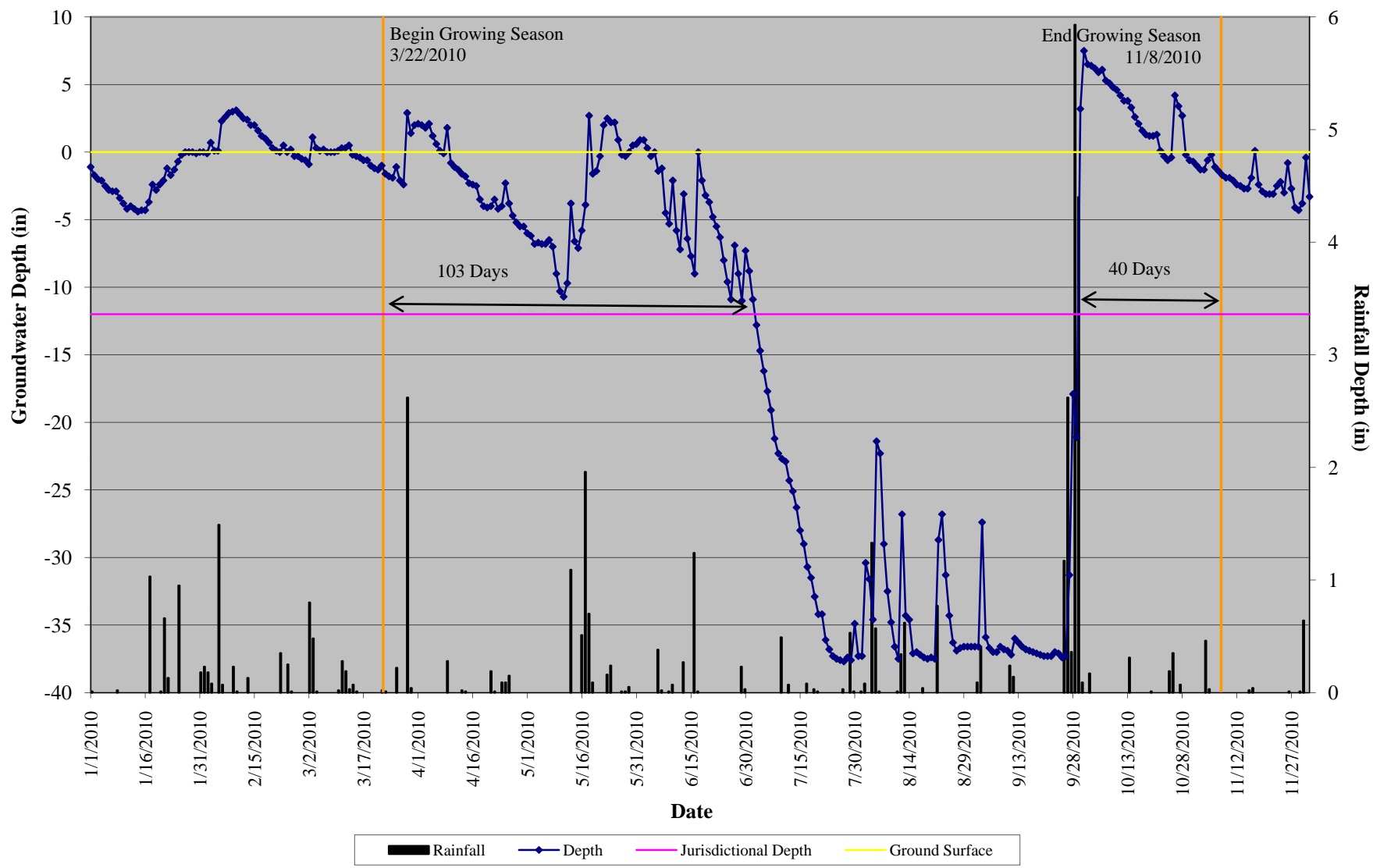
Roquist MY03 Groundwater Monitoring Gauge #5



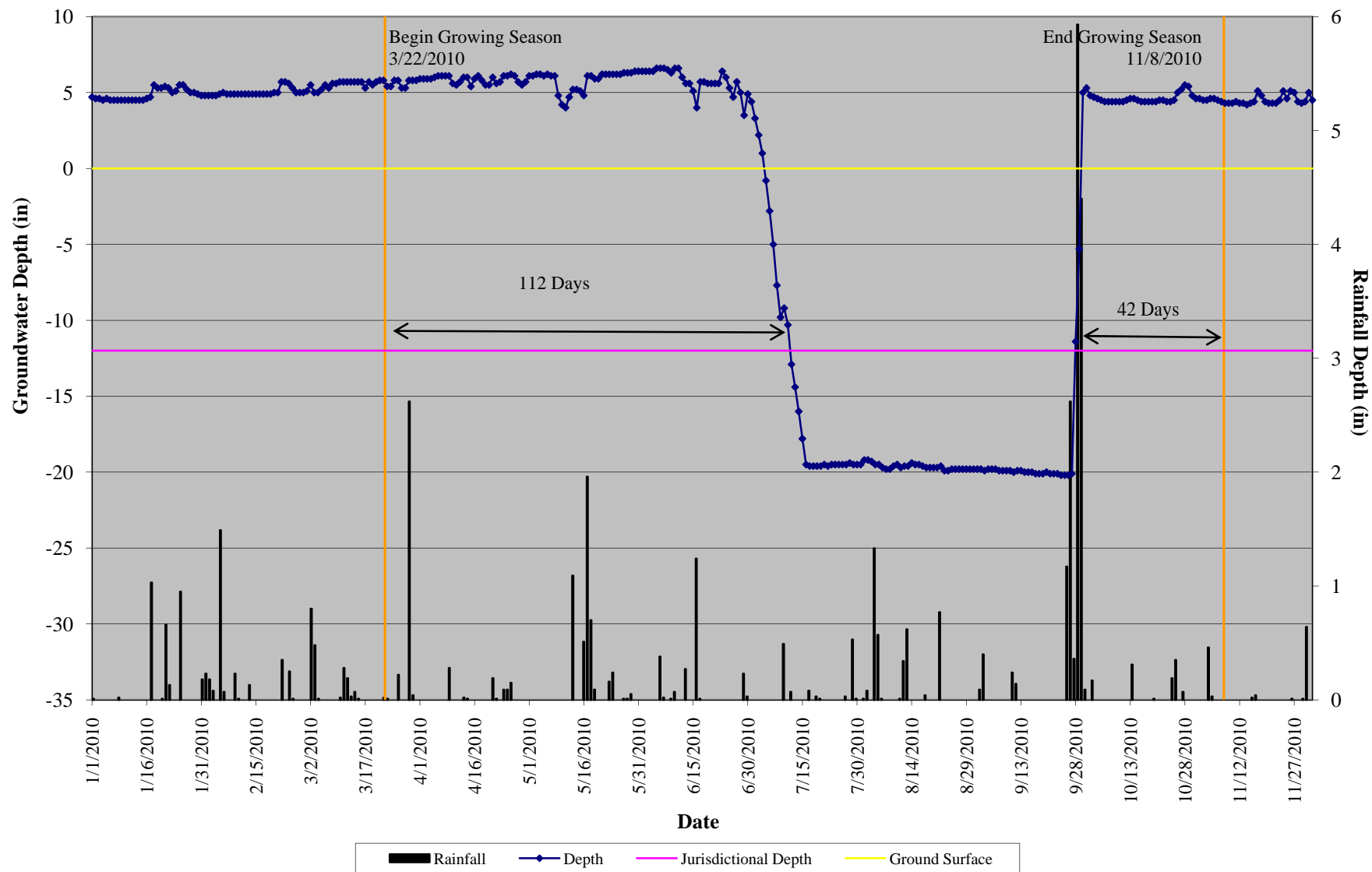
Roquist MY03 Groundwater Monitoring Gauge #6 (Reference for Gauge #5)



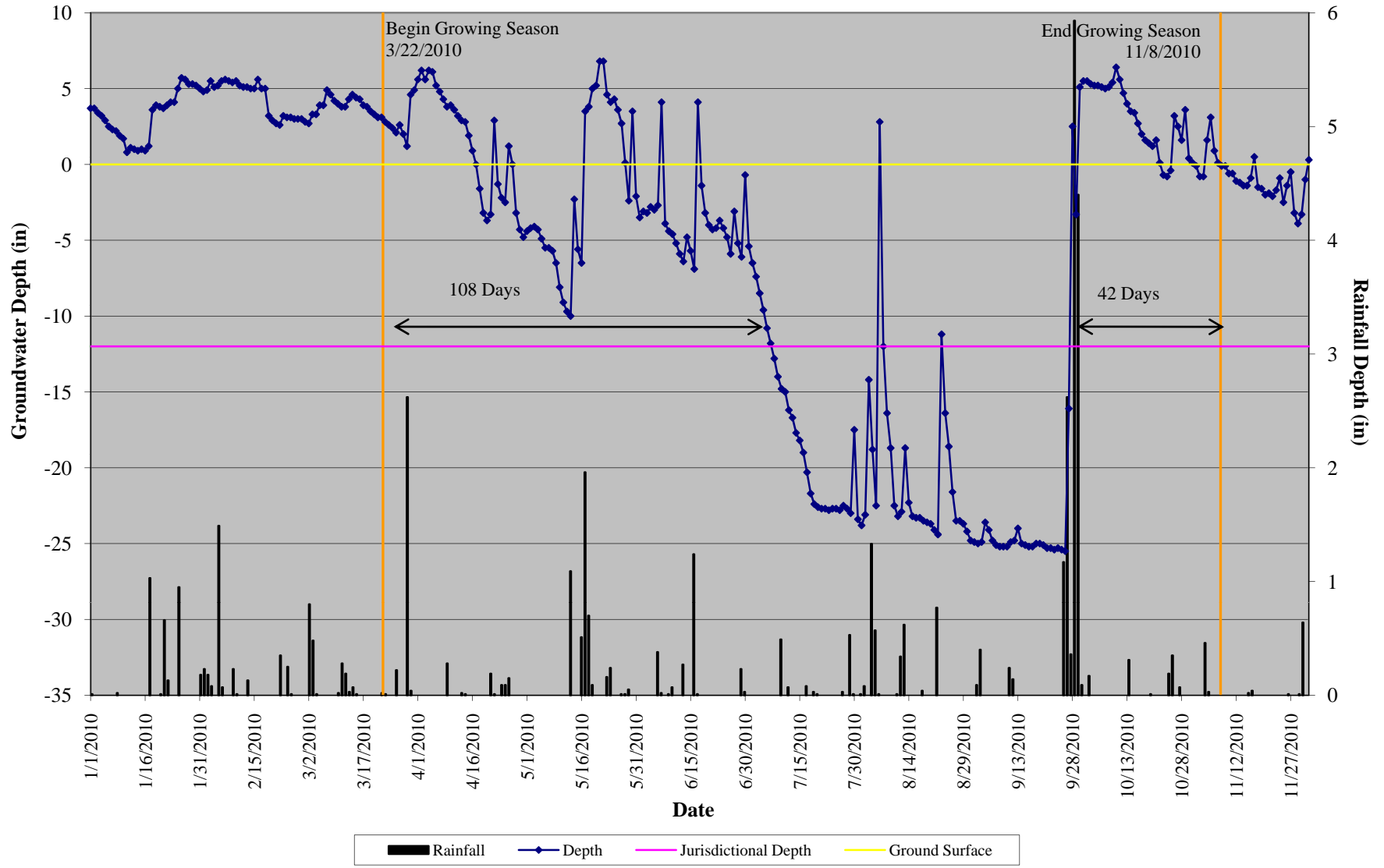
Roquist MY03 Groundwater Monitoring Gauge #9



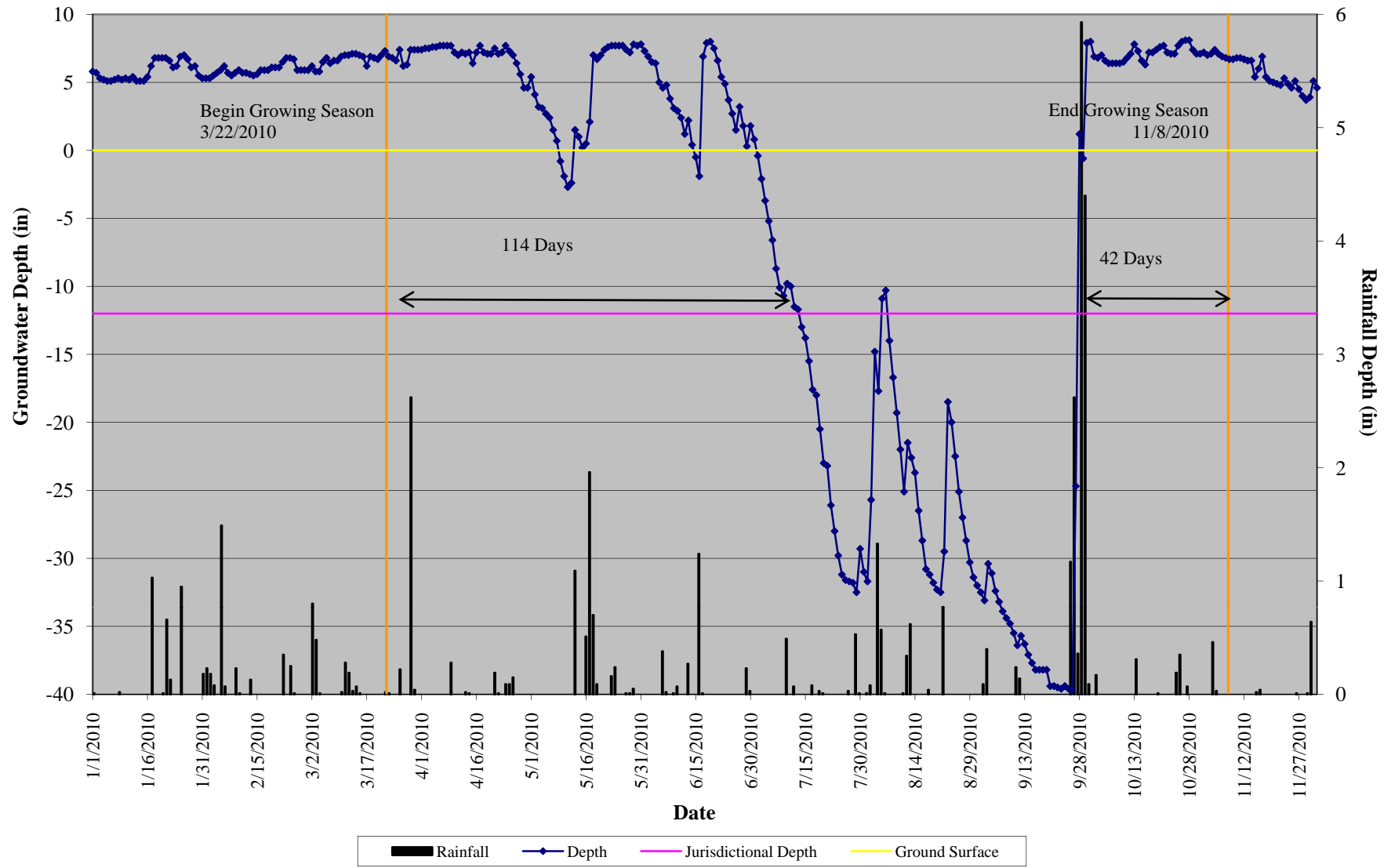
Roquist MY03
Groundwater Monitoring Gauge #13 (Reference for Gauge #9)



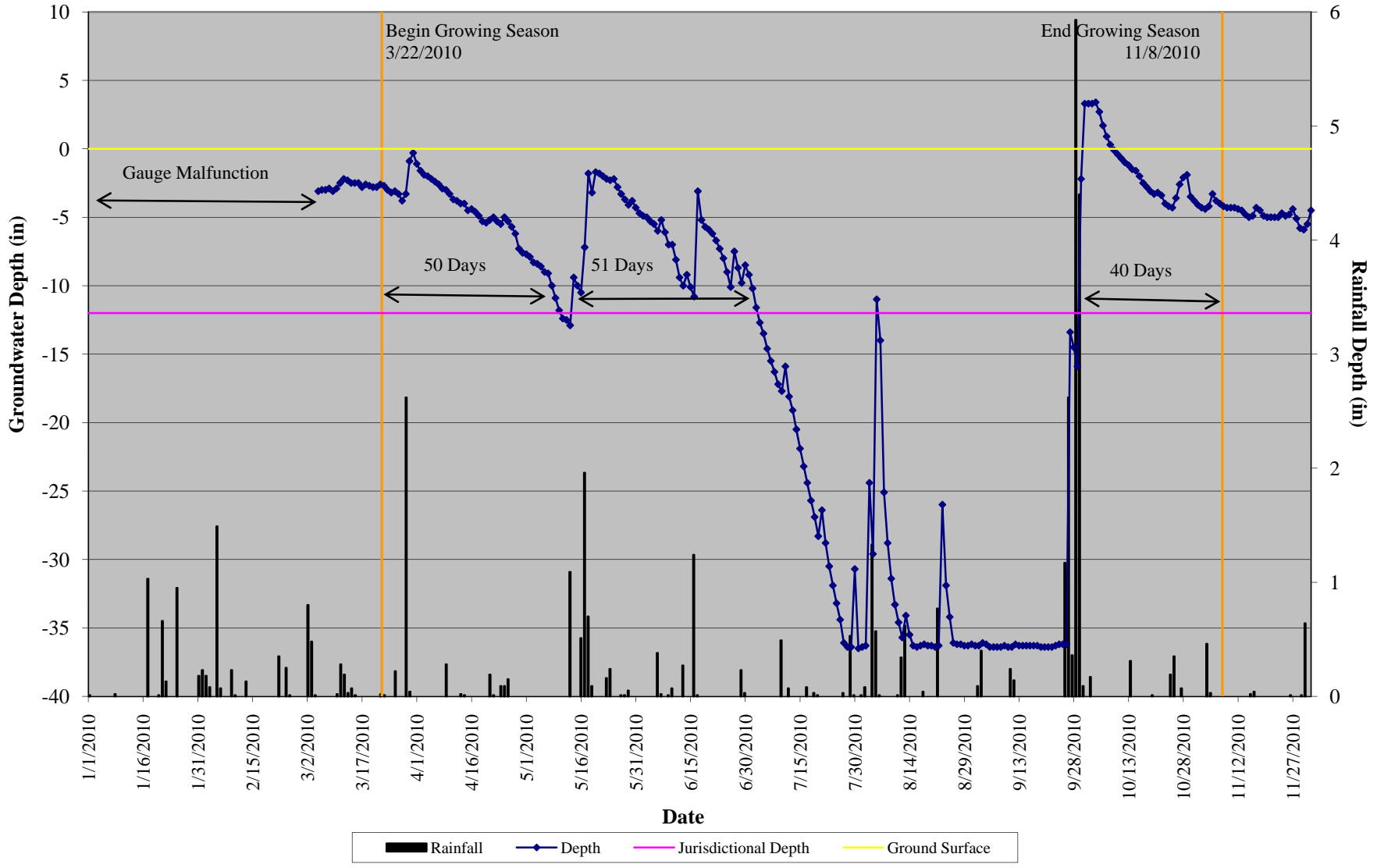
Roquist MY03 Groundwater Monitoring Gauge #11b



Roquist MY03
Groundwater Monitoring Gauge #12 (Reference for Gauge 11b)



Roquist MY03 Groundwater Monitoring Gauge #14



Roquist MY03 Groundwater Monitoring Gauge #15

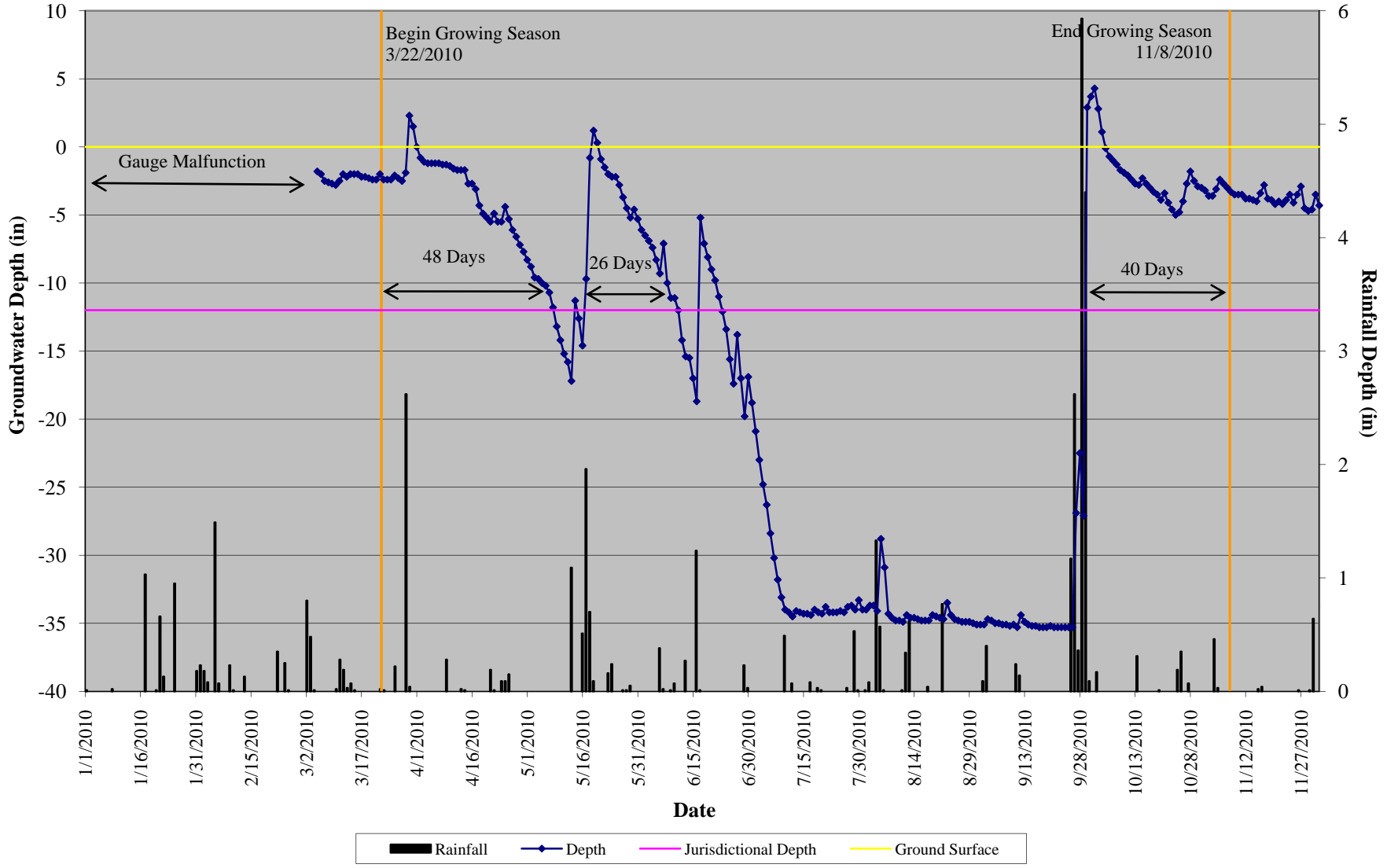


Table 9. Wetland Hydrology Criteria Attainment Table
Project Number and Name: 312 - Roquist Wetland

Gauge	Success Criteria Achieved/ Max Consecutive Days During Growing Season (Percentage)		
	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)
Gauge 1 <i>(Reference for Gauge 2)</i>	Yes/90 (39%)	Yes/95 (41%)	Yes/108 (47%)
Gauge 2	Yes/79 (32%)	Yes/71 (31%)	Yes/85 (37%)
Gauge 3b	Yes/76 (33%)	Yes/44 (19%)	Yes/40 (17%)
Gauge 4 <i>(Reference for Gauge 3b)</i>	Yes/79 (34%)	Yes/65 (28%)	Yes/46 (20%)
Gauge 5	Yes/79 (34%)	Yes/69 (30%)	Yes/51 (22%)
Gauge 6 <i>(Reference for Gauge 5)</i>	Yes/85 (37%)	Yes/73 (32%)	Yes/101 (46%)
Gauge 9	Yes/78 (34%)	Yes/67 (29%)	Yes/103 (45%)
Gauge 13 <i>(Reference for Gauge 9)</i>	Yes/98 (42%)	Yes/93 (40%)	Yes/108 (47%)
Gauge 11b	Yes/92 (40%)	Yes/73 (32%)	Yes/114 (49%)
Gauge 12 <i>(Reference for Gauge 11b)</i>	Yes/96 (42%)	Yes/97 (42%)	Yes/112 (49%)
Gauge 14	Yes/83 (36%)	Yes/73 (32%)	Yes/51 (22%)
Gauge 15	Yes/76 (33%)	Yes/66 (29%)	Yes/48 (21%)