

WHITELACE CREEK STREAM ENHANCEMENT
AND WETLAND RESTORATION SITE
MONITORING REPORT (YEAR 2 OF 5)

Lenoir County, North Carolina
EEP Project No. 420



Prepared for:
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652



Status of Plan: Final
Submission Date: March 2008

Monitoring Firm:



Stantec

Stantec Consulting Services Inc
801 Jones Franklin Road, Suite 300
Raleigh, NC 27606

EXECUTIVE SUMMARY

The North Carolina Ecosystems Enhancement Program (EEP) enhanced 5,901 linear feet of the Whitelace Creek stream channel located west of Kinston, in Lenoir County, North Carolina. Additionally, 7.7 and 13.0 acres of wetland area were restored and enhanced, respectively. The site construction was completed in August of 2005, and planting occurred in March of 2006. This report provides the monitoring information for year two (2) of the stream enhancement and wetland restoration project.

The project consists of a tributary of the Neuse River Basin, located in Lenoir County, within an EEP-owned conservation easement 6.5 miles west of Kinston. The site is located adjacent to the Kennedy Home, approximately one mile south of US 70 and comprises approximately 37.0 acres.

Portions of the Whitelace Creek were identified as suitable for stream enhancement and wetland restoration by the NCEEP. Due to previous dredging and straightening which occurred to accommodate past land uses (i.e., a large dairy operation and other agricultural practices), the acreage of riverine wetlands in the area was reduced because of the lowering of the streambed elevation, adversely affecting wetland hydrology. Restoration activities for this project included excavation of the floodplain to provide Level 1 stream enhancement, riverine wetland enhancement and restoration, and Neuse River riparian buffer enhancement and restoration.

On September 18th, 2007 the Year 2 monitoring survey was completed for the vegetation at the Whitelace Creek project site. As directed by NCEEP, stream stability measurements (i.e., cross-sections, longitudinal profile and pebble counts) were not taken, because the stream portion of the project was enhancement and, therefore, did not involve significant work on the stream channel. The general assessment of stream stability revealed excellent connection to the floodplain, with a bank height ratio of approximately one. Despite previous straightening there were no signs of bank erosion anywhere on the site. Several reaches of the stream had developed several mid-channel bars which were well vegetated. In some instances, these bars can lead to lateral migration and bank instability. No signs of instability were identified during the site visits, but these areas should be monitored in the future. Additionally, the crest gauge on-site was checked in September and November of 2007. A bankfull event was verified in September. In November, the water level exceeded bankfull, likely due to beaver activity near the crest gauge. Beaver activity was also likely present further downstream.

Vegetative monitoring was performed using the Carolina Vegetation Survey methodology on nine of the original 15 plots, as requested by NCEEP. Monitoring revealed that only 3 of the 9 plots (33%) met the 3-year vegetative success criteria of 320 planted stems or greater per acre. There are a number of issues causing the failure of the remaining 6 plots. There was a relatively low number of healthy plant species in vegetation plots 1 through 5, likely due to previous heavy flooding in 2006 as noted in the Year 1 monitoring report. In 2007, the higher areas onsite have been adversely affected by an extreme drought while the lower areas onsite have been flooded by beaver activity. Other problems included the presence of invasive or exotic species such as *Typha latifolia*, *Murdannia keisak*, and *Persicaria sagittata*. *Persicaria* is currently causing problems with vegetation vigor and survival and should be controlled. *Typha* and *Murdannia* will be watched throughout the monitoring period to ensure that they do not start causing harm to the planted species. It should be noted that there were a large number of river birch and silverling volunteers throughout the site. The major issue affecting the poor performance of the vegetation on the site is the localized flooding caused by beaver activity. The beavers should be removed, thereby

allowing the site hydrology to return to conditions outlined in the restoration plan. However, beaver activity is likely to continue. Therefore, the site should be replanted with trees of appropriate species and size to withstand periodic inundation.

Groundwater data collected through November of 2007 was used to assess the compliance of the site with wetland hydrology criteria. Seven groundwater monitoring gauges are currently active on the project site. A site is considered to meet the requirements for wetland hydrology if the groundwater level is within 12 inches of the ground surface for 12.5% of the growing season consecutively. Five of the gauges met the criteria for 2007. Two of the seven gauges did not meet the criteria during the growing season of 2007. Gauge 4 had a maximum of 15 (6%) consecutive days where the groundwater level was within 12 inches of the surface. Gauge 2 had a maximum of 17 days (7%). However, gauge data could not be collected at Gauge 2 after September 6, 2007 due to a problem with the gauge. Given that precipitation was below the 30% percentile for the area, the failure of some gauges to indicate hydrologic success is not cause for significant concern.

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1.0 Project Background

1.1 PROJECT OBJECTIVES

Previous dredging and straightening of Whitelace Creek had lowered the streambed elevation, thereby causing a reduction in the acreage of riverine wetlands due to a lowered water table. Restoration and enhancement objectives for this project included the restoration of historic stream and wetland functions that existed on-site prior to dredging and vegetation removal. Site alterations at Whitelace Creek included the excavation or reestablishment of the floodplain and in-situ stream channel modification to the existing stream. The goals of these activities were to reintroduce surface water flood hydrodynamics from a 10.1 square mile watershed along the restored length of stream and floodplain. Subsequent objectives were to restore wetland hydrology and to reforest the site with streamside and riparian forest communities.

1.2 PROJECT STRUCTURE

The project area consists of a tributary of the Neuse River Basin, Whitelace Creek, located in Lenoir County, within an NCEEP-owned conservation easement west of Kinston, North Carolina. The project area comprises approximately 37.0 acres and has a watershed area of 10.1 square miles.

Restoration activities included the excavation of the floodplain to provide Level 1 stream enhancement, riverine wetland enhancement and restoration, and Neuse River riparian buffer enhancement and restoration. Stream pattern and profile were not altered. The 7.7 acres of riverine wetland restoration encompassed the excavated floodplain adjacent to approximately 3,500 linear feet of Whitelace Creek, including two closed hog waste lagoons. The sludge from these lagoons was removed during restoration. Additionally, 13.0 acres of riverine wetland enhancement was generated primarily within riparian areas within the eastern (downstream) portion of the site.

Exhibit Table I. Project Restoration Components Whitelace Creek Wetland Restoration Site/EEP Project No. 420								
Reach ID	Existing Feet/Acres	Type	Approach	Footage or Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
Reach 1	3693	E1	P2	3693	1.5	2462.0	0+35 - 37+58	Total accounts for 30 l.f. gap in easement at road crossing
Reach 2	2208	E2	P2	2208	2.5	883.2	37+58 - 59+66	
Riverine Wetland Restoration		R	P2	7.7 ac	1	7.7	NA	Stations 0+00 - 37+58 mark the extent of the floodplain grading
Riverine Wetland Enhancement		E	NA	13.0 ac	*	*	NA	
Neuse River Buffer Restoration		R	NA	27.1 ac	*	*	NA	
Neuse River Buffer Enhancement		E	NA	7.2 ac	*	*	NA	
Mitigation Unit Summations								
Stream (lf)	Riparian Wetland (ac)	Nonriparian Wetland (ac)	Total Wetland (ac)	Buffer (ac)	Comment			
3345		0.0		0.0				

R = Restoration

E1 = Stream Enhancement 1

S = Stabilization

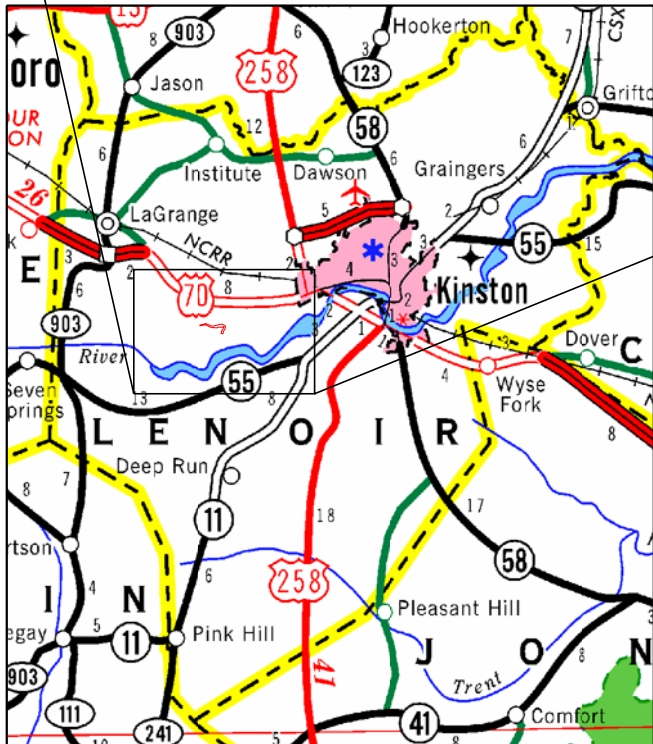
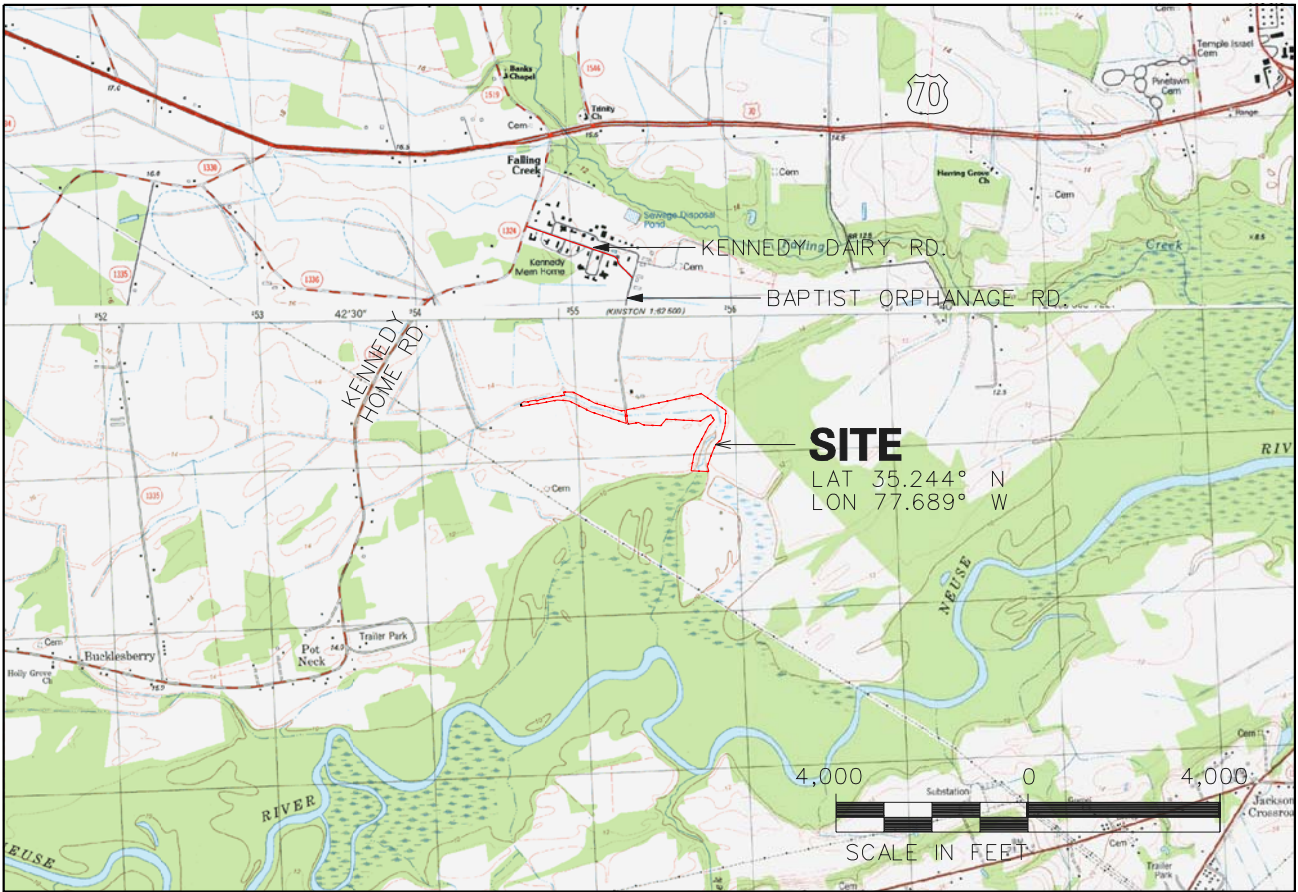
P=Preservation

*Mitigation Ratios are needed from EEP

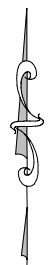
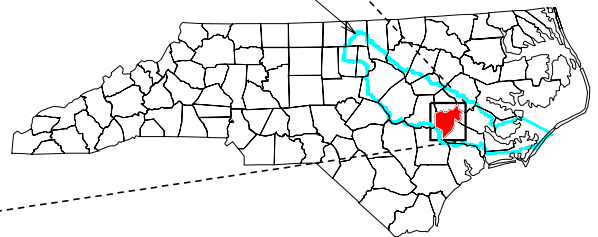
1.3 LOCATION AND SETTING

The restoration site is located 6.5 miles west of Kinston, in Lenoir County, North Carolina. The site is located in a rural area, adjacent to the Kennedy Home complex approximately one mile south of US 70. The site can be accessed from a bridge on Baptist Orphanage Road, which crosses Whitelace Creek (Figure 1).

Site directions: from Raleigh follow US 70 East toward Kinston. Approximately 8 miles east of La Grange, take a right on Kennedy Home Road. Continue approximately 0.3 miles and take the first left onto Kennedy Dairy Road. Follow Kennedy Dairy Road through the Kennedy Home complex. Continue through the traffic circle, stay right, and merge onto Baptist Orphanage Road. Travel approximately 0.5 miles until reaching a small concrete bridge spanning Whitelace Creek. This point is near the middle of the site. The stream enhancement reach begins approximately 2,400 feet upstream of the bridge and ends approximately 3,500 feet downstream. The 7.7 acres of riverine wetland restoration encompasses the excavated floodplain adjacent to approximately 3,500 linear feet of Whitelace Creek. The 13.0 acres of riverine wetland enhancement occurs primarily within the riparian areas within the eastern (downstream) portion of the project area.



NEUSE RIVER
 BASIN (CU 03020202)



Client: _____ Project: _____

SITE LOCATION MAP
WHITELACE CREEK STREAM AND WETLAND RESTORATION SITE
 LENOIR COUNTY, NORTH CAROLINA

Dwn By:	GWN	Ckd By:	JWG
Date:	NOV 2006		
Scale:	AS SHOWN		
ESC Project No.:	02-111		

FIGURE

1

1.4 PROJECT HISTORY AND BACKGROUND

Exhibit Table II. Project Activity and Reporting History Whitelace Creek Wetland Restoration Site/EEP Project No. 420			
Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	NA	NA	Feb 2004
Final Design - 90%	NA	NA	Nov 2004
Construction	Aug 2005	NA	Aug 2005
Temporary S&E mix applied to entire project area	NA	NA	Jul 2005
Permanent seed mix applied to entire project area	NA	NA	Aug 2006
Bare Root Seedling Installation	Mar 2006	NA	Mar 2005
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	NA	NA	Apr 2005
Final Report	NA	NA	Apr 2005
Year 1 Monitoring	Nov 2006	Nov 2006	Nov 2006
Year 2 Monitoring	Nov 2007	Nov 2007	Dec 2007
Year 3 Monitoring	NA	NA	NA
Year 4 Monitoring	NA	NA	NA
Year 5 Monitoring	NA	NA	NA

NA = Not Applicable

Exhibit Table III. Project Component Table Whitelace Creek Wetland Restoration Site/EEP Project No. 420	
Designer	EcoScience Corporation 1101 Haynes Street Suite 101 Raleigh, NC 27604
Construction Contractor	Shamrock Environmental Corporation PO Box 14987 Greensboro, NC 27415
Planting Contractor	Emerald Forest Incorporated 4651 Backwoods Road Chesapeake, VA 23322-2456
Seeding Contractor	Wheat Swamp Landscaping 4675 Ben Dail Road LaGrange, NC 28551-8038
Seed Mix Sources	IKEX, Inc. PO Box 250 Middlesex, NC 27557
Nursery Stock Suppliers	Warren County Nursery 6492 Beersheba Highway McMinnville, TN 37110 Pinelands Nursery and Supply 323 Island Road Columbus, NJ 08022 Coastal Plain Conservation Nursery 3067 Connors Drive Edenton, NC 27932
Monitoring Performers (Year 0-1)	EcoScience Corporation 1101 Haynes Street, Suite 101 Raleigh NC 27604 (919)828-3433
Monitoring Performers (Year 2)	Stantec Consulting Services, Inc. 801 Jones Franklin Road, Ste 300 Raleigh, NC 27606
Stream Monitoring POC Vegetation Monitoring POC Wetland Monitoring POC	David Bidelspach (919)851-6866 Amber Coleman (919)851-6866 Amber Coleman (919)851-6866

Exhibit Table IV. Project Background Table Whitelace Creek Wetland Restoration Site/EEP Project No. 420	
Project County	Lenoir
Drainage Area	10.1 sq mi
Drainage impervious cover estimate (%)	< 1 percent
Stream Order	2 nd order
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Floodplains and Low Terraces
Rosgen Classification of As-built	C/E
Cowardin Classification	R2UB23Cb
Dominant soil types	Johnston, stream channels, 80% of Site Lakeland, uplands/terraces, 15% of Site Pactolus, uplands/terraces, 4% of Site Kalmia, terraces, 1% of Site
Reference site ID	01-05471-01A
USGS HUC for Project	03020202040020
USGS HUC for Reference	03020202040020
NCDWQ Subbasin for Project	03-04-05
NCDWQ Subbasin for Reference	03-04-05
NCDWQ Classification for Project	C SW NSW
NCDWQ Classification for Reference	C SW NSW
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	No
Percent of project easement fenced	No

1.5 MONITORING PLAN VIEW

A monitoring plan view map is provided in Figure 2. Figures 3 and 4 include plan views of the riverine wetland and Neuse buffer enhancement, respectively.



EcoScience Corporation

Raleigh, North Carolina

REVISIONS

Client:

**NC DENR
ECOSYSTEM
ENHANCEMENT
PROGRAM**

Project:

**WHITELACE
CREEK
STREAM AND
WETLAND
RESTORATION
SITE**

EEP Project No. 420

**LENOIR COUNTY,
NORTH CAROLINA**

Title:

**MONITORING
PLAN
VIEW**

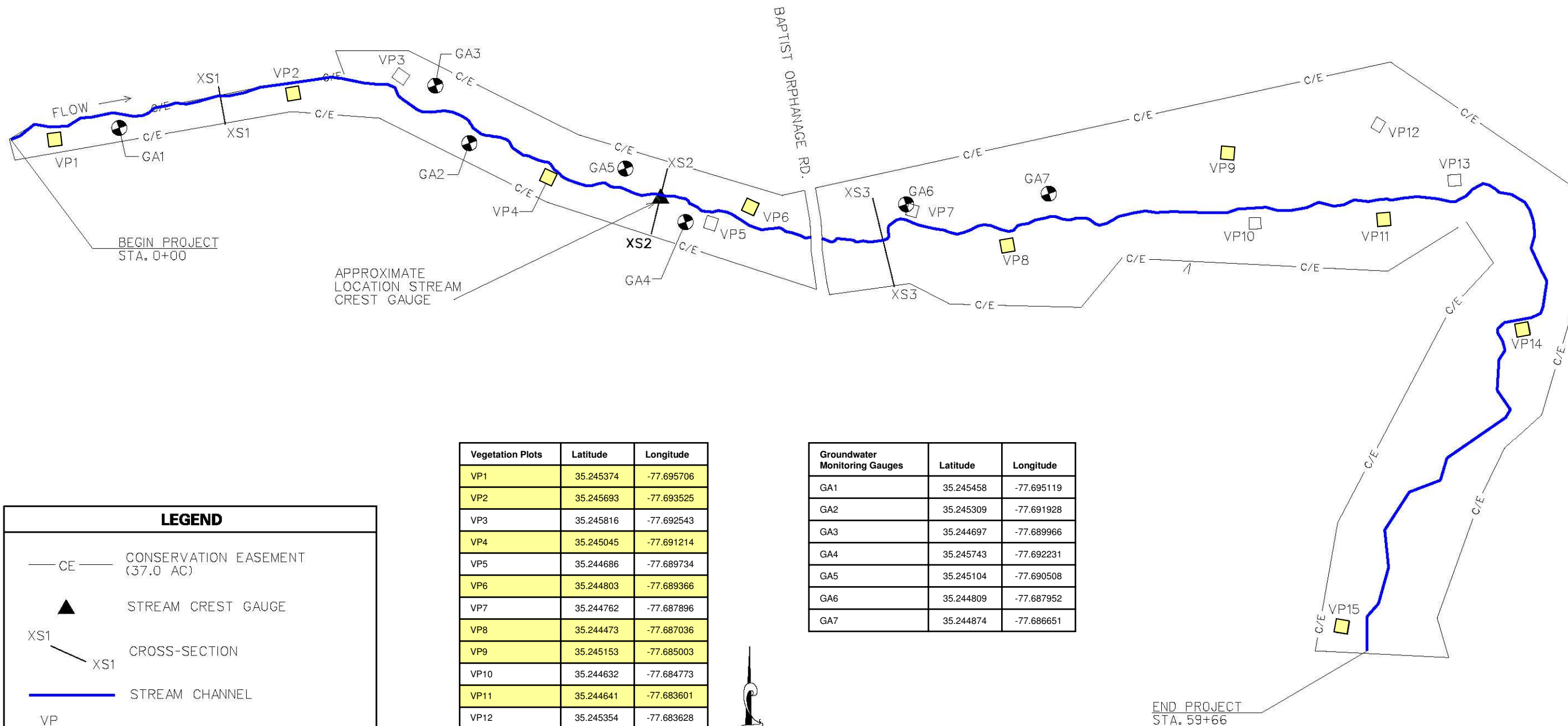
Dwn By: GWN Date: NOV 2006

Ckd By: GWN Scale: AS SHOWN

ESC Project No.: 02-111

FIGURE

2

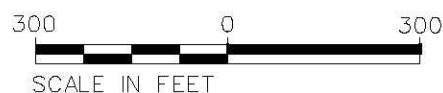
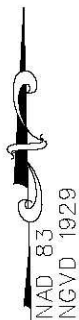


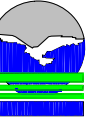
LEGEND	
— CE —	CONSERVATION EASEMENT (37.0 AC)
▲	STREAM CREST GAUGE
XS1	CROSS-SECTION
—	STREAM CHANNEL
VP □	VEGETATION PLOT (10M X 10M)
GA1 ●	GROUNDWATER MONITORING GAUGE

Vegetation Plots	Latitude	Longitude
VP1	35.245374	-77.695706
VP2	35.245693	-77.693525
VP3	35.245816	-77.692543
VP4	35.245045	-77.691214
VP5	35.244686	-77.689734
VP6	35.244803	-77.689366
VP7	35.244762	-77.687896
VP8	35.244473	-77.687036
VP9	35.245153	-77.685003
VP10	35.244632	-77.684773
VP11	35.244641	-77.683601
VP12	35.245354	-77.683628
VP13	35.244934	-77.682950
VP14	35.243818	-77.682330
VP15	35.241601	-77.684023

Groundwater Monitoring Gauges	Latitude	Longitude
GA1	35.245458	-77.695119
GA2	35.245309	-77.691928
GA3	35.244697	-77.689966
GA4	35.245743	-77.692231
GA5	35.245104	-77.690508
GA6	35.244809	-77.687952
GA7	35.244874	-77.686651

■ Vegetation plots highlighted in yellow were monitored in 2007





EcoScience Corporation

Raleigh, North Carolina

REVISIONS

NO.	DATE	DESCRIPTION

Client:

**NCDENR
ECOSYSTEM
ENHANCEMENT
PROGRAM**

Project:

**WHITELACE
CREEK
STREAM AND
WETLAND
RESTORATION
SITE**
EEP Project No. 420
**LENOIR COUNTY,
NORTH CAROLINA**

Title:

**STREAM AND
WETLAND
SITE
MITIGATION
UNITS**

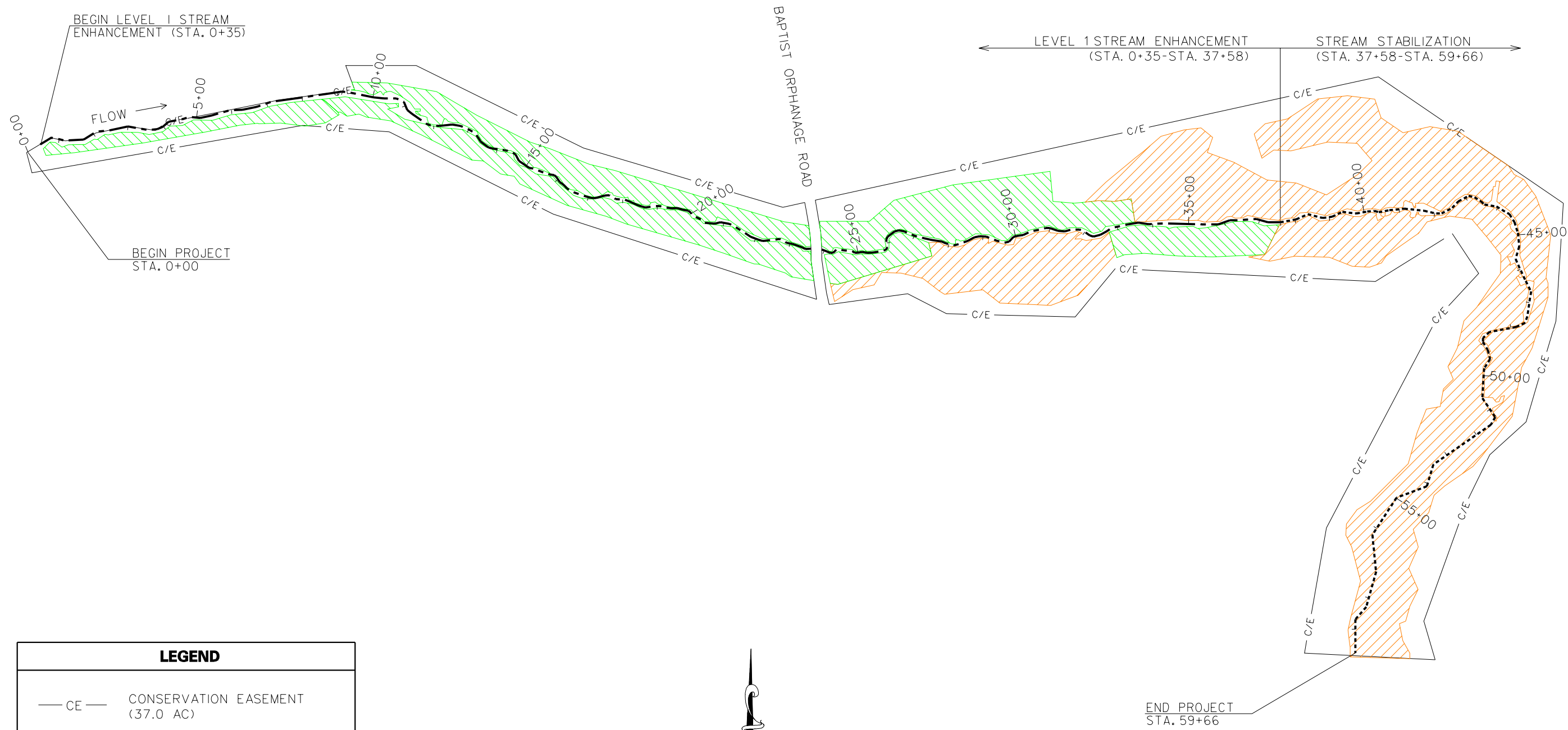
Dwn By: GWN Date: NOV 2006

Ckd By: JWG Scale: AS SHOWN

ESC Project No.: 02-111

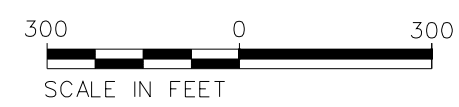
FIGURE

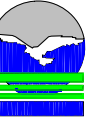
3



LEGEND

- CE — CONSERVATION EASEMENT (37.0 AC)
- RIVERINE WETLAND ENHANCEMENT (13.0 AC)
- RIVERINE WETLAND RESTORATION (7.7 AC)
- - - LEVEL 1 STREAM ENHANCEMENT (3,693 LF)
- STREAM STABILIZATION (2,208 LF)





EcoScience Corporation

Raleigh, North Carolina

REVISIONS

No.	Description

Client:
**NCDENR
 ECOSYSTEM
 ENHANCEMENT
 PROGRAM**

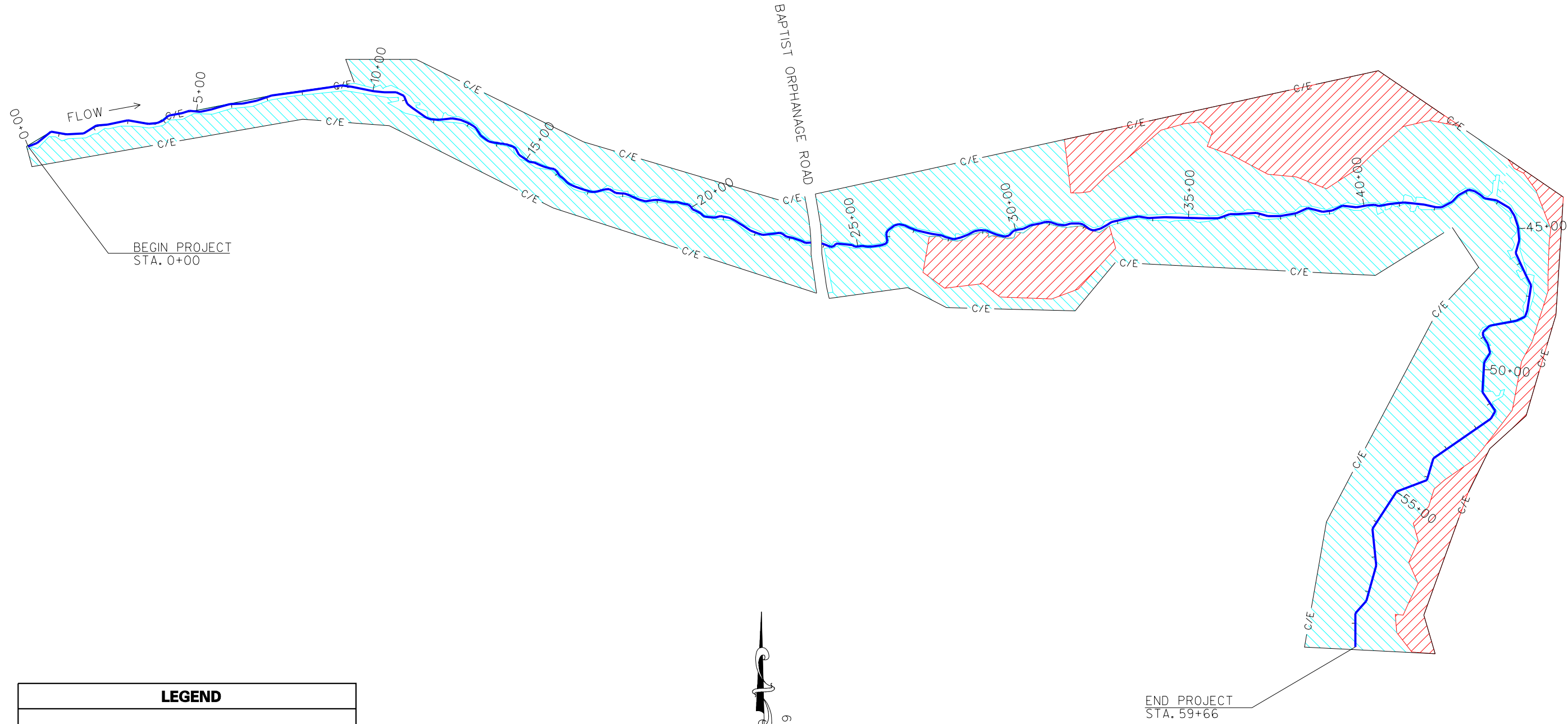
Project:
**WHITELACE
 CREEK
 STREAM AND
 WETLAND
 RESTORATION
 SITE**
EEP Project No. 420
**LENOIR COUNTY,
 NORTH CAROLINA**

Title:
**NEUSE RIVER
 RIPARIAN
 BUFFER SITE
 MITIGATION
 UNITS**

Dwn By: GWN Date: NOV 2006

Ckd By: JWG Scale: AS SHOWN

ESC Project No.: 02-111



LEGEND	
— CE —	CONSERVATION EASEMENT (37.0 AC)
	STREAM CHANNEL
	NEUSE RIVER BUFFER ENHANCEMENT (7.2 AC)
	NEUSE RIVER BUFFER RESTORATION (27.1 AC)



FIGURE

4

Back of 11x17

2.0 Project Condition and Monitoring Results

2.1 VEGETATION ASSESSMENT

Fifteen vegetative sample plots were quantitatively monitored during the first growing season. Species composition, density, and survival were monitored during Year 0 and Year 1. The number of plots was reduced to nine for monitoring in the second year, as requested by NCEEP. These plots include the original plots named VP1, VP2, VP4, VP6, VP8, VP9, VP11, VP14, and VP15. The Carolina Vegetation Survey (CVS) methodology was utilized for vegetative monitoring in Year 2. Level 2 (planted and natural stems) methodology was completed on all the plots except for plots VP3, VP5, VP7, VP10, VP11, VP12 and VP13.

As per the mitigation plan, the vegetative success criteria are based on the US Army Corps of Engineers Stream Mitigation Guidelines (USACE, 2003). The final vegetative success criteria will be the survival of 260 5-year old planted woody stems per acre at the end of the year 5 monitoring period. An interim measure of vegetation planting success will be the survival of at least 320 3-year old planted woody stems per acre at the end of year 3 of the monitoring period.

The Year 2 stem counts within each of the nine vegetative monitoring plots are included in Exhibit Tables A1 through A5 in Appendix A1. Photos of the vegetative monitoring plots are included in Appendix A3. Stems per acre for each of the nine plots are reported in Table A5-A of Appendix A1.

2.1.1 Vegetation Problem Areas

Monitoring revealed that 3 of the 9 plots (33%) met the 3-year vegetative success criteria of 320 planted stems or greater per acre. There are a number of issues causing the failure of the remaining 6 plots. There was a relatively low number of healthy plant species in vegetation plots 1 through 5, likely due to previous heavy flooding in 2006 as noted in the Year 1 monitoring report. In 2007, the higher areas onsite have been adversely affected by an extreme drought while the lower areas onsite have been flooded by beaver activity. Other problems included the presence of invasive or exotic species such as *Typha latifolia*, *Murdannia keisak*, and *Persicaria sagittata*. *Persicaria* is currently causing problems with vegetation vigor and survival and should be controlled. *Typha* and *Murdannia* will be watched throughout the monitoring period to ensure that they do not start causing harm to the planted species. See Exhibit Table A6 in Appendix A1, as well as accompanying photos provided in Appendix A2. It should be noted that there were a large number of river birch and silverling volunteers throughout the site. The major issue affecting the poor performance of the vegetation on the site is the localized flooding caused by beaver activity. The beavers should be removed, thereby allowing the site hydrology to return to a conditions outlined in the restoration plan. However, beaver activity is likely to continue. Therefore, the site should be replanted with trees of appropriate species and size to withstand periodic inundation.

2.1.2 Vegetation Current Condition Plan View

Vegetative problem areas are shown on the Current Condition Plan View in Appendix D.

2.2 STREAM ASSESSMENT

Changes in stream profile and pattern were not included in the stream enhancement project for Whitelace Creek. As such, cross-section and longitudinal profile surveys and pebble were not performed for the Year 2 monitoring, as directed by NCEEP. However, a general assessment of stream stability was performed during field reconnaissance. Additionally, the crest gauge on-site was checked.

Field reconnaissance noted that the stream is an E type channel (Rosgen Classification) which is common in the coastal plain, with a low width-to-depth ratio and flat slopes (Appendix B4, Photo 1). The stream has excellent connection to the floodplain, with bank height ratio being approximately one. The channel shows signs of past straightening, but all banks are stable with little to no signs of bank erosion over the entire stream reach. In a few sections (mostly downstream) the stream has developed several mid-channel bars which are well vegetated (Appendix B4, Photo 2). This would indicate that the channel width is too wide in these areas. Mid-channel bars in some instances can lead to lateral migration and bank instability. However, with the abundance of bank vegetation and low flows there are currently no signs of instability. These areas should be monitored in the future.

During field reconnaissance, an abundance of different species of mussels were observed in the stream at the upstream end of the project site.

The crest gauge was checked during two site visits to Whitelace Creek in September and November of 2007 (Appendix B4, Photo 4). The September visit indicated that an overbank event had occurred since the last visit. In November, the water level was above bankfull, likely due to beaver activity near the crest gauge. In addition, the water level across the site rose throughout the Year 2 monitoring period. Since North Carolina has been in an extreme drought throughout this time it is likely that the overall rise in hydrology can be attributed to beaver activity downstream.

2.3 WETLAND ASSESSMENT

2.3.1 Current Condition Plan View

The plan view of the wetland problem areas is in Appendix D.

2.3.2 Wetland Criteria Attainment

A site is considered to meet the requirements for wetland hydrology if the groundwater saturation is within 12 inches of the ground surface consecutively for 12.5% of the growing season. Seven groundwater monitoring gauges are currently active on the project site. Five of the gauges met the criteria during the growing season of 2007, but two did not. The growing season in this area is from March 18th to November 8th for a total of 234 days (NRCS 2002). Gauge 4 had a maximum of 15 consecutive days (6%) where the ground was saturated within 12 inches of the surface. Gauge 2 had a maximum of 17 days (7%). It should be noted that Gauge 2 malfunctioned and data after September 6, 2007 was not obtained. A new gauge will be placed onsite as soon as possible and the old gauge brought back for possible data retrieval.

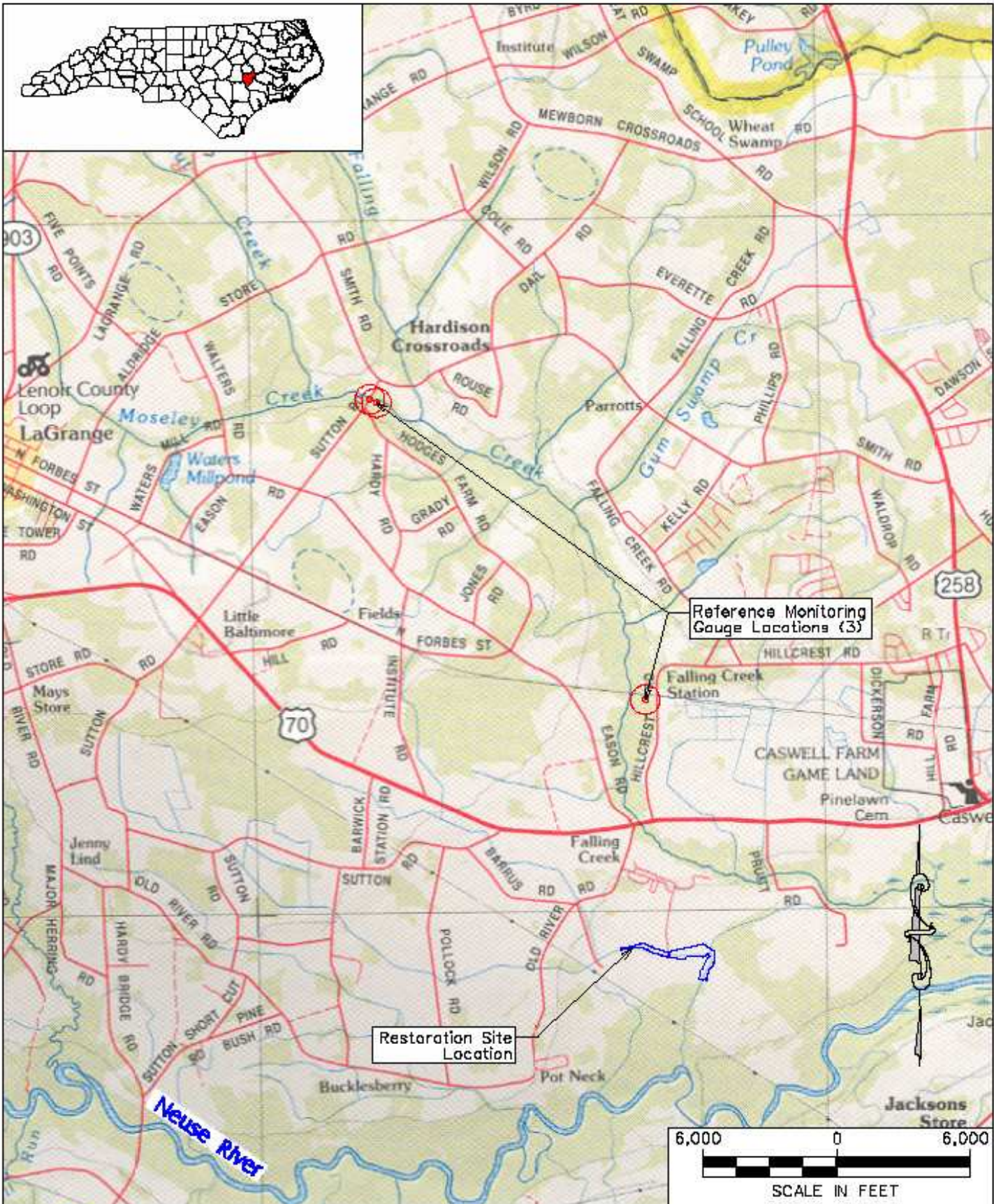
Three reference gauges are located northwest of the project site. Reference gauges 1 & 2 are located near the intersection of Sutton Road with Moseley Creek. Reference gauge 3 is located between Hillcrest Road and Moseley Creek, approximately 5500 feet north of Route 70 (Figure 5). Exhibit Table VI includes the latitude and longitude coordinates for the three reference gauges.

Groundwater Reference Gauges	Latitude	Longitude
RW1	35.313311	77.731836
RW2	35.313736	77.732833
RW3	35.276123	77.691827

All three reference gauges met the success criteria of saturation within 12 inches for 12.5% or of the growing season in 2007. Drought conditions did not appear to have a great effect on these gauges meeting the criteria. Reference gauge 1 decreased from 70 to 45 days of consecutive saturation from 2006 to 2007. Gauges 2 and 3 actually increased in the number of consecutive days of saturation between 2006 and 2007. Reference gauge 2 increased from 70 to 93 consecutive days, while gauge 3 increased from 70 to 159 days.

Tract	Well ID	Well Hydrology Threshold Met?	Tract Mean	Vegetation Plot ID	Vegetation Density Met (320 stems/acre)	Tract Mean
Site	1	Y	71%	VP1	N (162)	30%
	2	N		VP2	N (162)	
	3	Y		VP4	Y (445)	
	4	N		VP6	N (162)	
	5	Y		VP8	Y (445)	
	6	Y		VP9	Y (405)	
	7	Y		VP11	N (81)	
Reference	Ref Site 1	Y	100%	VP14	N (81)	(238 stems/acre)
	Ref Site 2	Y		VP15	N (202)	
	Ref Site 3	Y				

While all of the reference gauges succeeded, the failure of 2 of the 7 on-site gauges to meet the criteria for wetland hydrology is not cause for significant concern. As shown in the Graph on Page C11, data from the nearest meteorological station indicates that precipitation was below the 30% percentile for the area. The area experienced an extreme drought during 2007. With normal precipitation, the gauges should meet the criteria.



Project:
**REFERENCE GROUNDWATER MONITORING GAUGE LOCATIONS
 WHITELACE CREEK STREAM AND WETLAND RESTORATION SITE**
 EIP Project No. 422
 LENOIR COUNTY, NORTH CAROLINA

Drawn By:	GWN	Checked By:	JWG
Date:	NOV 2006		
Scale:	AS SHOWN		
ESC Project No.:	02-111		

FIGURE
5

3.0 References

Harrelson, C.C., C.L. Rawlins and J.P. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. United States Department of Agriculture, Fort Collins, CO.

Lee, Michael 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>)

NCEEP. 2005. Content, Format and Data Requirements for EEP Monitoring Reports. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 1.2 November 16, 2006.

NRCS. 2002. WETS Table for Lenoir County, NC. Natural Resource Conservation Service, National Water and Climate Center.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and surrounding areas. University of North Carolina Herbarium. Chapel Hill, NC. Working draft of January 11, 2007.

Appendix A. Vegetation Raw Data

A.1 VEGETATION DATA TABLES

EXHIBIT TABLE A1. VEGETATION METADATA	
database name	Whitelace_CVS_EEP_EntryTool_v220.mdb
database location	U:\171300168
computer name	COLEMANA
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	This worksheet, which is a summary of the project and the project data.
Proj, planted	Each project is listed with its PLANTED stems, for each year. This excludes live stakes and lists stems per acre.
Proj, total stems	Each project is listed with its TOTAL stems, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems. Listed in stems per acre.
Plots	List of plots surveyed.
Vigor	Frequency distribution of vigor classes.
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	Count of planted living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY	
Project Code	420
project Name	Whitelace Creek
Description	Wetland Restoration and Enhancement
River Basin	Neuse
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	9

EXHIBIT TABLE A2. VEGETATION VIGOR BY SPECIES

Species	4	3	2	1	0	Missing
<i>Betula nigra</i>		1				
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>		1	1			
<i>Carya aquatica</i>		1	1			
<i>Chamaecyparis thyoides</i>	1	2				3
<i>Cephalanthus occidentalis</i>	1					
<i>Cornus amomum</i>	2	4	3			3
<i>Liriodendron tulipifera</i> var. <i>tulipifera</i>				2		2
<i>Platanus occidentalis</i> var. <i>occidentalis</i>	1	1	1			1
<i>Quercus laurifolia</i>	1	1				
<i>Quercus lyrata</i>	1	3	1			
<i>Quercus nigra</i>	1					1
<i>Quercus pagoda</i>		1				
<i>Quercus phellos</i>		5				1
<i>Salix sericea</i>		1	5	2	2	

EXHIBIT TABLE A3. VEGETATION DAMAGE BY SPECIES

Species	All Damage Categories						
	(no damage)	Insects	Site Too Dry	Site Too Wet	Unknown		
<i>Betula nigra</i>	1	1					
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	2	2					
<i>Carya aquatica</i>	2	1	1				
<i>Chamaecyparis thyoides</i>	6	3					3
<i>Fraxinus pennsylvanica</i>	4	4					
<i>Liriodendron tulipifera</i> var. <i>tulipifera</i>	2			2			
<i>Nyssa biflora</i>	8	7					1
<i>Platanus occidentalis</i> var. <i>occidentalis</i>	1	1					
<i>Quercus</i>	2	1					1
<i>Quercus laurifolia</i>	4	2		2			
<i>Quercus lyrata</i>	2	2					
<i>Quercus michauxii</i>	3	2					1
<i>Quercus pagoda</i>	3	1		1			1
<i>Quercus phellos</i>	2	2					
<i>Taxodium distichum</i>	15	12				2	1
<i>Ulmus americana</i> var. <i>americana</i>	1		1				
Unknown	1		1				
TOT: 17	59	41	1	2	5	2	8

EXHIBIT TABLE A4. VEGETATION DAMAGE BY PLOT

Plot	All Damage Categories						
	(no damage)	Insects	Site Too Dry	Site Too Wet	Unknown		
WL-Amber-0001-year:2	4	4					
WL-Amber-0002-year:2	6	4					2
WL-Amber-0004-year:2	12	10					2
WL-Amber-0006-year:2	4	3					1
WL-Amber-0008-year:2	13	9	1	1			2
WL-Amber-0009-year:2	11	10		1			
WL-Amber-0011-year:2	2					2	
WL-Amber-0014-year:2	2	1					1
WL-Amber-0015-year:2	5				5		
TOT: 9	59	41	1	2	5	2	8

EXHIBIT TABLE A5-A. PLANTED STEMS BY PLOT AND SPECIES

Species	Total Planted Stems			Plot									
	# plots	avg# stems		WL-Amber-0001-year:2	WL-Amber-0002-year:2	WL-Amber-0004-year:2	WL-Amber-0006-year:2	WL-Amber-0008-year:2	WL-Amber-0009-year:2	WL-Amber-0011-year:2	WL-Amber-0014-year:2	WL-Amber-0015-year:2	
<i>Betula nigra</i>	1	1	1	1									
<i>Carpinus caroliniana</i> var. <i>caroliniana</i>	2	2	1	1	1								
<i>Carya aquatica</i>	2	2	1				1	1					
<i>Chamaecyparis thyoides</i>	3	2	1.5		2			1					
<i>Fraxinus pennsylvanica</i>	4	3	1.33	1	1		2						
<i>Liriodendron tulipifera</i> var. <i>tulipifera</i>	2	1	2									2	
<i>Nyssa biflora</i>	6	4	1.5	1		3		1	1				
<i>Platanus occidentalis</i> var. <i>occidentalis</i>	1	1	1	1									
<i>Quercus</i>	2	2	1		1	1							
<i>Quercus laurifolia</i>	4	3	1.33			1	1					2	
<i>Quercus lyrata</i>	2	2	1		1			1					
<i>Quercus michauxii</i>	3	3	1			1	1	1					
<i>Quercus pagoda</i>	3	3	1	1			1					1	
<i>Quercus phellos</i>	2	2	1		1	1							
<i>Taxodium distichum</i>	15	7	2.14	2		1	1	4	3	2	2		
<i>Ulmus americana</i> var. <i>americana</i>	1	1	1				1						
TOT: 16	53	16		4	4	11	4	11	10	2	2	5	
Stems per acre				162	162	445	162	445	405	81	81	202	

A.2 VEGETATION PROBLEM AREA PHOTOS



Photo 1. *Typha latifolia* has invaded the floodplain on the left bank upstream of Veg Plot 9, presumably in response to beaver induced flooding (7/31/07)



Photo 2. *Persicaria sagittata* is out competing planted woody species at Veg Plot 13 (7/31/07)



Photo 3. *Murdannia keisak* is competing with desired herbaceous species at Veg Plot 11 (7/31/07)



Photo 4. Flooding, dead planted tree and *Murdannia keisak* at Veg Plot 11 (9/23/07)



Photo 5. The stream channel is choked with *Persicaria* near Veg Plot 14 (looking downstream, 7/31/07).



Photo 6. At Veg Plot 1 there was limited planted vegetation found on floodplain – probably due to previous flood events. On the face of the slope up to the original ground elevation, the planted vegetation was doing better. (Stream is on left side of photo, 7/31/07)



Photos 7/8. Looking downstream from the bridge (upper photo, 7/31/07) and (lower photo 11/16/07).
Flooding likely due to beaver activity downstream.

A.3 VEGETATION MONITORING PLOT PHOTOS



Photo Station 1: Vegetation Plot 1 (9/18/07)



Photo Station 2: Vegetation Plot 2 (9/18/07)



Photo Station 3: Vegetation Plot 4 (9/18/07)



Photo Station 4: Vegetation Plot 6 (9/18/07)



Photo Station 5: Vegetation Plot 8 (9/18/07)



Photo Station 6: Vegetation Plot 9 (9/18/07)



Photo Station 7: Vegetation Plot 11 (9/18/07)



Photo Station 8: Vegetation Plot 14 (9/18/07)



Photo Station 9: Vegetation Plot 15 (9/18/07)

Appendix B. Geomorphologic Raw Data

B.1 CURRENT CONDITION PLAN VIEW (STREAM)

The stream was only assessed visually during Monitoring Year 2. Problem areas were not found.

B.2 STREAM PROBLEM AREAS TABLE

Stream Problem Areas were not found.

B.3 REPRESENTATIVE STREAM PROBLEM AREAS PHOTOS

Stream Problem Areas were not found.

B.4 REPRESENTATIVE STREAM PHOTOS



Photo 1. Looking upstream at crest gauge location (7/31/07).



Photo 2. Looking downstream near station 10+00 (7/31/07). Note formation of mid-channel bars. Stand of trees is near vegetation plot 4.

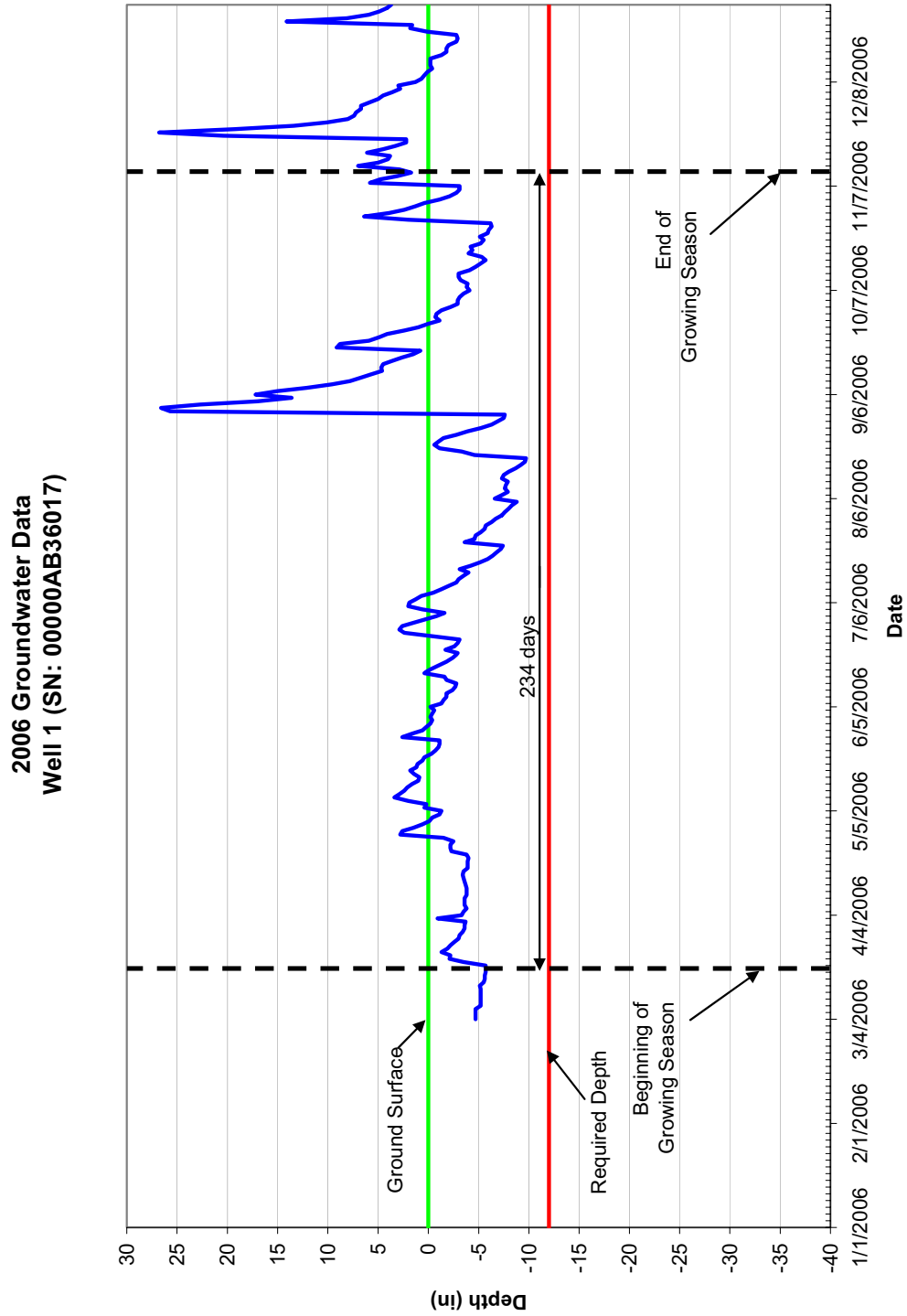


Photo 3. Flooding downstream of road near Veg Plot 7 - looking downstream (11/16/07)

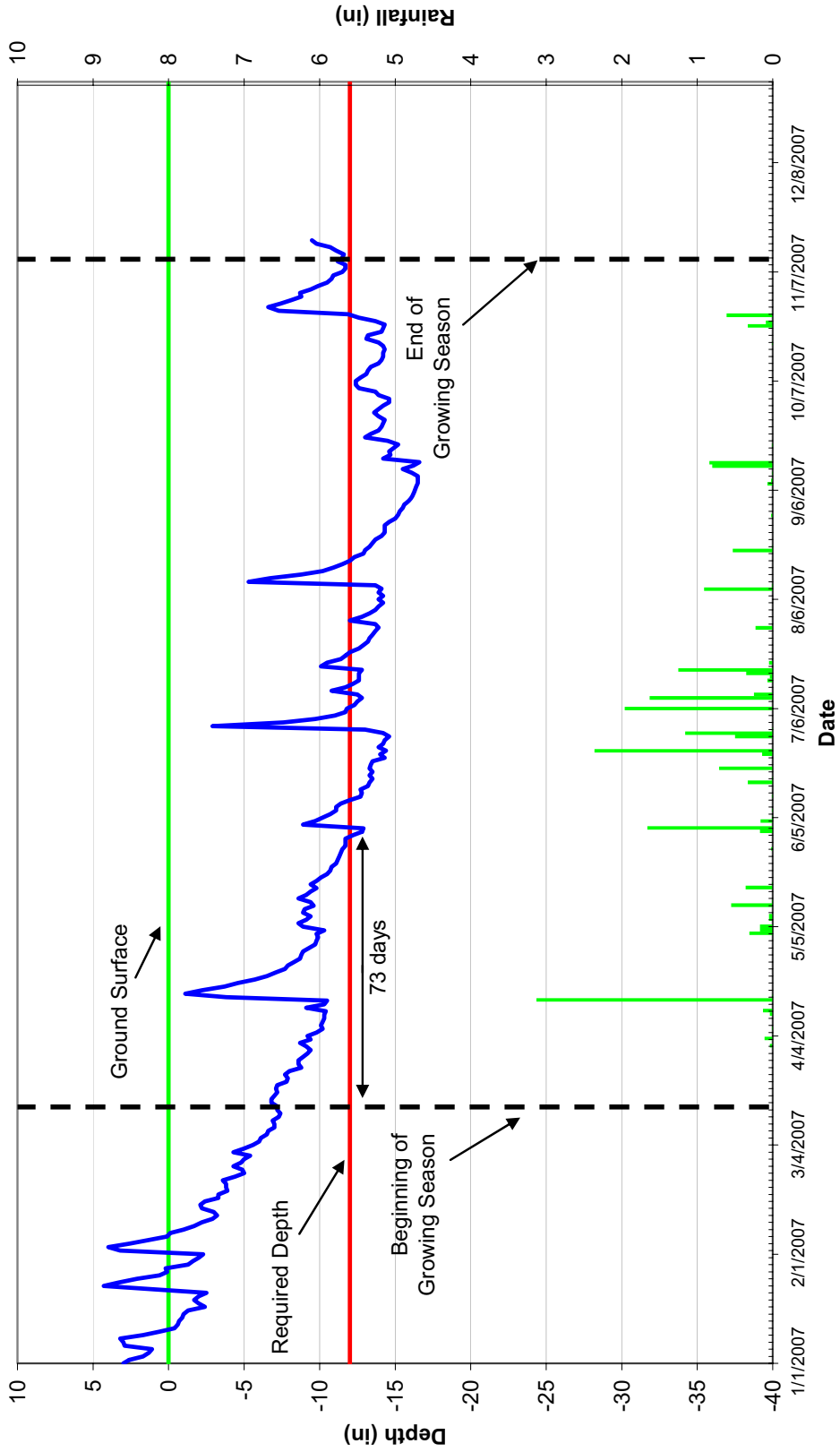


Photo 4. Crest gauge showing water above bankfull (11/16/07)

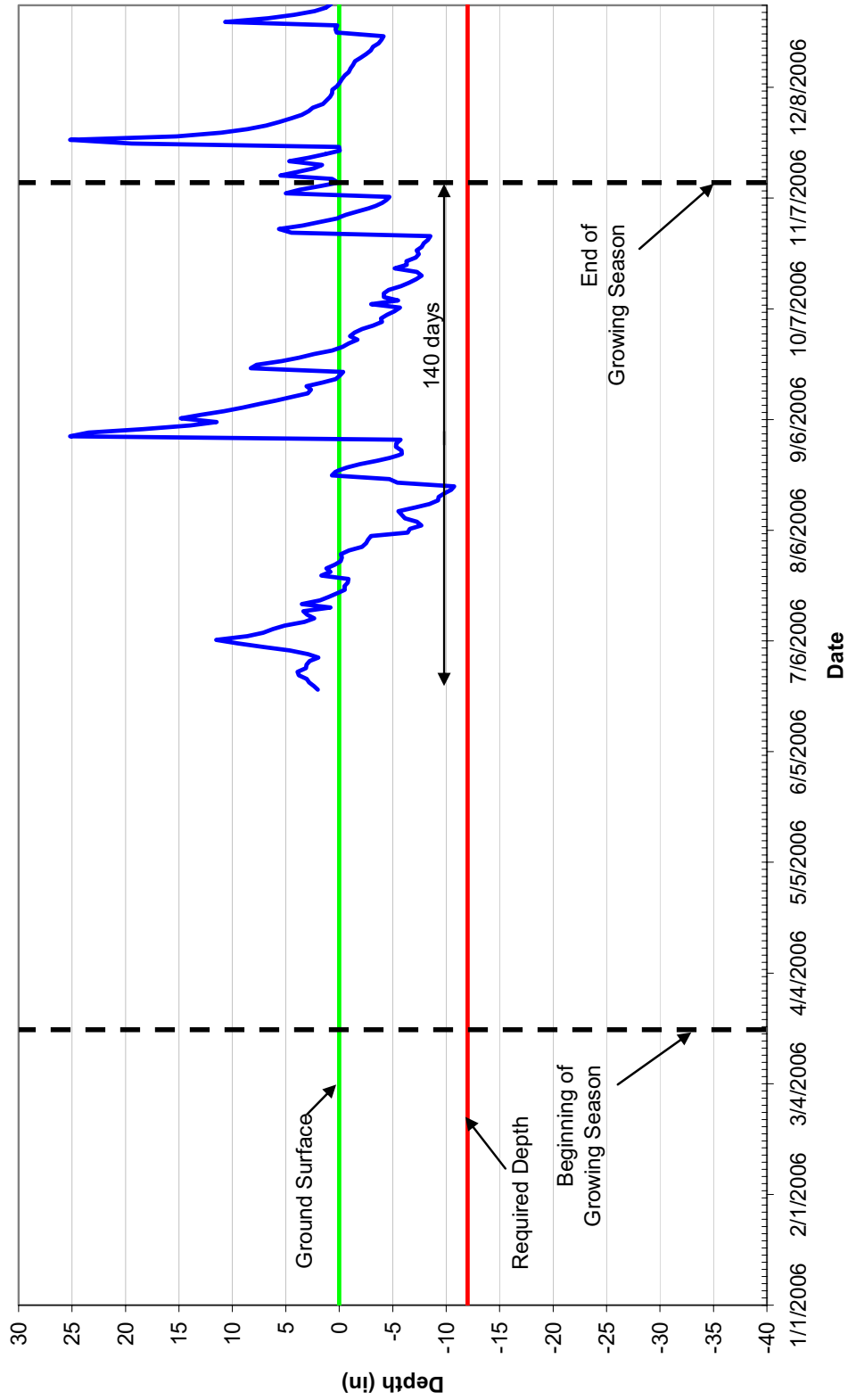
Appendix C. Hydrology Data



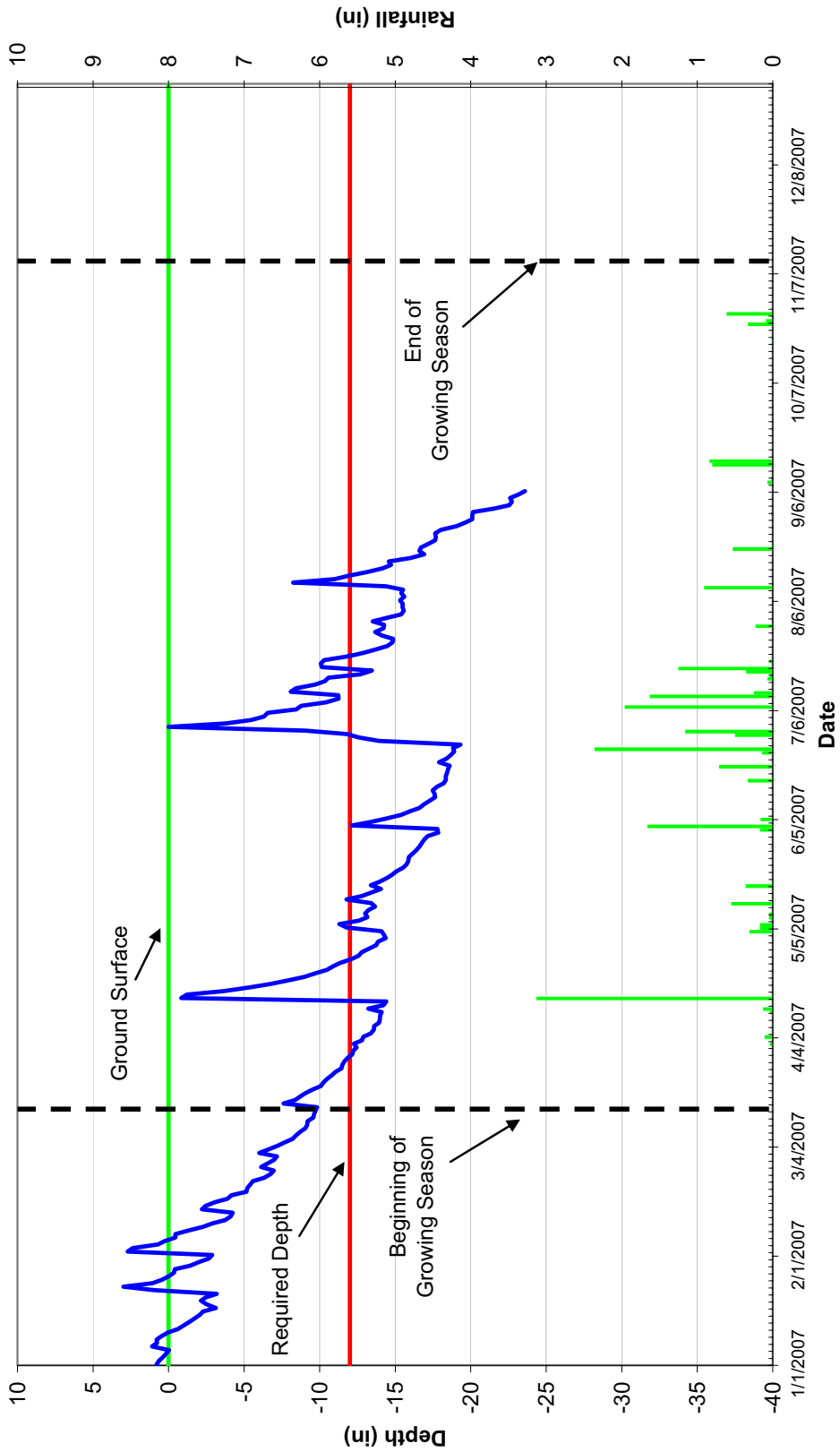
2007 Groundwater Data
Well 1 (SN: 00000AB36017)



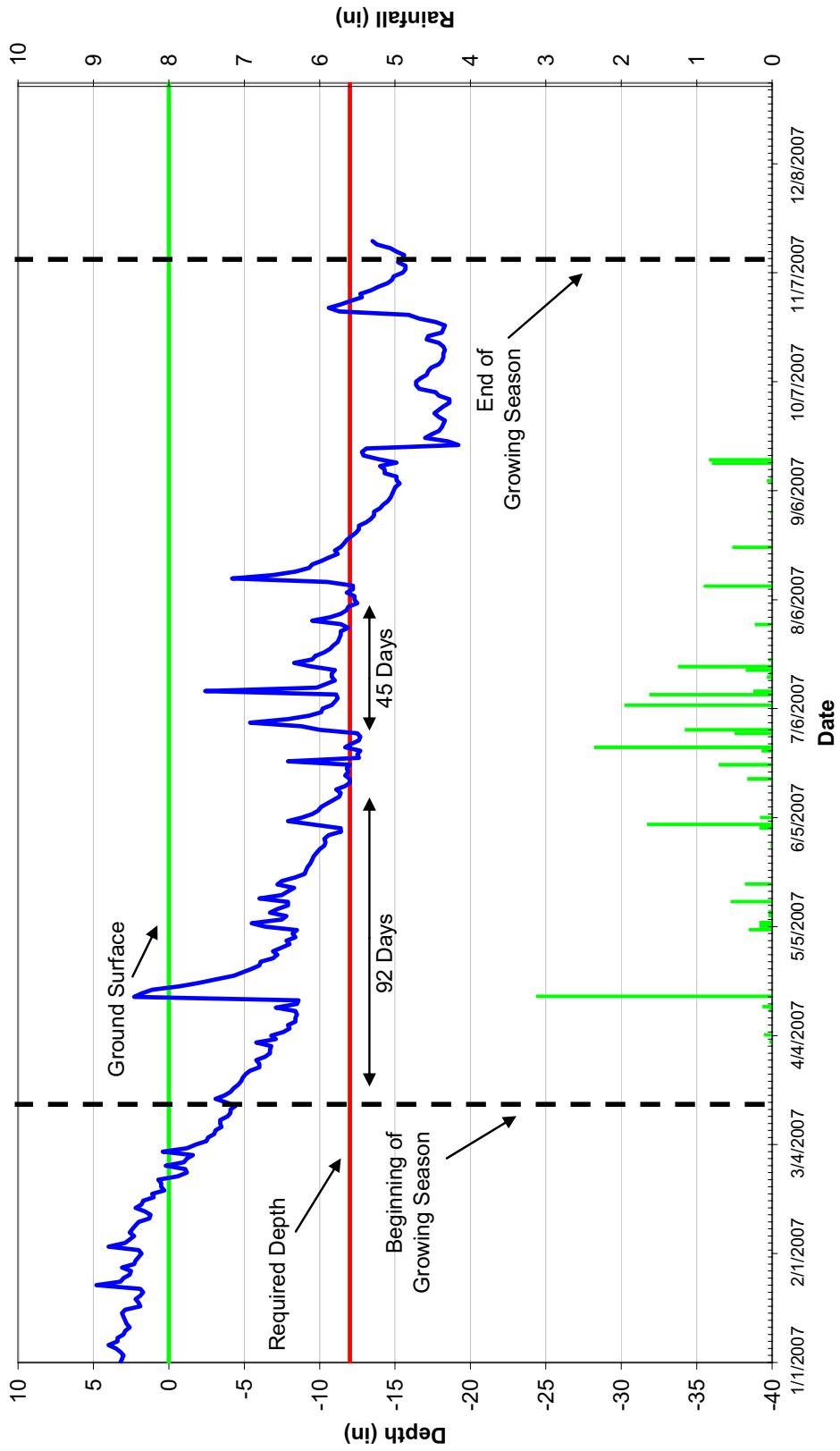
2006 Groundwater Data
Well 2 (SN: N3D45EA7)



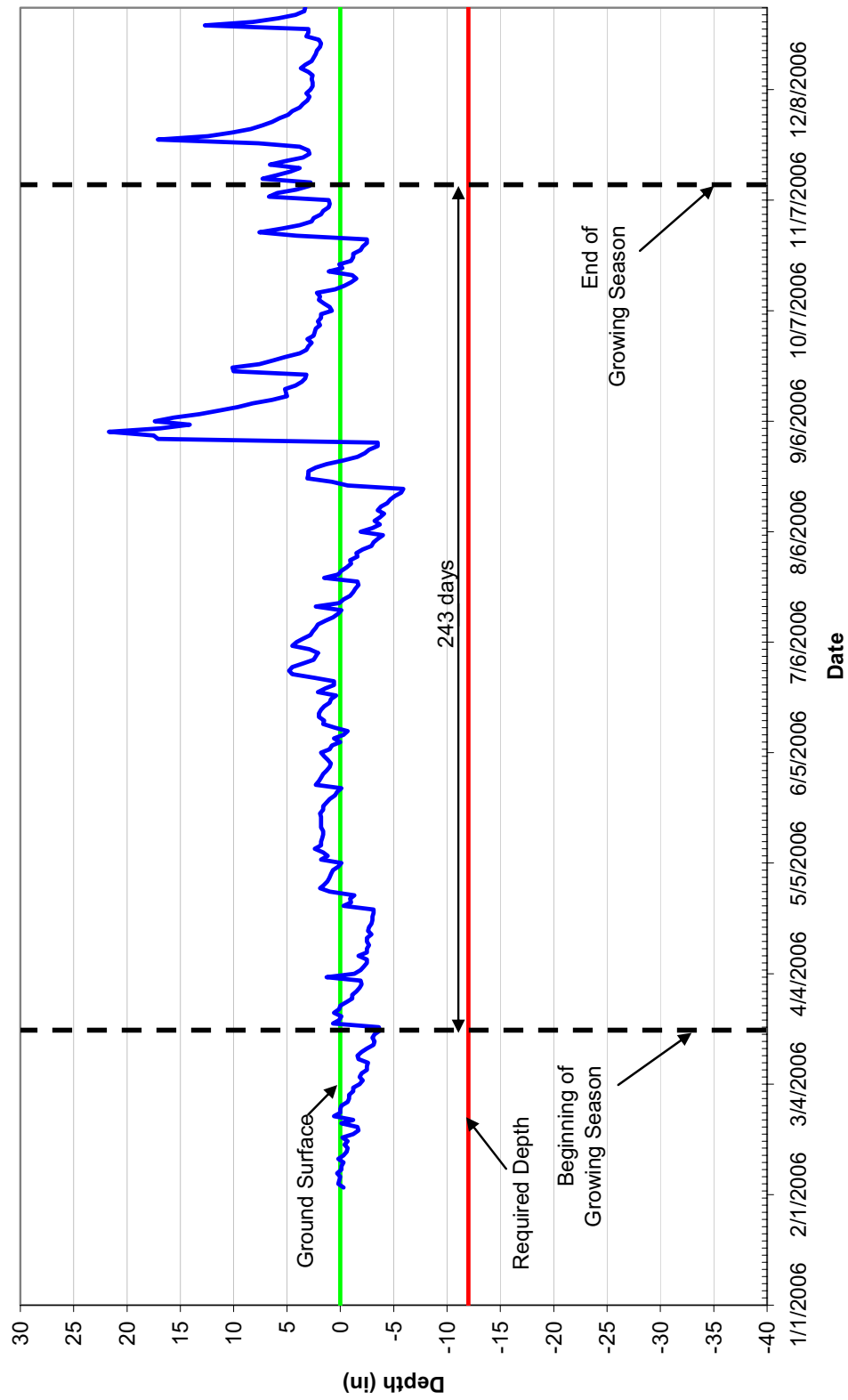
2007 Groundwater Data
Well 2 (SN: N3D45EA7)



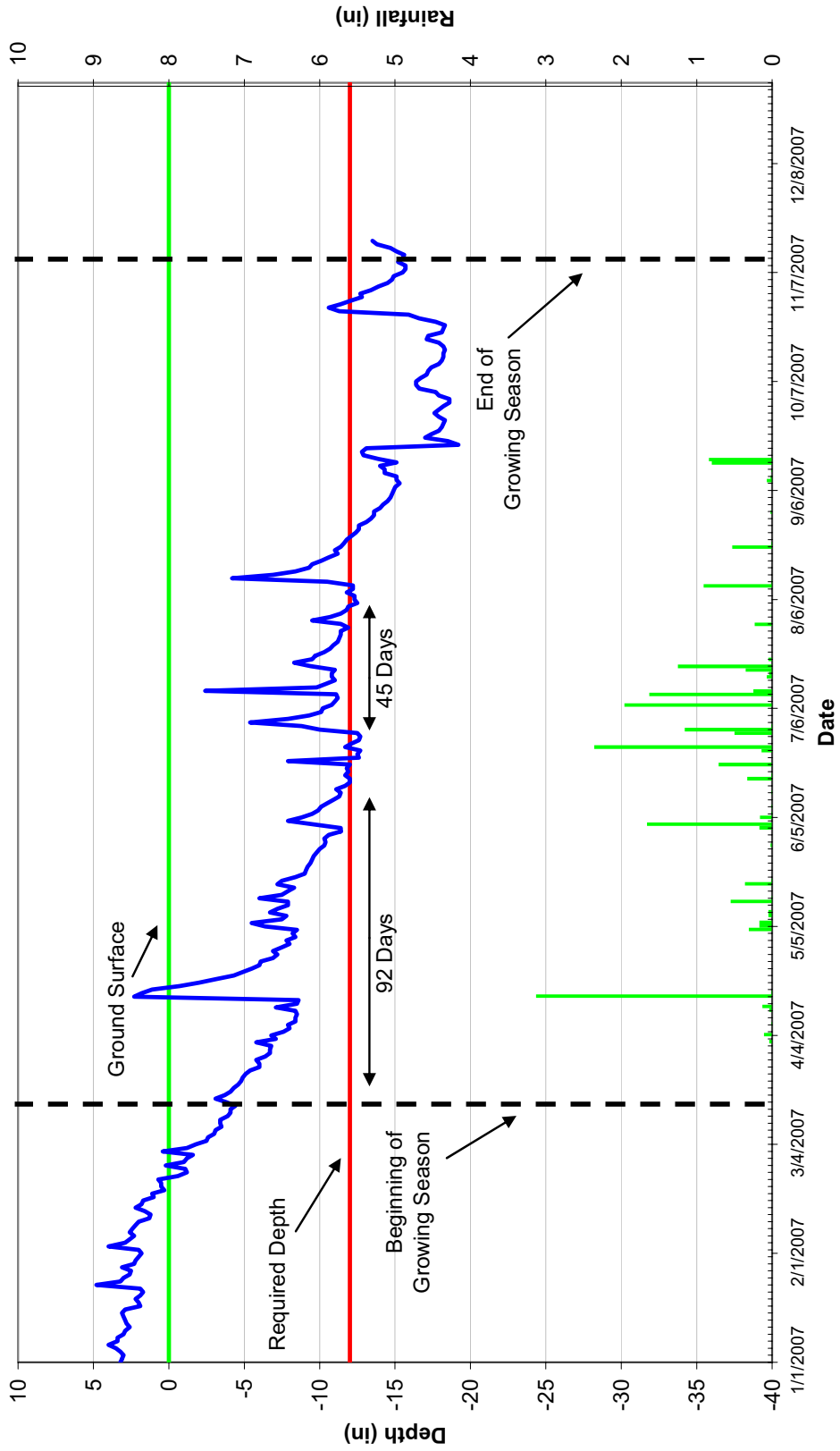
2007 Groundwater Data
Well 3 (SN: 00000A287A2A)



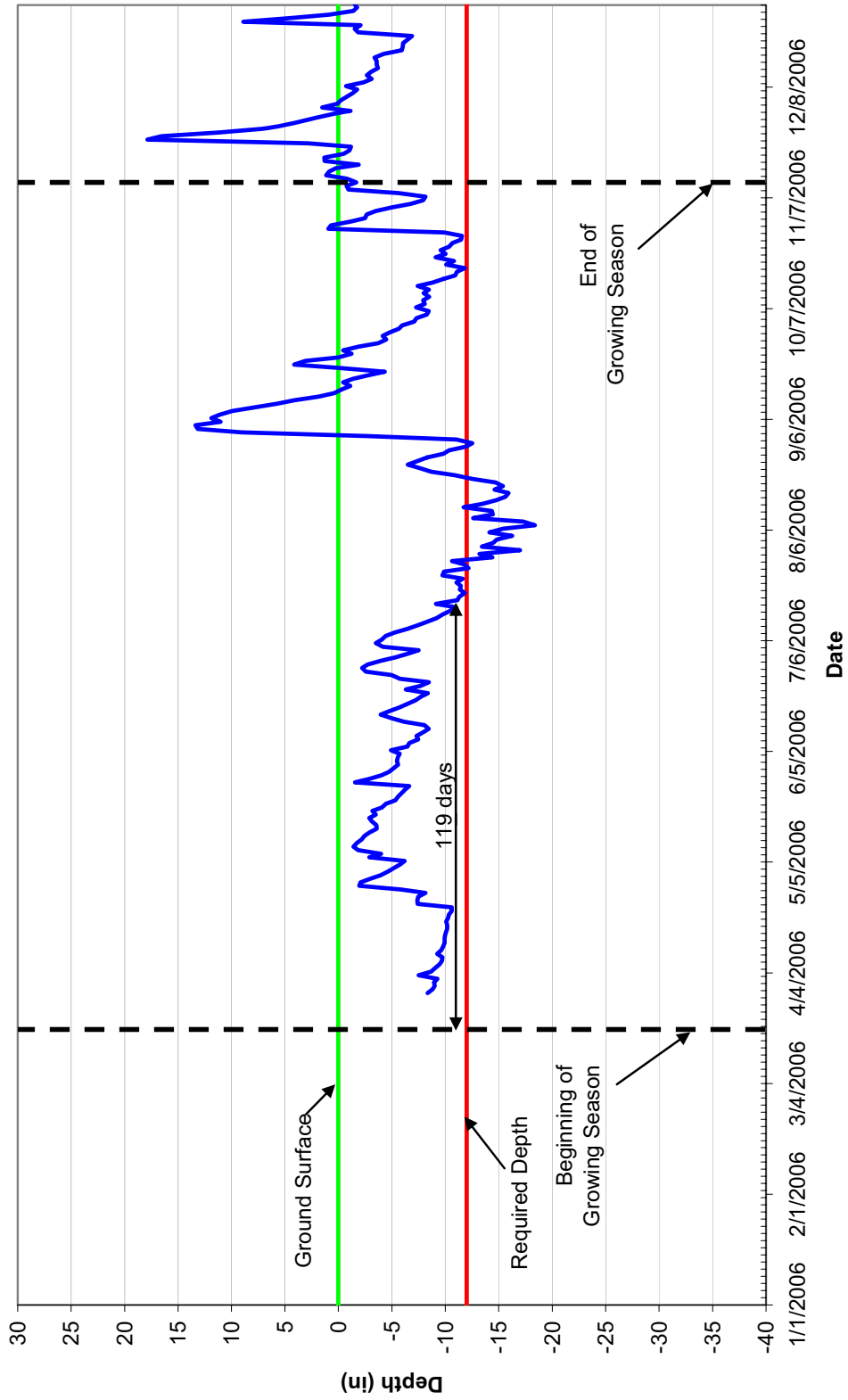
2006 Groundwater Data
Well 3 (SN: 00000A287A2A)



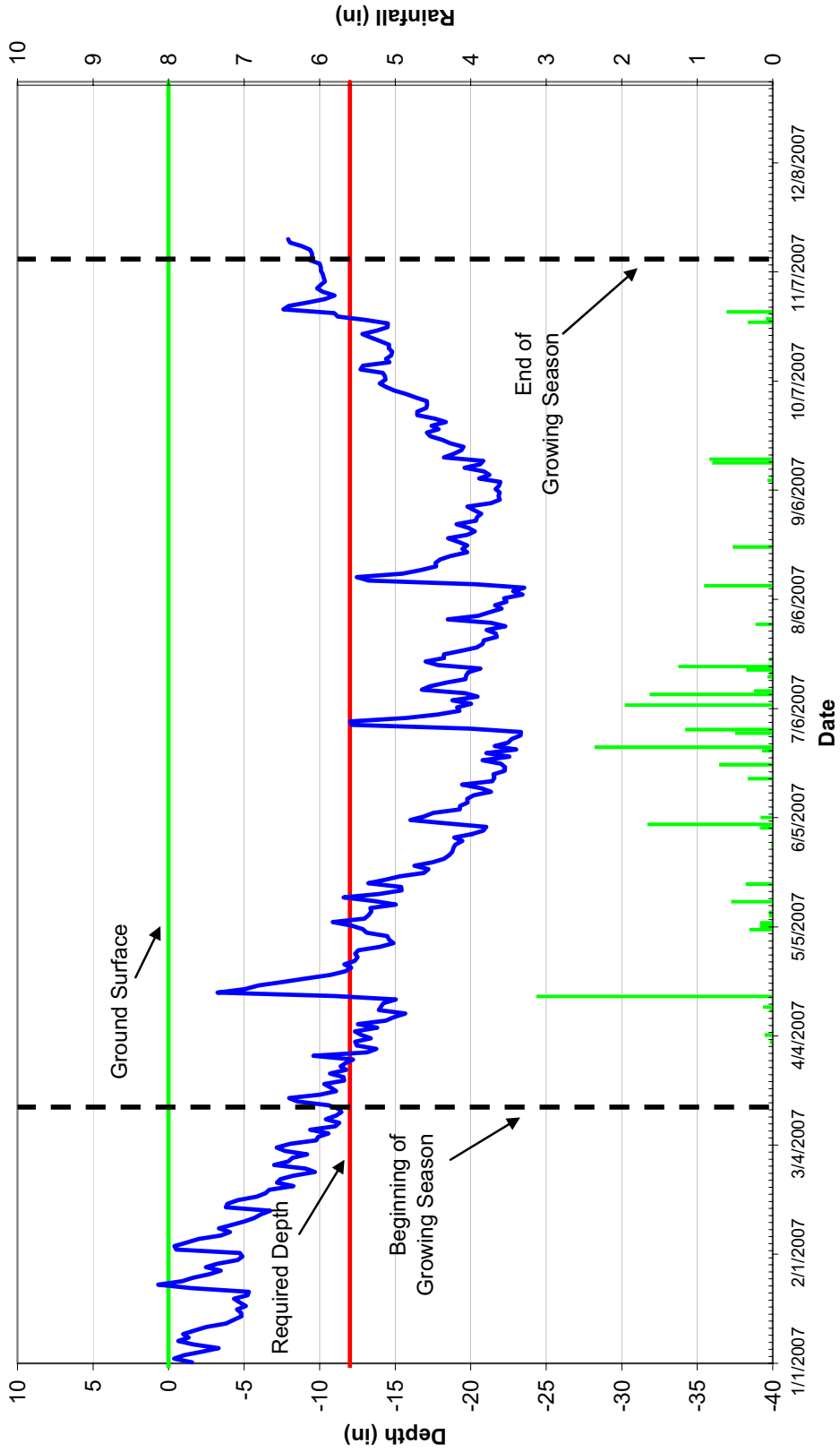
2007 Groundwater Data
Well 3 (SN: 00000A287A2A)



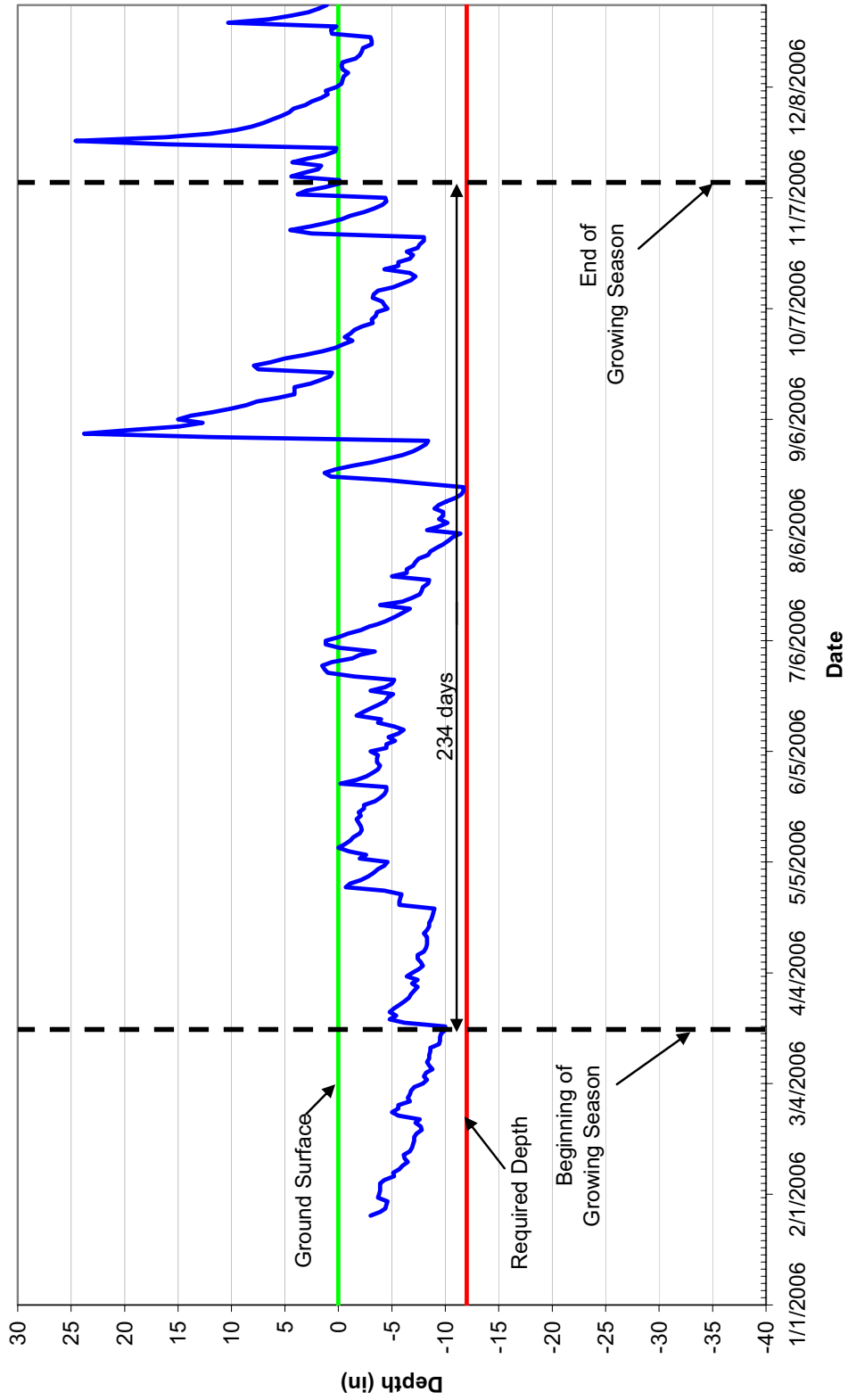
2006 Groundwater Data
Well 4 (SN: N3D45F5A)



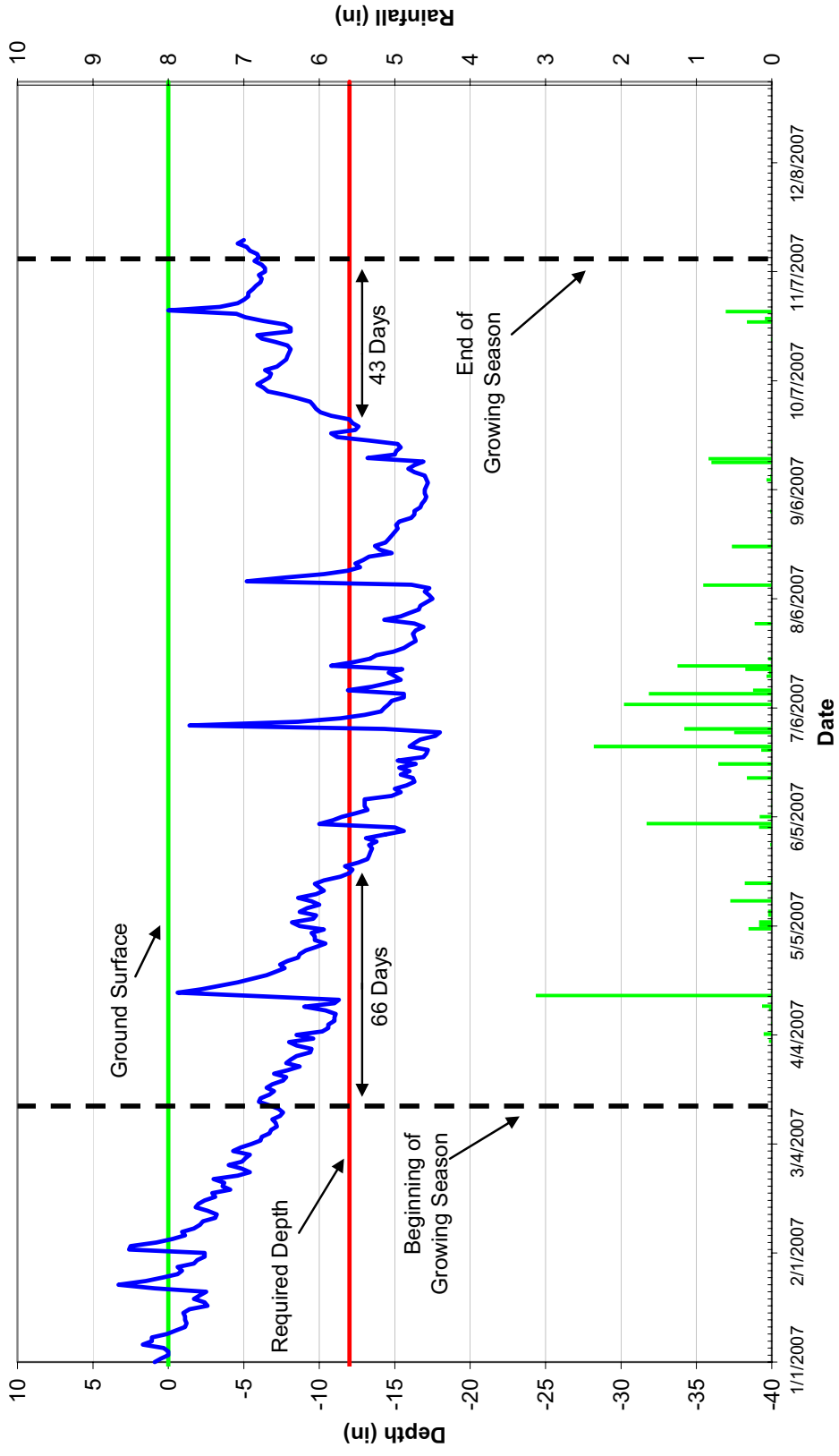
2007 Groundwater Data
Well 4 (SN: N3D45F5A)



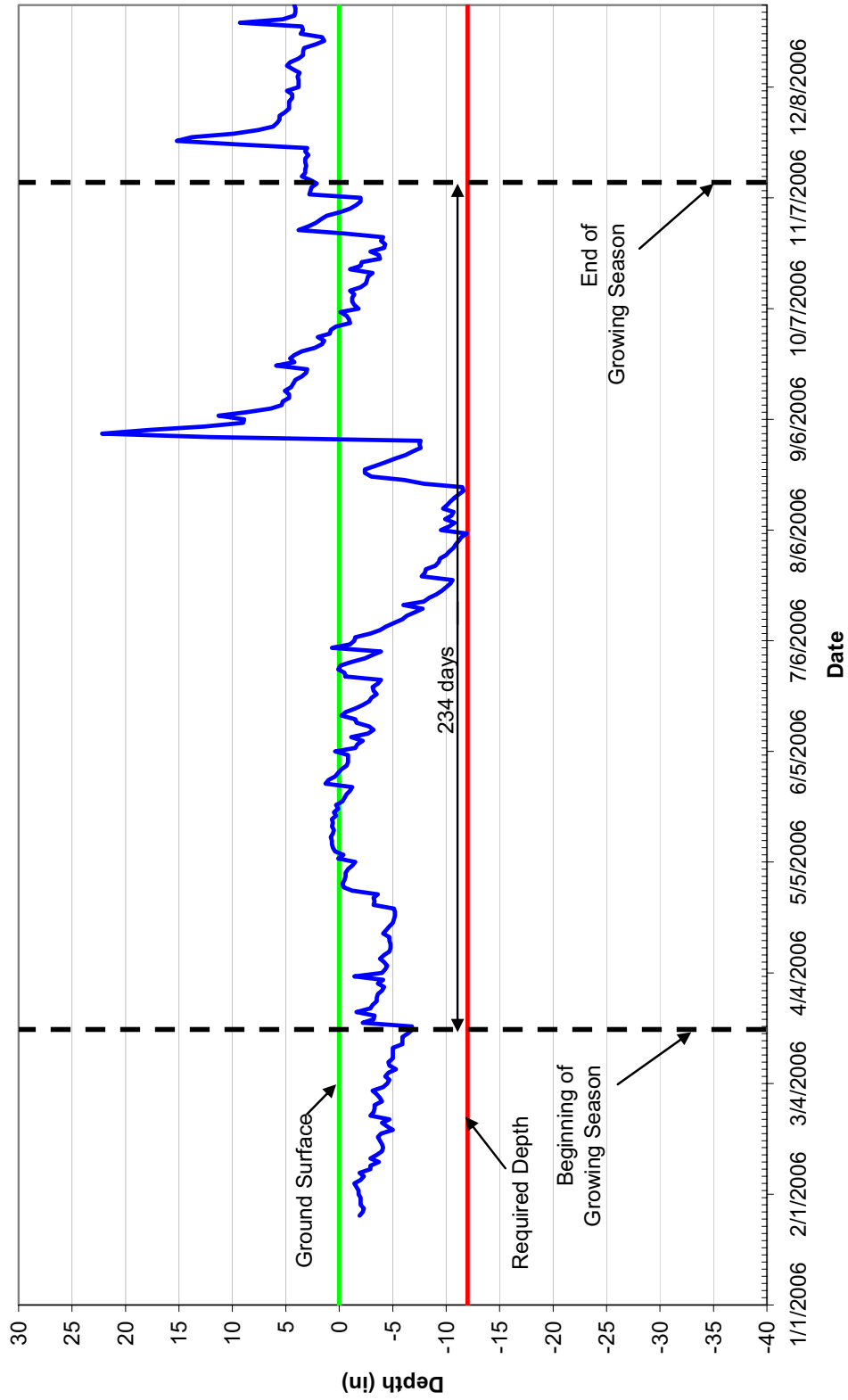
2006 Groundwater Data
Well 5 (SN: 00000A27B888)



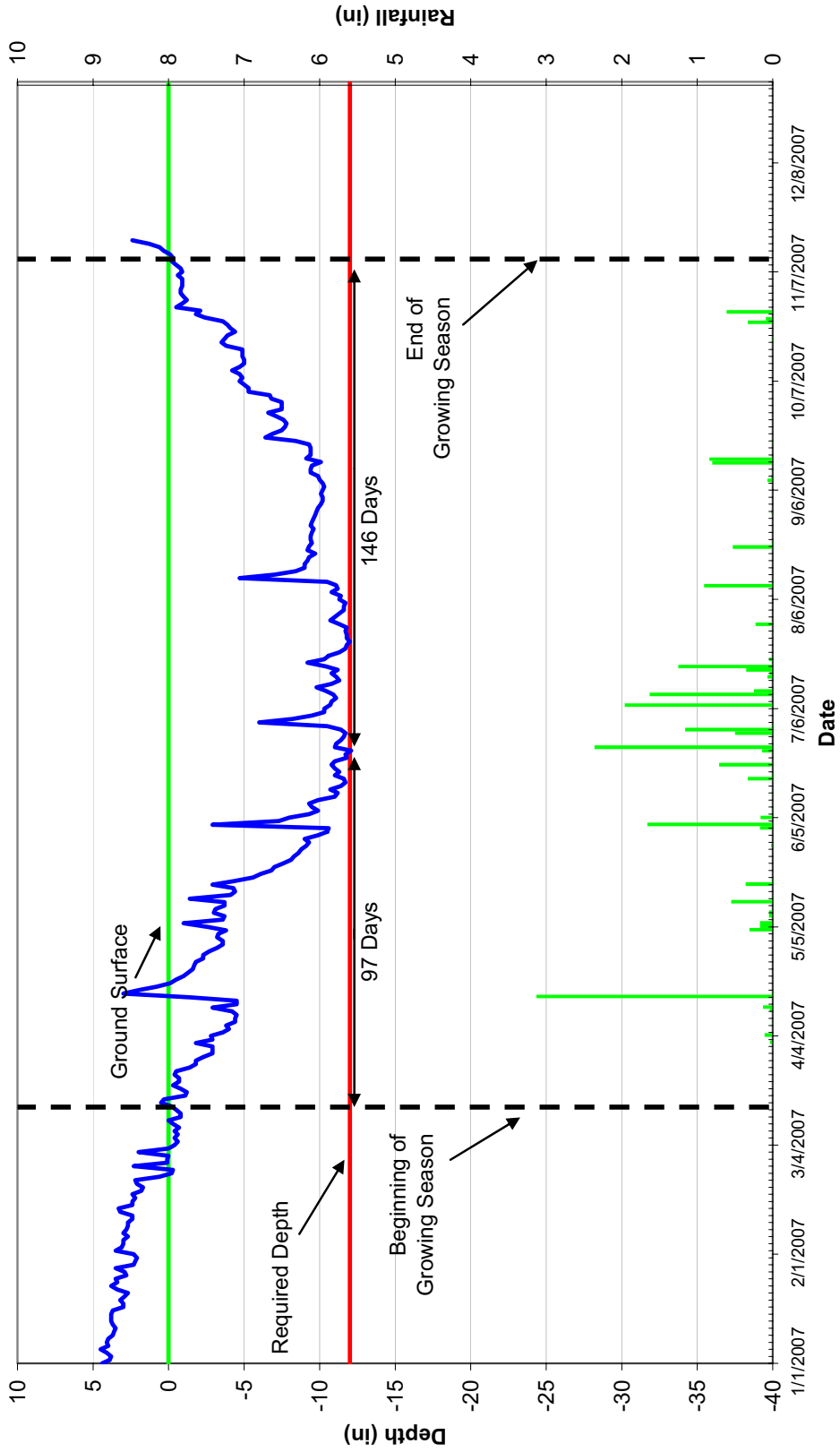
2007 Groundwater Data
Well 5 (SN: 00000A27B888)



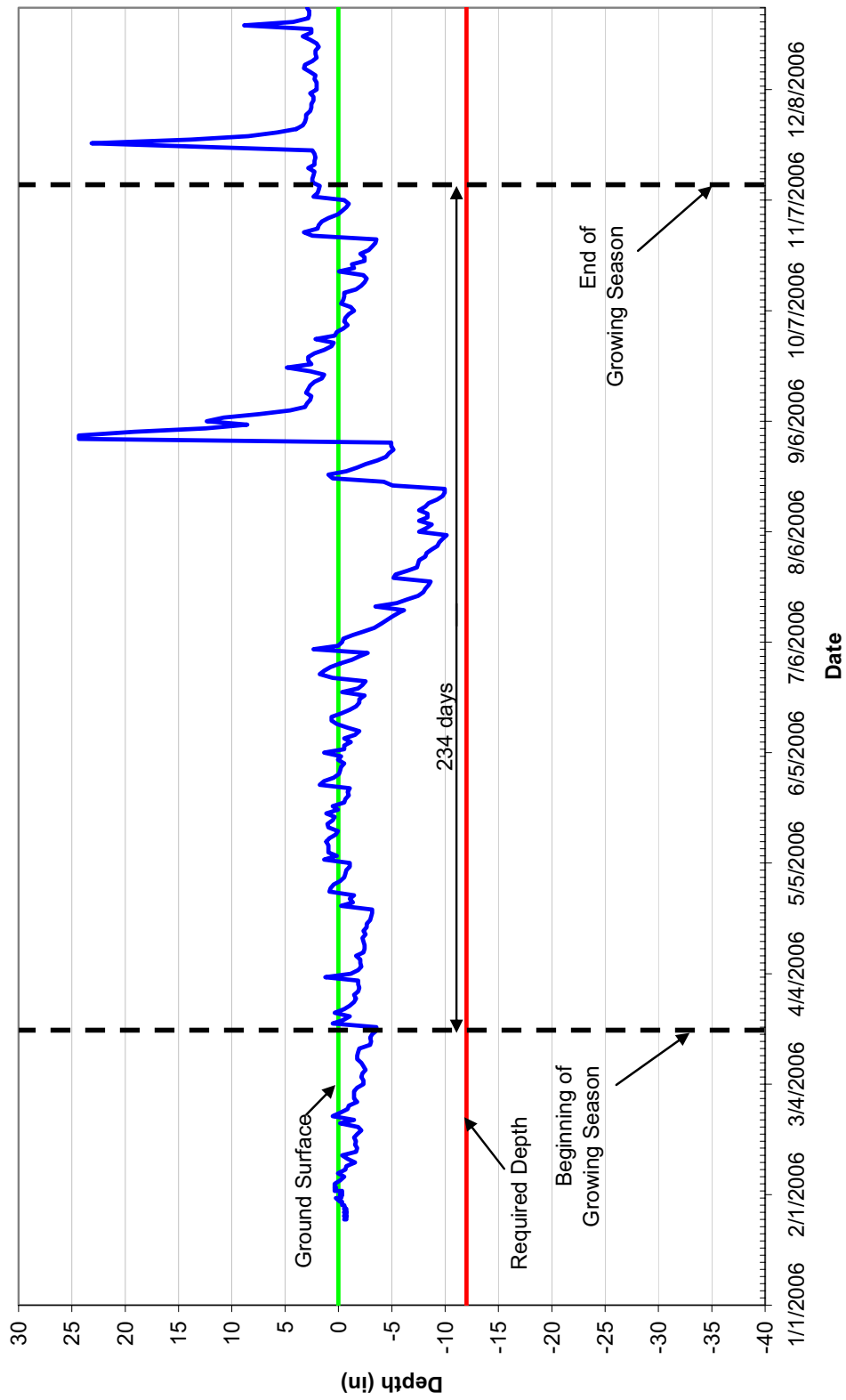
2006 Groundwater Data
Well 6 (SN: 00000AB36333)



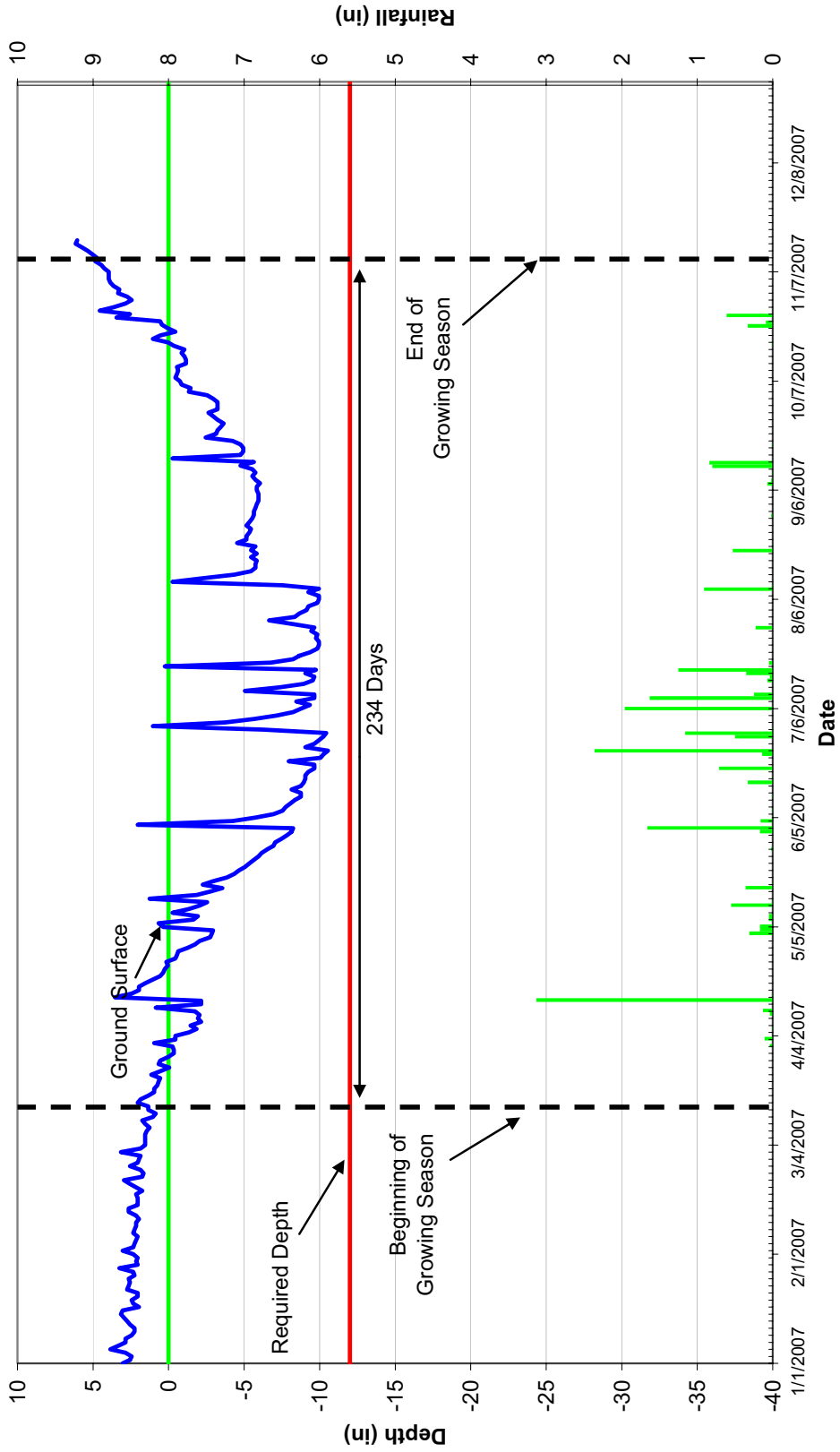
2007 Groundwater Data
Well 6 (SN: 00000AB36333)



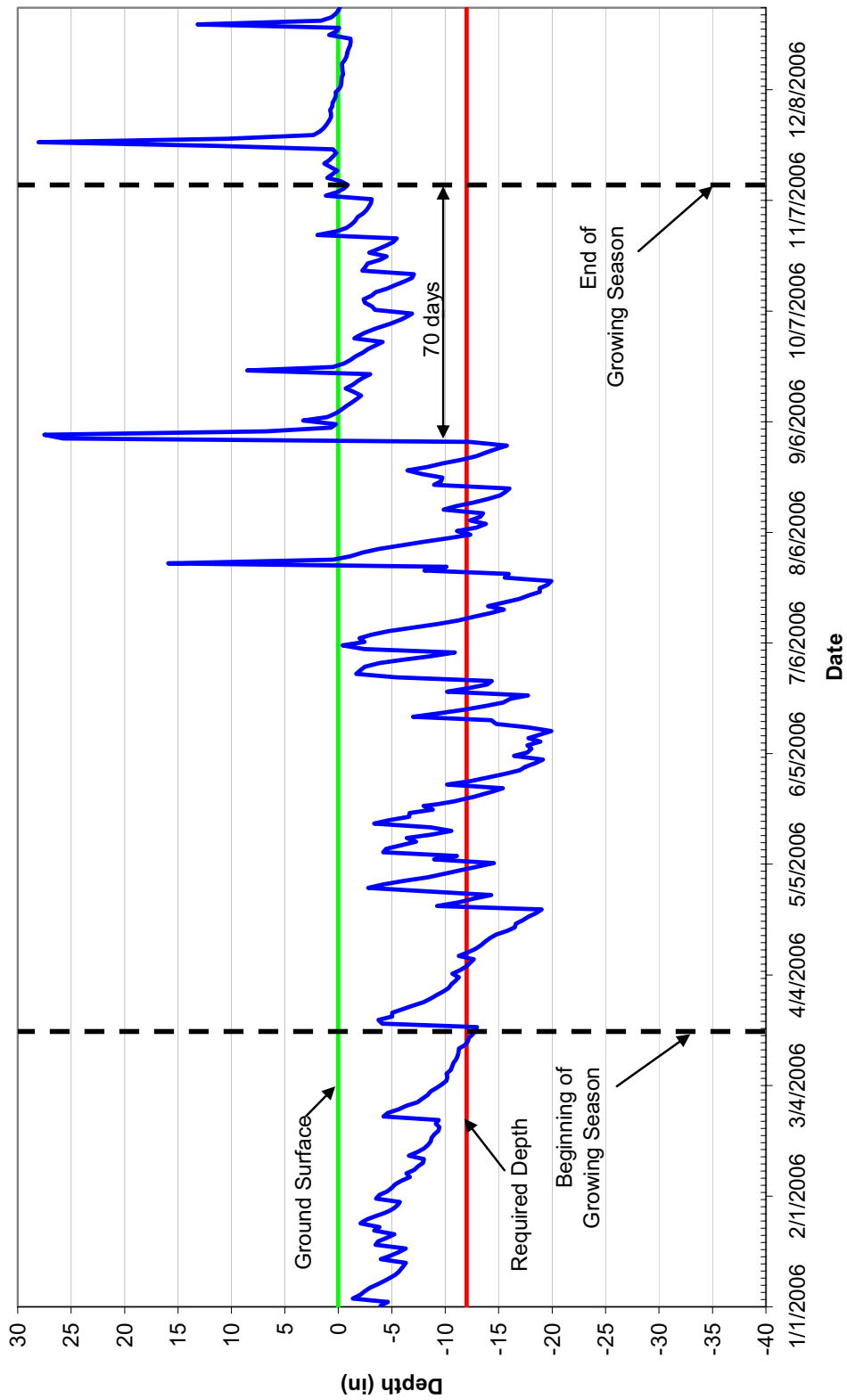
2006 Groundwater Data
Well 7 (SN: 00000A28BC19)



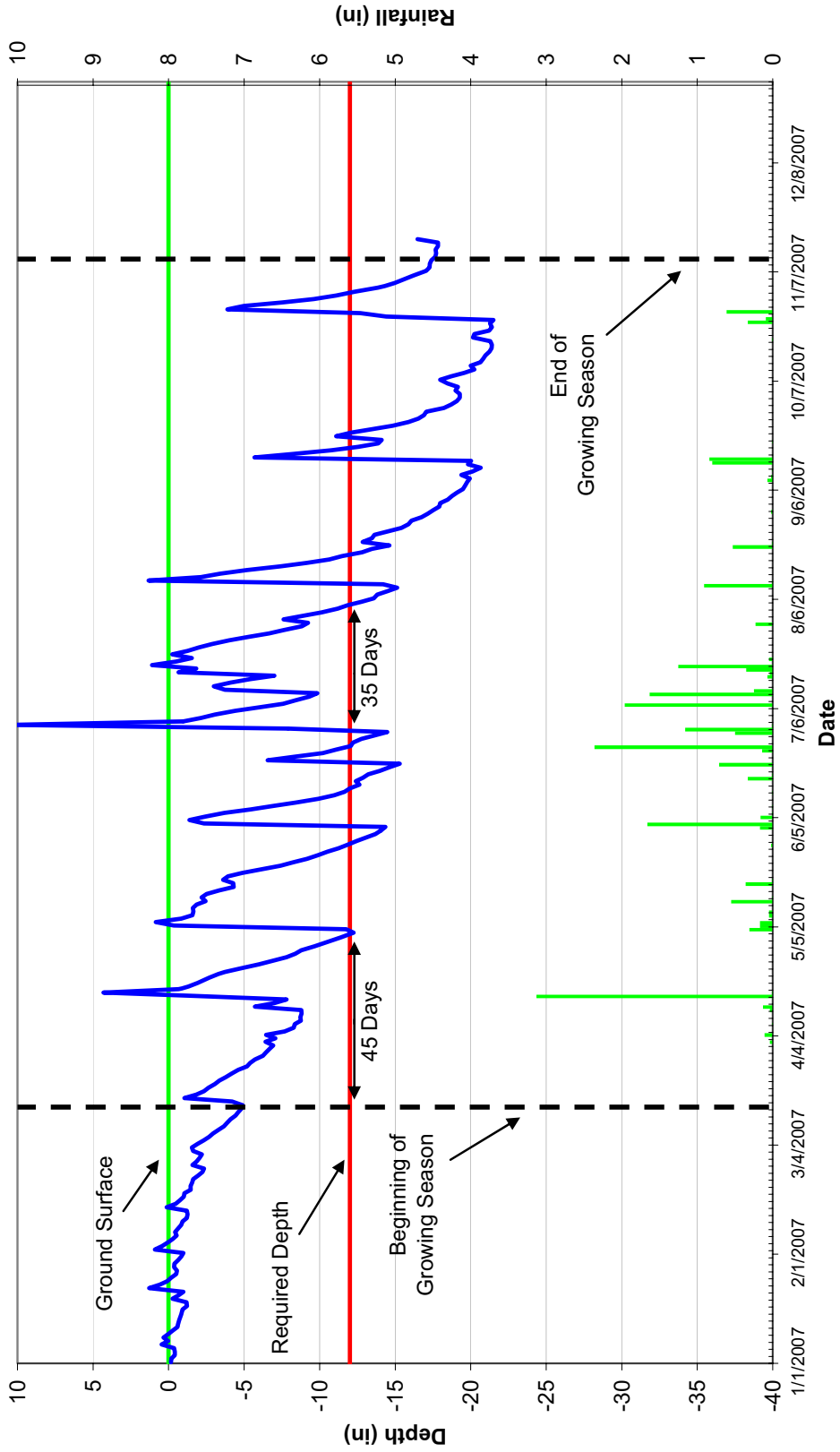
2007 Groundwater Data
Well 7 (SN: 00000A28BC19)



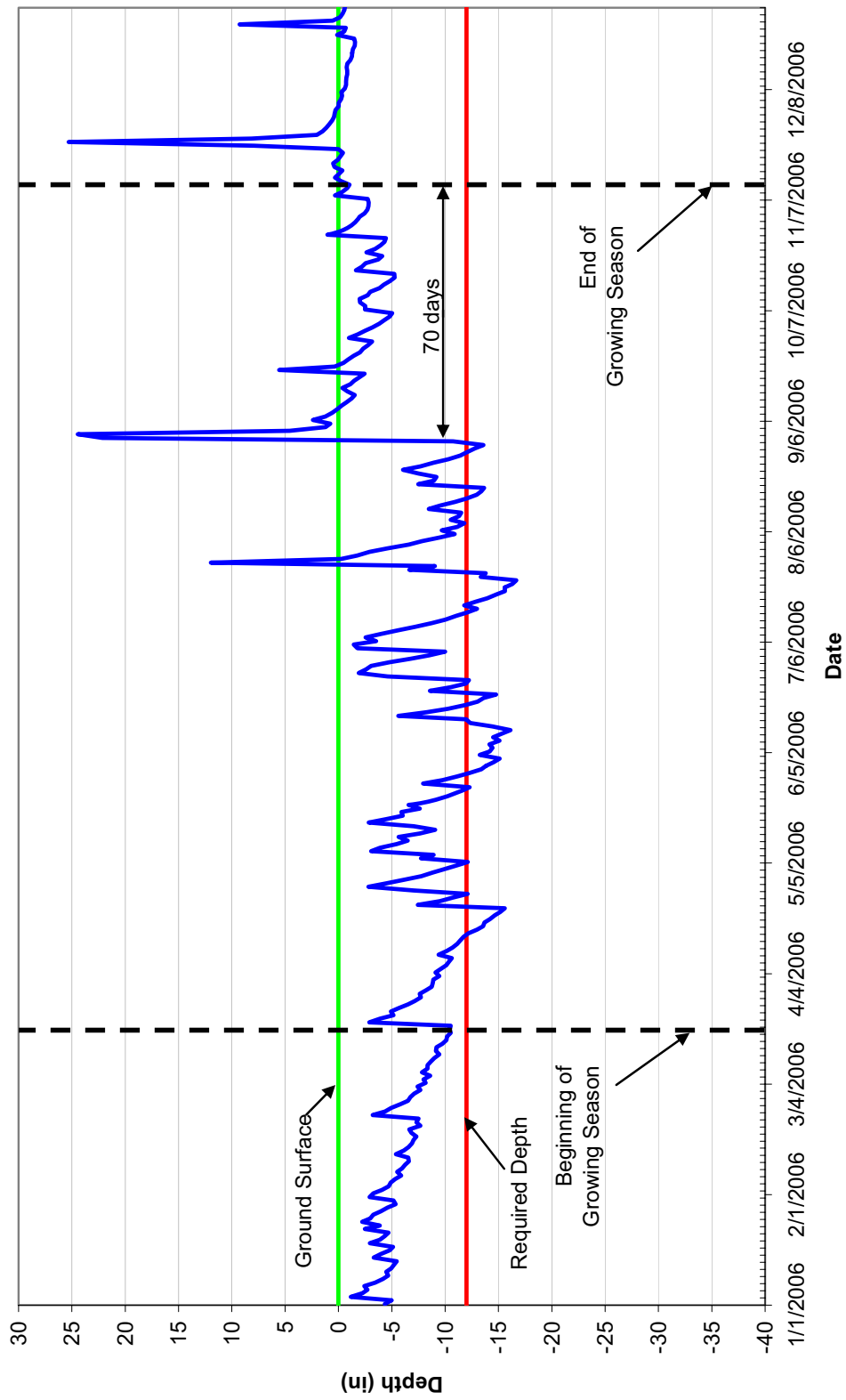
2006 Groundwater Data
Well Ref-1 (SN: N3D44981)



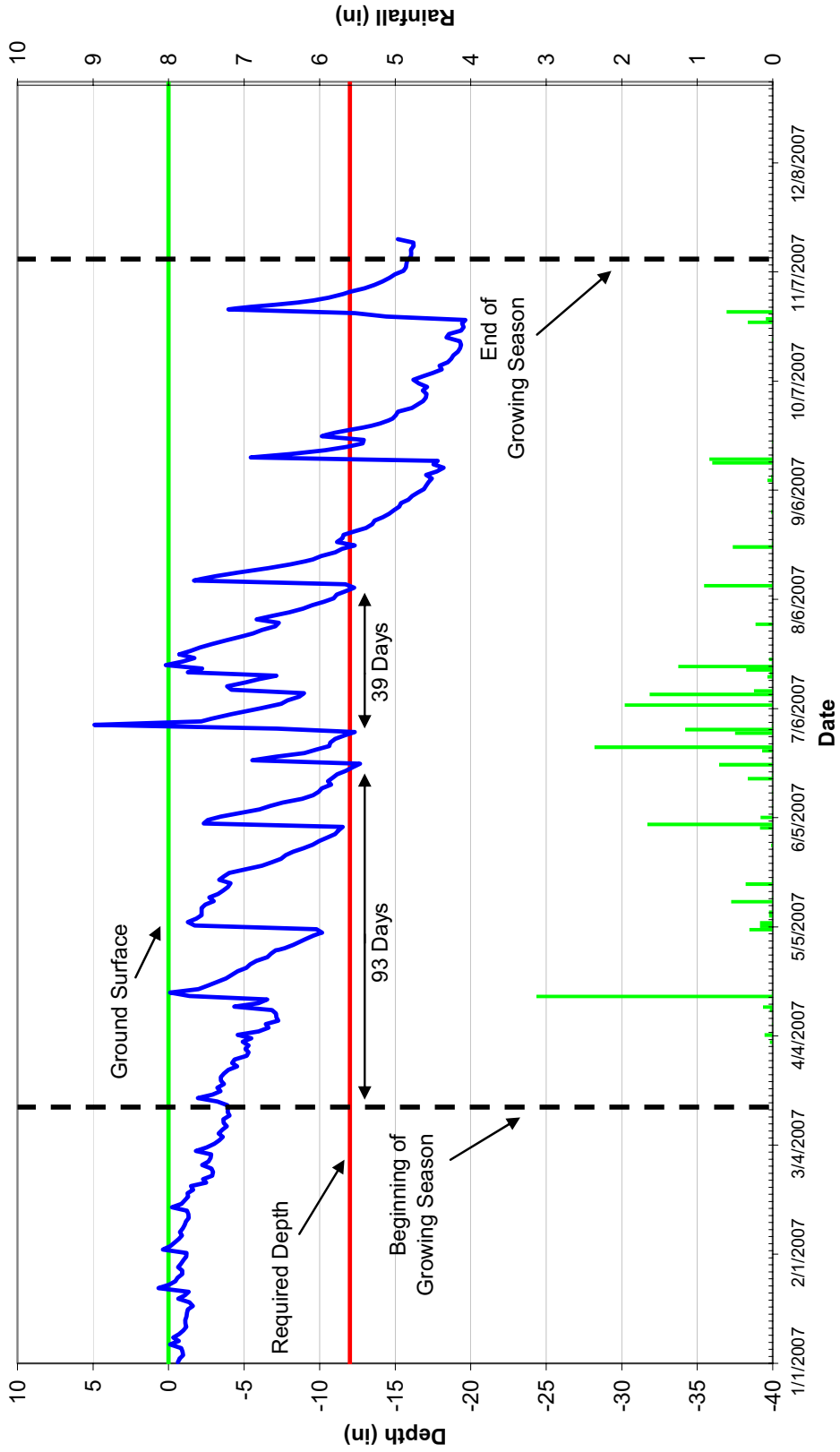
2007 Groundwater Data
Well Ref-1 (SN: N3D44981)



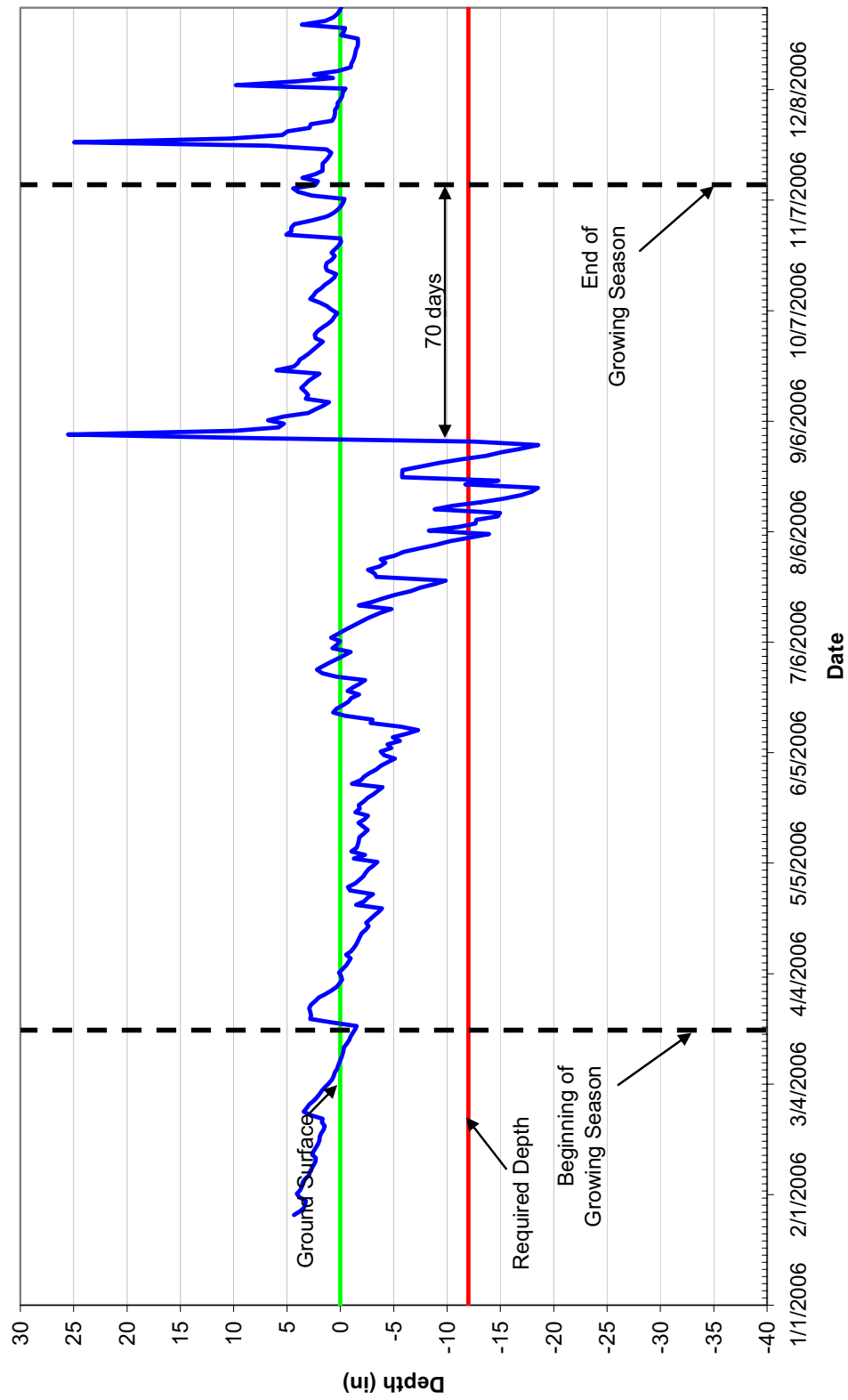
2006 Groundwater Data
Well Ref-2 (SN: N3D457A5)



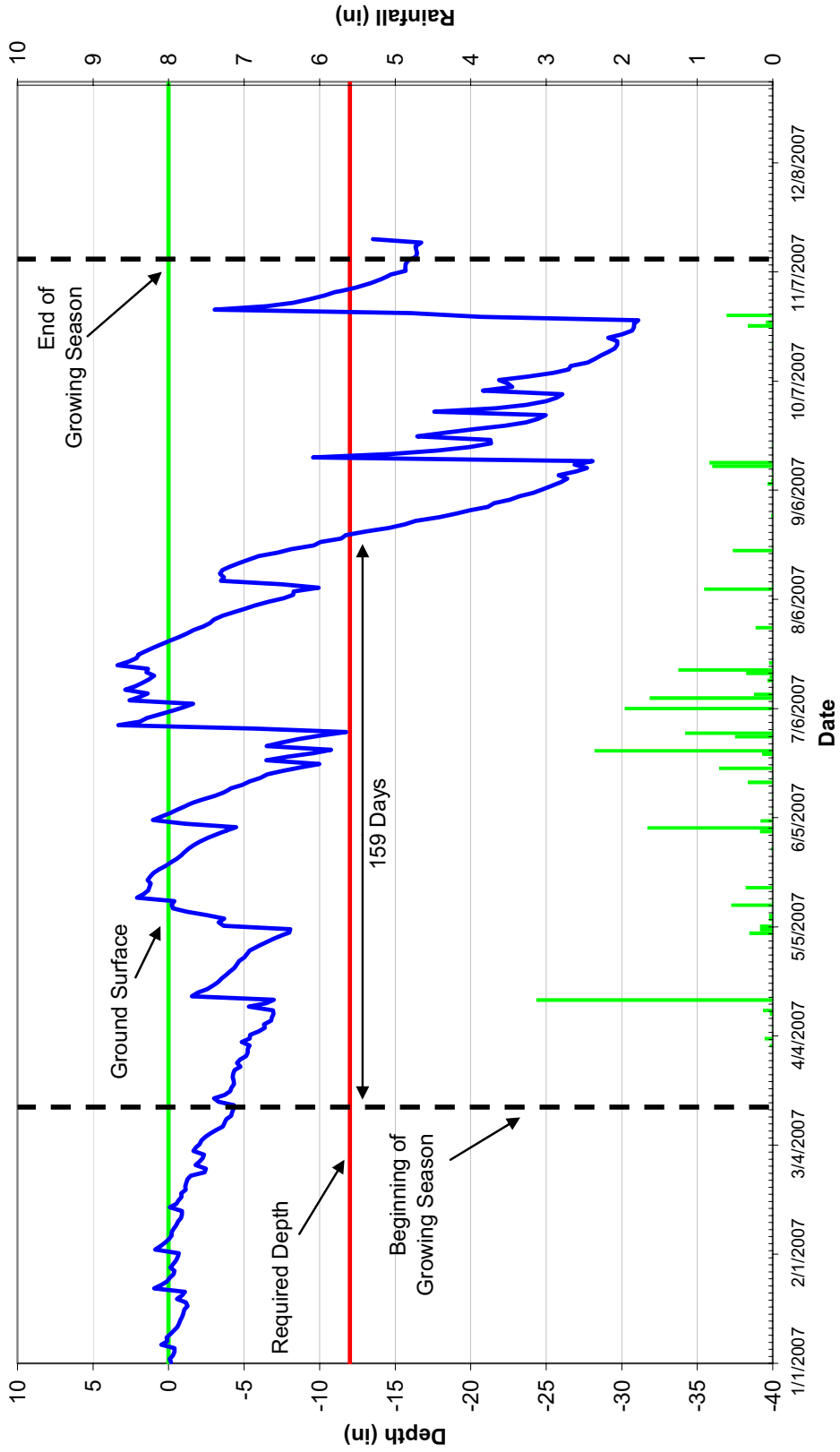
2007 Groundwater Data
Well Ref-2 (SN: N3D457A5)



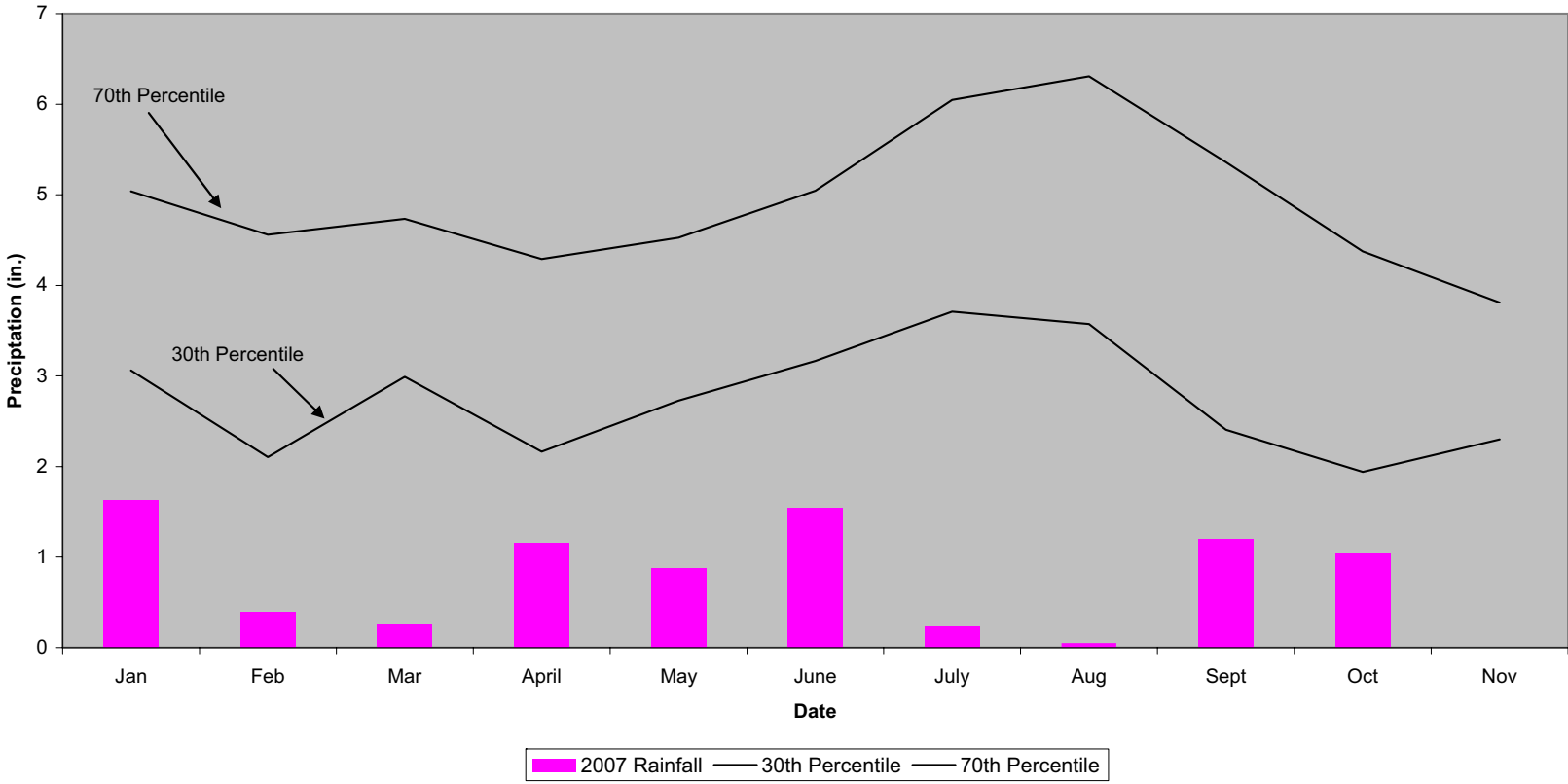
2006 Groundwater Data
Well Ref-3 (SN: N3D448AB)



**2007 Groundwater Data
Well Ref-3 (SN: N3D448AB)**



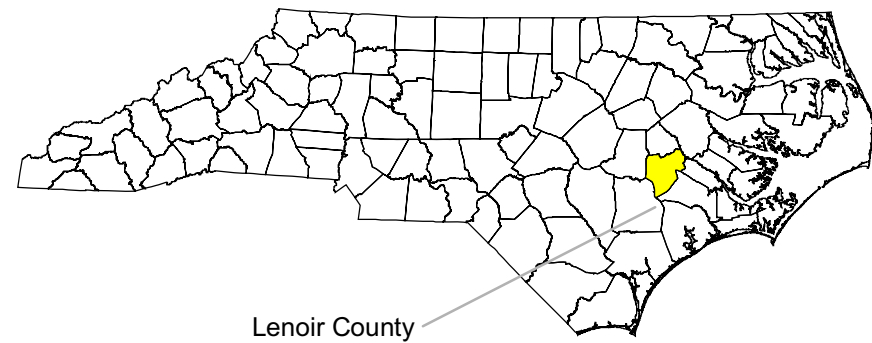
**Whitlace Creek 30-70 Percentile Graph
Lenoir, Co.**



Appendix D. Current Condition Plan View



Aerial: 2006 USDA NAIP imagery



Lenoir County

Legend

- Stream
- Crest Gauge
- Conservation Easement
- Located Beaver Dam
- Vegetation Plots
- <math>< 320</math> stems/acre
- >math>> 320</math> stems/acre
- Monitoring Gauges
- Not meeting success criteria for MY2
- Approximate Veg Problem Areas
- Murdannia*
- Persicaria*
- Typha*
- weak woody vegetation

Appendix D Current Condition Plan View Map
 Whitelace Creek Stream Enhancement and Wetland Restoration, EEP #420
 Lenoir County, North Carolina
 March 2008

