

BENSON GROVE MITIGATION SITE

2006 Annual Monitoring Report (Year 5)

Johnson County

EEP Project No. 32

Design Firm: Rummel, Klepper & Kahl, LLP

NCDOT Format

Prepared for:



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BENSON GROVE MITIGATION SITE
2006 Annual Monitoring Report (Year 5)

SUMMARY

The Benson Grove Mitigation Site (Site) has been planned as compensatory mitigation for impacts associated with the Northern Wake Expressway (Raleigh Outer Loop, Tip No. R-2000F and R2000G) located in Wake County, North Carolina. Per a letter from the Ecosystem Enhancement Program (EEP) to the North Carolina Department of Transportation (NCDOT) dated August 25, 2004, the EEP has accepted the transfer of all off-site mitigation projects. Therefore, EEP will be responsible for fulfilling the remaining requirements and future remediation for the Benson Grove Site. The NCDOT monitoring report format has been retained for clarity and continuity.

The following report summarizes the monitoring activities that have occurred in the past year at the Benson Grove Mitigation Site (Site). Site construction was completed in March 2002. The 2006 monitoring report represents the fifth year of monitoring for the Site. The Site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the Site is deemed successful.

Site hydrology is being monitored with 11 groundwater monitoring gauges and one on-site rain gauge. Ten vegetation plots are used to evaluate the 31.5 acres reforested within the Site.

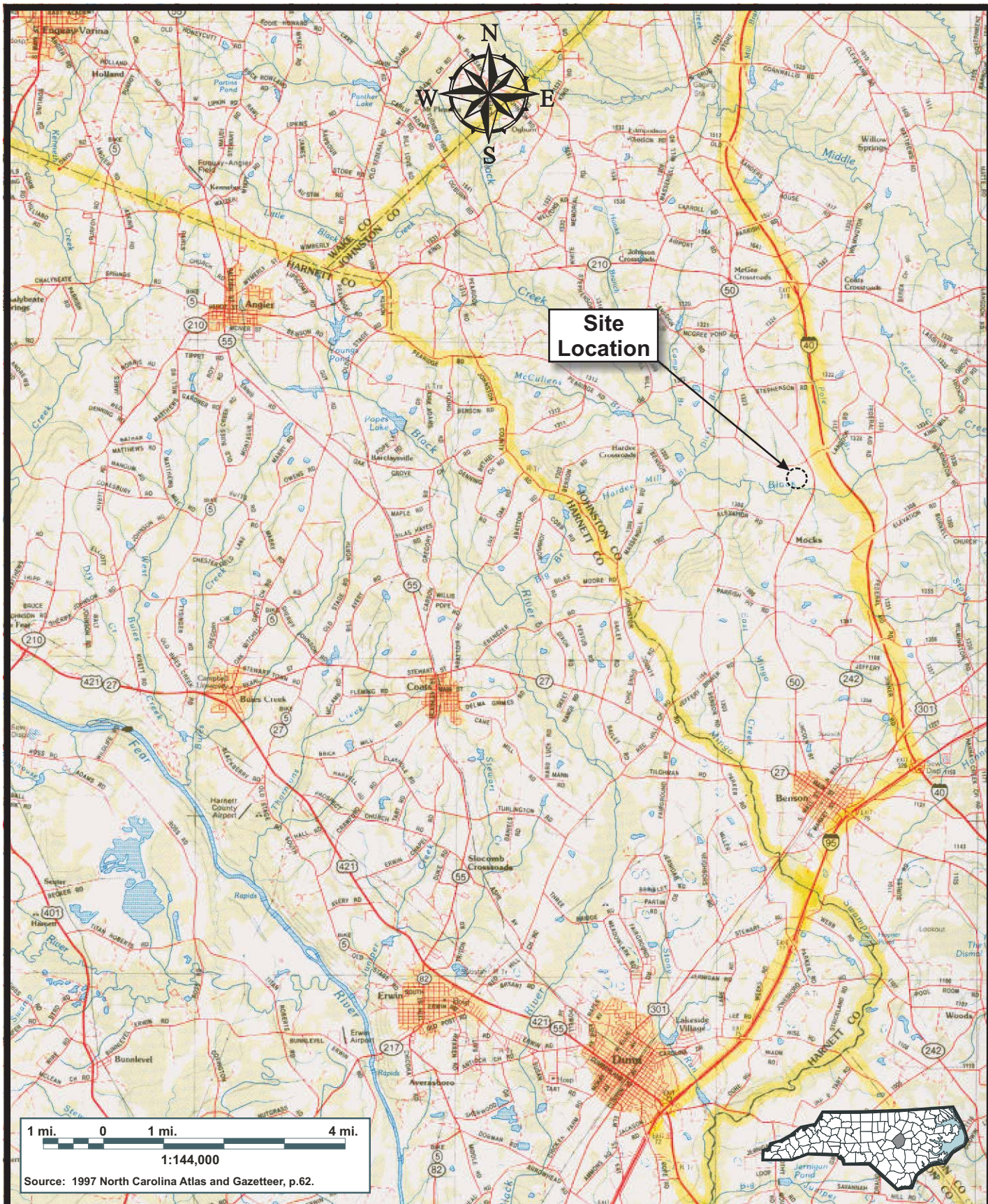
1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Site is located just west of NC 50 on SR 1319 (Zacks Mill Road) in Johnston County (Figure 1, Appendix A). The Site is situated in the Black Creek floodplain within the greater Neuse River Basin (Hydrological Unit 030404). The Site comprises approximately 81.9 acres. Black Creek forms the boundary along the southern edge of the property and upland slopes border the northern boundary. The Site will provide approximately 31.4 acres of forested wetland restoration and approximately 50.5 acres of preservation.

1.2 PURPOSE

In order to demonstrate successful wetland mitigation, hydrological and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrological conditions and vegetation survival. The following report details the results of hydrological and vegetative monitoring at the Site during the 2006 growing season.



1 mi. 0 1 mi. 4 mi.
 1:144,000
 Source: 1997 North Carolina Atlas and Gazetteer, p.62.



SITE LOCATION
Benson Grove Mitigation Site
 Johnston County, North Carolina
 EEP Project Number 32

Dwn. by: MAF
 Ckd by: JWG
 Date: DEC 2006
 Project: 06-282.01

FIGURE
1

1.3 PROJECT HISTORY

December 2001	Herbicide Application I
February 2002	Herbicide Application II
February 2002	Herbicide Application
March 2002	Site Planted
June 2002	Vegetation Monitoring (1 year)
March-November 2002	Hydrologic Monitoring (1 year)
February 2003	Supplemental Planting
July 2003	Vegetation Monitoring (2 year)
July 2003	On-site agency meeting to discuss nuisance species
March-November 2003	Hydrologic Monitoring (2 year)
June 2004	Vegetation Monitoring (3 year)
March-November 2004	Hydrologic Monitoring (3 year)
October 2005	Vegetation Monitoring (4 year)
March-November 2005	Hydrologic Monitoring (4 year)
October 2006	Vegetation Monitoring (5 year)
March-November 2006	Hydrologic Monitoring (5 year)

2.0 HYDROLOGY

2.1 SUCCESS CRITERIA

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology state that the restoration areas must be inundated or saturated (within 12 inches of the surface) by surface water or groundwater for at least 12.5 percent of the growing season (consecutive days) during a normal precipitation year. Areas that have between 5 and 12.5 percent of the growing season may be considered hydric under certain conditions. Areas inundated for less than 5 percent of the growing season are always classified as non-wetlands.

The growing season in Johnston County begins March 21 and ends November 4. These dates correspond to a 50 percent probability that temperatures will not drop to 28 degrees Fahrenheit or lower after March 21 and before November 10 (Natural Resources Conservation Service, Soil Survey of Johnston County). The growing season is 228 days.

2.2 HYDROLOGIC DESCRIPTION

In March 2002, 11 Remote Data Systems (RDS) continuous logging groundwater monitoring gauges were installed on-site (Figure 2, Appendix A). The monitoring gauges record daily readings of depth to groundwater and this year's data represents the fifth growing season that the monitoring gauges have been in place. The Site was designed to receive hydrologic inputs from rainfall, groundwater, and surface water from overbanking events.

2.3 RESULTS OF HYDROLOGIC MONITORING

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within 12 inches of the surface was calculated for each monitoring gauge and this number was converted into a percentage of the 228-day growing season. The results are presented in Table 1.

Appendix B contains the hydrographs for each monitoring gauge for the current monitoring year. The corresponding rain data collected from the on-site rain gauge is also provided on each hydrograph.

Figure 2 (Appendix A) provides a graphical representation of the hydrologic results. Gauges highlighted in green indicate wetland hydrology for more than 12.5 percent of the growing season. In the fifth and final year of monitoring, all 11 groundwater monitoring gauges met the wetland hydrology success criteria of 12.5 percent or greater of the growing season.

2.3.2 Climatic Data

Figure 3 provides an evaluation of the local climate in comparison with historical data in order to determine whether 2006 was a year with “average” rainfall. The bars are the monthly rainfall totals for the 2006 hydrologic year. Also represented are the 30th and 70th percentiles of monthly precipitation for Smithfield located approximately 10 miles east of the Site. The historical data and monthly data were collected from the Southeast Regional Climate Data.

Months with below average rainfall include: January, February, March, and July. The months of April, May, August, September, and October experienced average rainfall. June received above average rainfall. A normal yearly rainfall in the area is approximately 47.3 inches.

Table 1. Benson Grove Hydrologic Monitoring Results

Monitoring Gauge	<5%	5-12.5%	>12.5%	Actual %	Success Date
BGGW-1			✓	70	March 21 – August 26
BGGW-2			✓	18	June 4 – July 15
BGGW-3			✓	14	April 30 – June 1
BGGW-4			✓	15	March 21 – April 25
BGGW-5			✓	30	March 21 – May 30
BGGW-6			✓	30	March 21 – May 30
BGGW-7			✓	53	March 21 – July 19
BGGW-8			✓	30	March 21 – May 30
BGGW-9			✓	30	March 21 – May 31
BGGW-10			✓	18	April 18 – May 26
BGGW-11			✓	29	March 21 – May 27

2.4 CONCLUSION

The current year represents the fifth year for hydrologic monitoring. In general, water levels showed a typical pattern of flooding during the spring, followed by a late summer and fall draw down period, punctuated by peaks associated with precipitation events. All 11 gauges indicated saturation within 12 inches of the ground surface for greater than 12.5 percent of the growing season.

3.0 VEGETATION

3.1 SUCCESS CRITERIA

Success criteria states that at least 320 stems per acre must survive after the completion of the third growing season and 240 stems per acre after the fifth growing season. If desired vegetation has not been established, EEP will notify the appropriate agencies and will implement corrective measures. Site photographs are provided in Appendix C.

3.2 DESCRIPTION OF SPECIES

The following tree species were planted in the Wetland Restoration Area:

Fraxinus pennsylvanica, green ash

Quercus falcata var. *pagodaefolia*, cherrybark oak

Quercus laurifolia, laurel oak

Quercus lyrata, overcup oak

Quercus nigra, water oak

Liriodendron tulipifera, tulip poplar

Quercus phellos, willow oak

Taxodium distichum, bald cypress

Nyssa aquatica, water tupelo

3.3 RESULTS OF VEGETATION MONITORING

The following table lists the densities of planted tree species recorded in each established 0.06-acre (50-foot by 50-foot) plots (Figure 4).

TABLE 2: Vegetation Monitoring Statistics

Plot Number	1	2	3	4	5	6	7	8	9	10	Total
Green Ash <i>Fraxinus pennsylvanica</i>		6	6	7	4		2	1	9	15	50
Cherrybark Oak <i>Quercus falcata</i> var. <i>pagodaefolia</i>		5		3	6						14
Laurel Oak <i>Quercus laurifolia</i>											0
Overcup Oak <i>Quercus lyrata</i>	2	1						7		10	20
Water Oak <i>Quercus nigra</i>				1				1		3	5
Tulip Poplar <i>Liriodendron tulipifera</i>											0
Willow Oak <i>Quercus phellos</i>	4		1	5	5			5		6	26
Bald Cypress <i>Taxodium distichum</i>	2	1		10		11	12	4	12	2	54
Water Tupelo <i>Nyssa aquatica</i>		100	4	1	1		1	5	2	1	115
Total (2006)	8	113	11	27	16	11	15	23	23	37	284
Total (2005)	10	13	17	23	15	9	18	22	44	37	208
Total (2004)	8	22	9	23	24	15	19	28	44	39	231
Total (at Planting)	28	23	31	23	35	32	20	31	46	39	308
Density (2006) (Trees/Acre)	139	1,969	192	470	279	192	261	401	401	645	
Average 2006 Density (Trees/Acre)											495

Stem counts were made of additional, volunteer woody species within the study plots. These are listed in Table 3.

TABLE 3: Volunteer Woody Stem Counts in the Study Plots.

Plot Number	1	2	3	4	5	6	7	8	9	10	Total
Black Willow <i>Salix nigra</i>	2							1			3
Buttonbush <i>Cephalanthus occidentalis</i>							1				1
Groundsel Bush <i>Baccharis halimifolia</i>	18	61	6	53	43	1		11			198
Persimmon <i>Diospyros virginiana</i>	3			1							4
Red Maple <i>Acer rubrum</i>	125	204	55	61	17	2		53	85	11	613
Sweetgum <i>Liquidambar styraciflua</i>	8		24	8	1				6	3	50
Loblolly <i>Pinus taeda</i>		1		2	1						4
Total	156	266	85	125	62	3	1	65	91	19	873

In addition, the following herbaceous species were documented: blackberry (*Rubus argutus*), climbing hempweed (*Mikania scandens*), common cattail (*Typha latifolia*), dog fennel (*Eupatorium capillifolium*), false nettle (*Boehmeria cylindrica*), goldenrod (*Solidago* sp.), jewelweed (*Impatiens capensis*), marsh dayflower (*Murdannia keisak*), marsh fleabane (*Pluchea* sp.), meadow beauty (*Rhexia mariana*), passion flower (*Passiflora incarnata*), plume grass (*Erianthus* sp.), seedbox (*Ludwigia alternifolia*), soft rush (*Juncus effusus*), St. John's wort (*Hypericum* sp.), straw-colored flatsedge (*Cyperus strigosus*), swamp mallow (*Hibiscus moscheutos*), swamp sunflower (*Helianthus angustifolius*), tearthumb (*Polygonum saggitatum*), woolgrass (*Scirpus cyperinus*), Virginia buttonweed (*Diodia virginiana*), and yankeeweed (*Eupatorium compositifolium*).

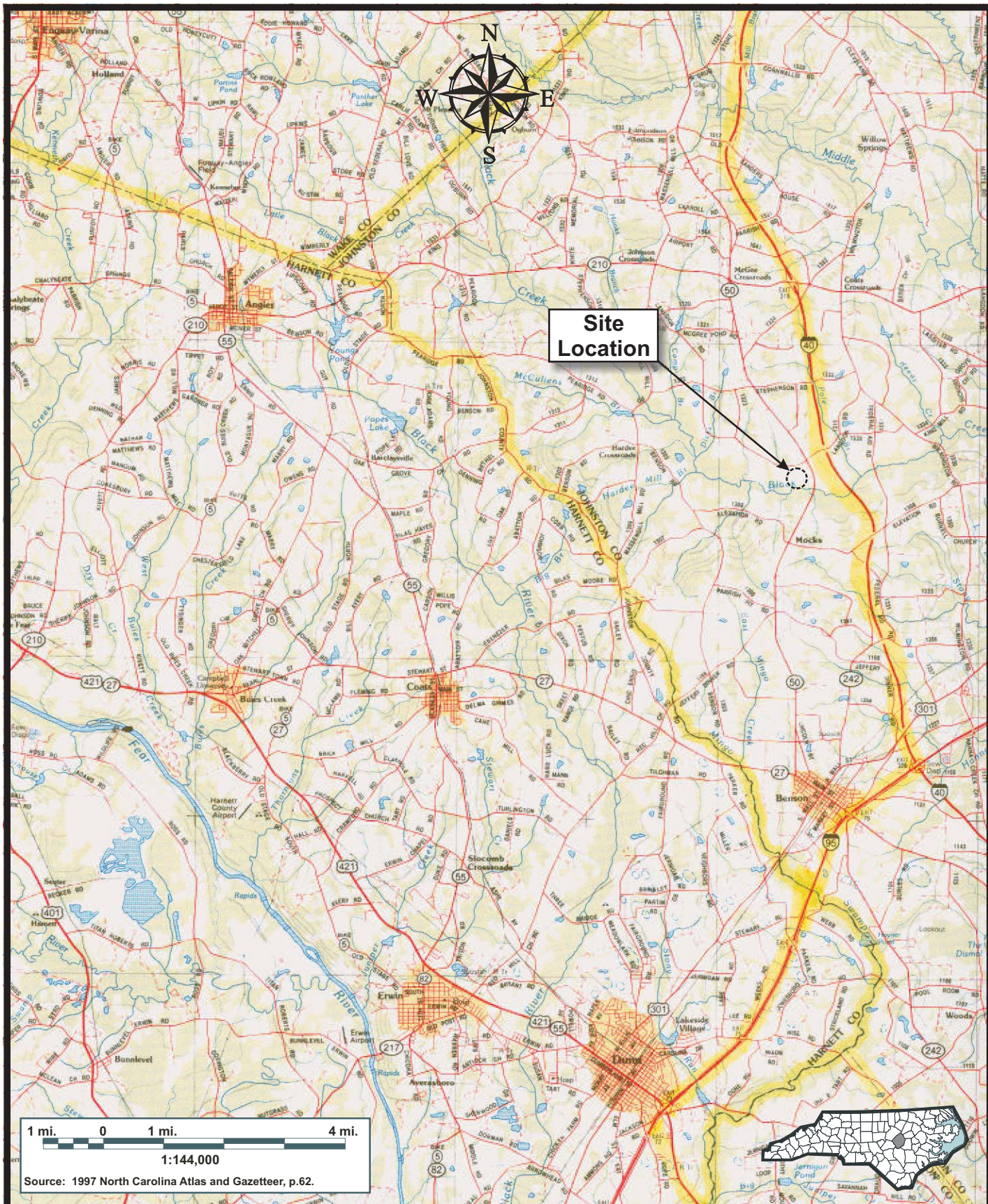
3.4 CONCLUSION

Of the 81.9 acres on this site, approximately 31.5 acres involved tree planting. Ten vegetation monitoring plots, 50 by 50 feet (0.06 acre) in size, were established throughout the planting areas. The 2006 vegetation monitoring results revealed an average density of 495 trees per acre of planted species. This average is above the minimum success criteria of 320 trees per acre after the third growing season and 240 trees per acre after the fifth growing season.

Nuisance trees such as red maple and sweetgum occur in significant amounts in some areas of the site, as seen in Plots 1, 2, 3, and 8. The increase in stem counts of these species is likely due to site characteristics and proximity to seed sources. However, these occurrences do not appear to have a direct effect on the survivability of planted species on the plots.

APPENDIX A

FIGURES



1 mi. 0 1 mi. 4 mi.
 1:144,000
 Source: 1997 North Carolina Atlas and Gazetteer, p.62.








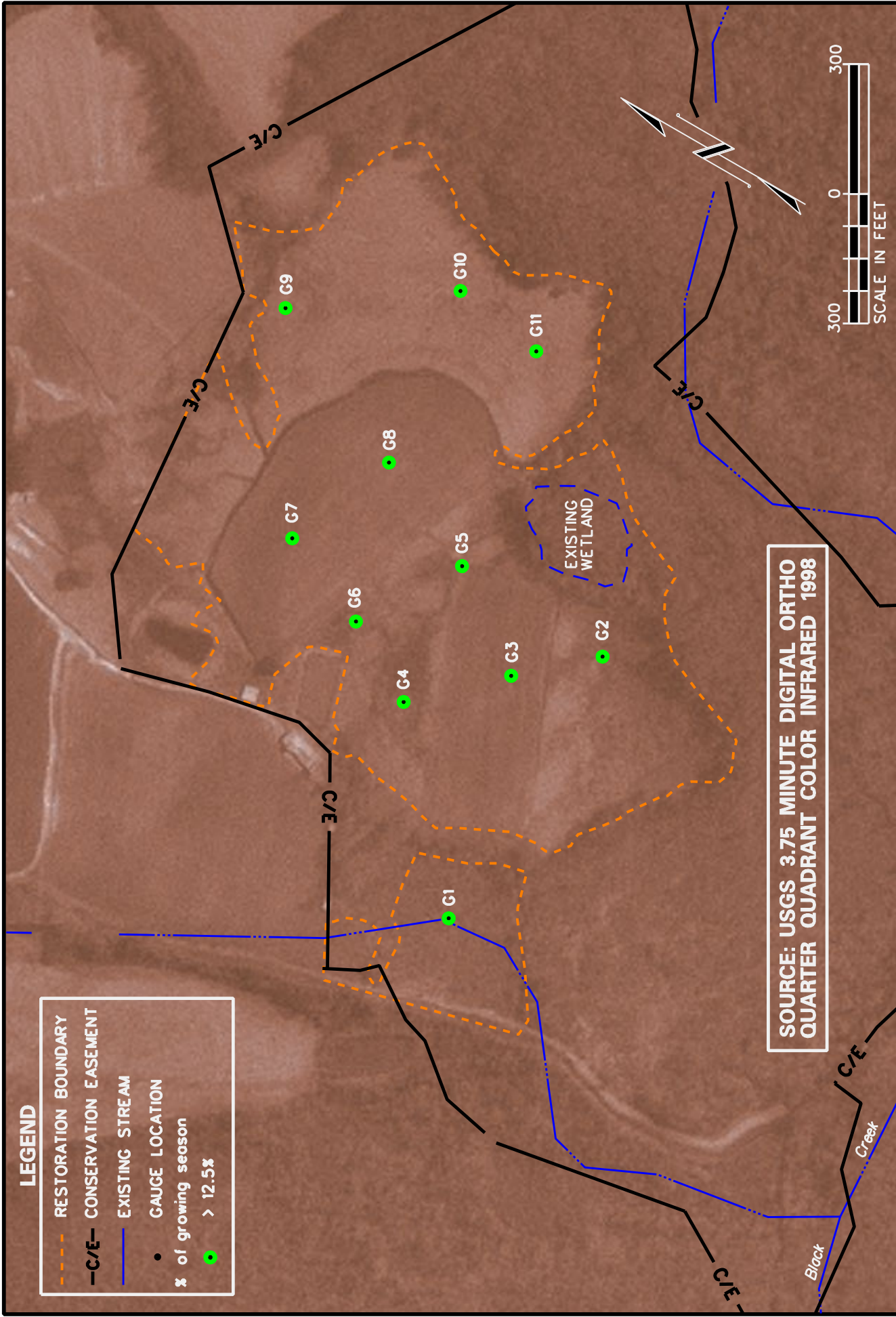
SITE LOCATION
Benson Grove Mitigation Site
 Johnston County, North Carolina
 EEP Project Number 32

Dwn. by:	MAF
Ckd by:	JWG
Date:	DEC 2006
Project:	06-282.01

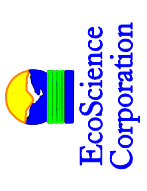

FIGURE
1

LEGEND

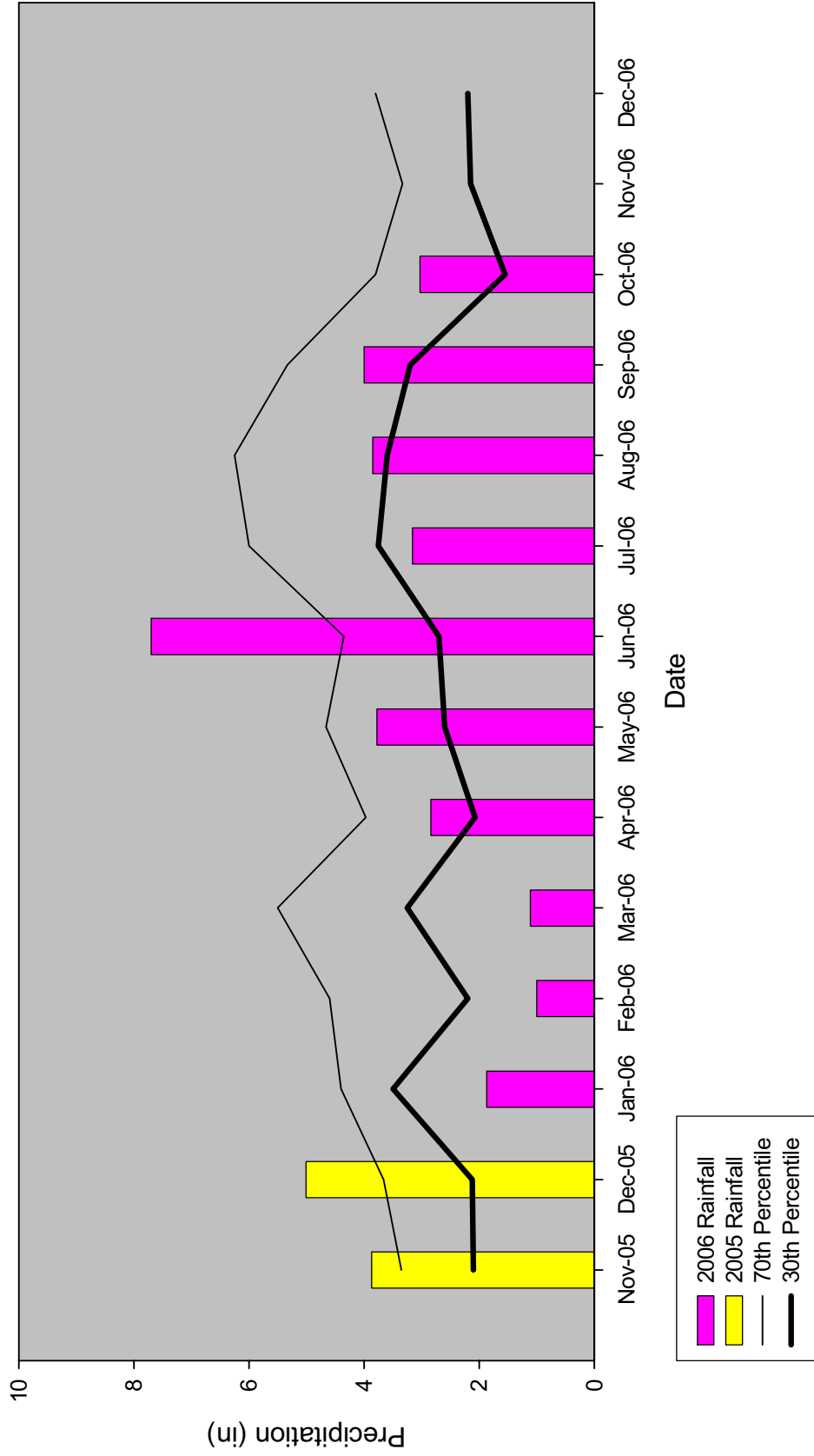
-  RESTORATION BOUNDARY
-  CONSERVATION EASEMENT
-  EXISTING STREAM
-  GAUGE LOCATION
-  % of growing season > 12.5%




SOURCE: USGS 3.75 MINUTE DIGITAL ORTHO QUARTER QUADRANT COLOR INFRARED 1998

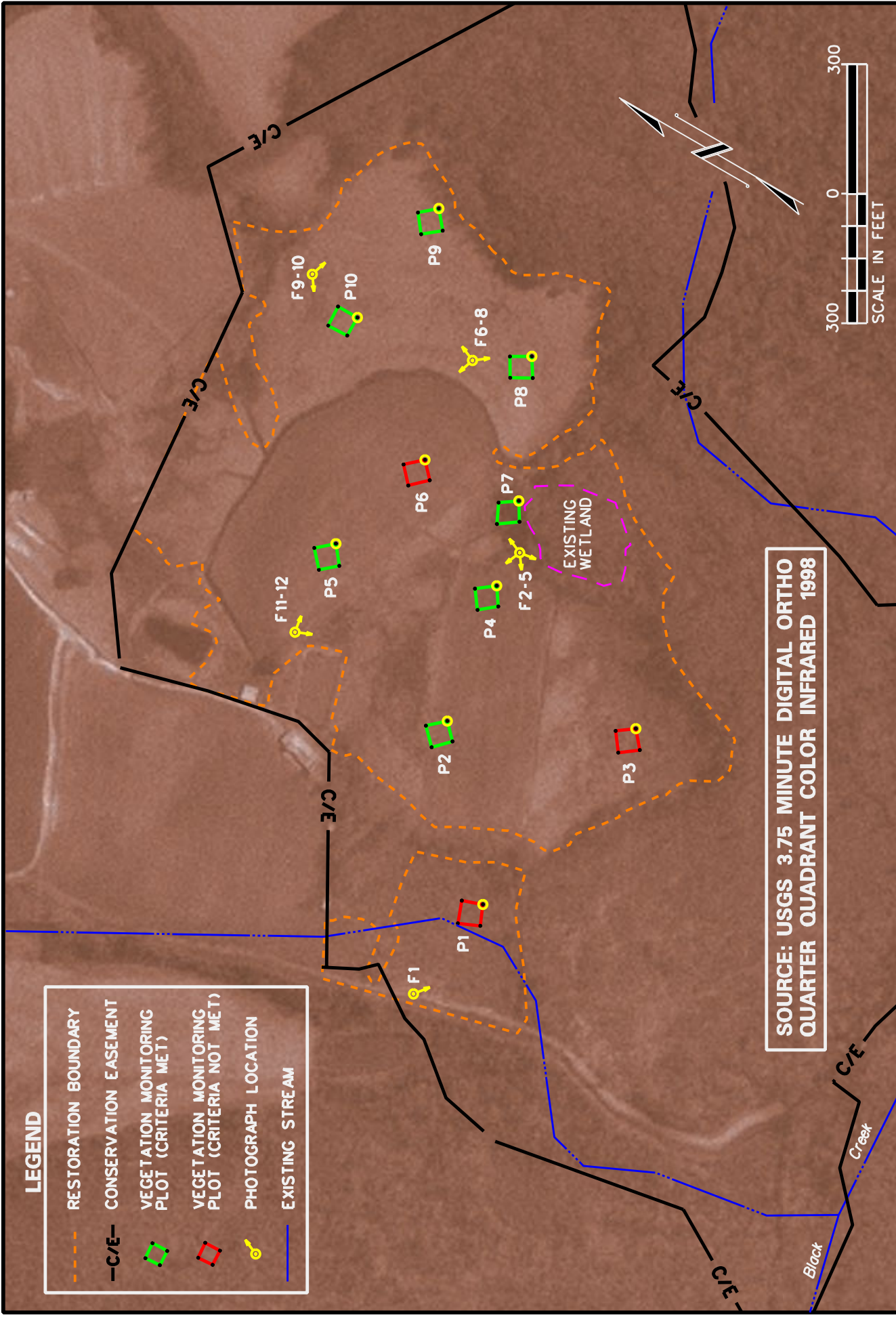
 <p>EcoScience Corporation Raleigh, North Carolina</p>	 <p>Ecosystem Enhancement PROGRAM</p>	<p>Client: _____</p>		<p>Project: _____</p>	
		<p>MONITORING GAUGE LOCATIONS AND RESULTS Benson Grove Mitigation Site</p>			
		<p>Drawn By: GWN</p>	<p>Date: DEC 2006</p>		
		<p>Cl'd By: JWG</p>	<p>Scale: 1" = 300'</p>		
		<p>ESC Project No.: 06-282.02</p>			
<p>FIGURE 2</p>					

**Fig 3. Benson Grove 30-70 Percentile Graph 2006
Smithfield, NC**



LEGEND

-  RESTORATION BOUNDARY
-  CONSERVATION EASEMENT
-  VEGETATION MONITORING PLOT (CRITERIA MET)
-  VEGETATION MONITORING PLOT (CRITERIA NOT MET)
-  PHOTOGRAPH LOCATION
-  EXISTING STREAM



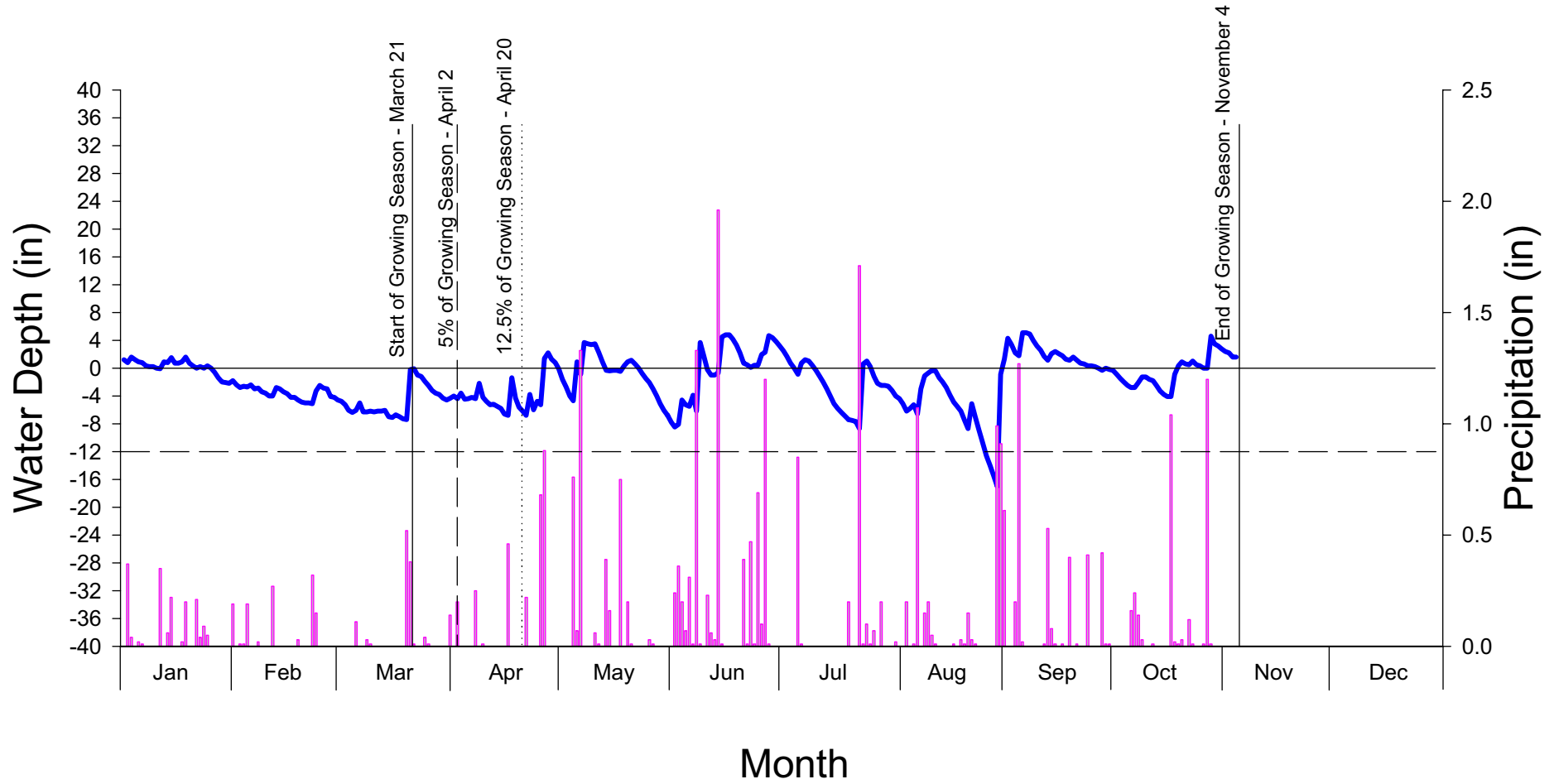
SOURCE: USGS 3.75 MINUTE DIGITAL ORTHO QUARTER QUADRANT COLOR INFRARED 1998

 <p>EcoScience Corporation Raleigh, North Carolina</p>	<p>Client:</p> 	<p>Project:</p> <p>VEGETATION MONITORING PLOTS AND PHOTOGRAPH LOCATIONS Benson Grove Mitigation Site</p>		<p>FIGURE</p> <p>4</p>
		<p>Date:</p> <p>DEC 2006</p>	<p>ESC Project No.:</p> <p>06-282.02</p>	
		<p>Drawn By:</p> <p>GWN</p>	<p>Scale:</p> <p>1" = 300'</p>	
		<p>Created By:</p> <p>JWG</p>		

APPENDIX B

GROUNDWATER GAUGE HYDROGRAPHS

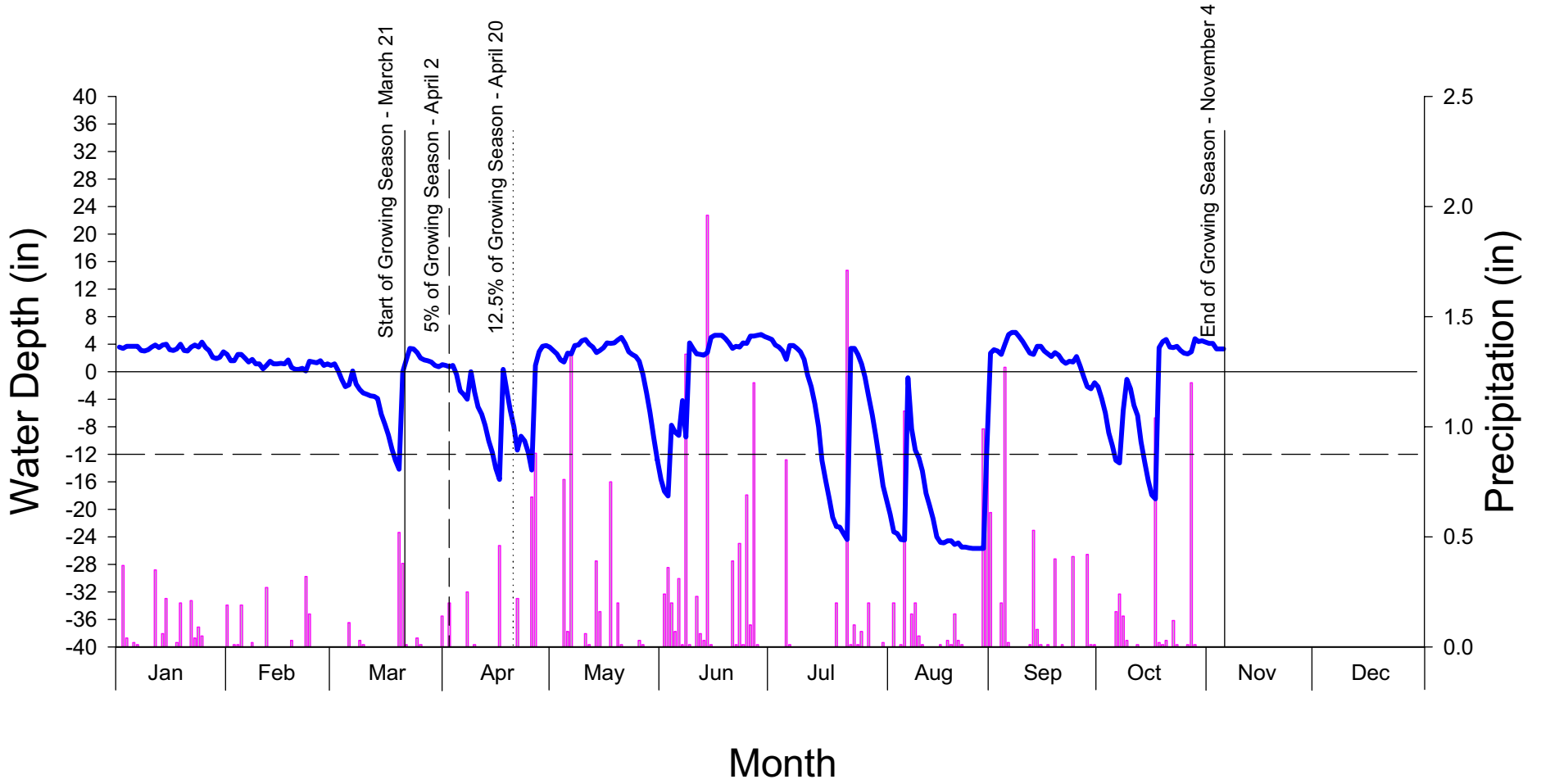
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Benson Grove

2006

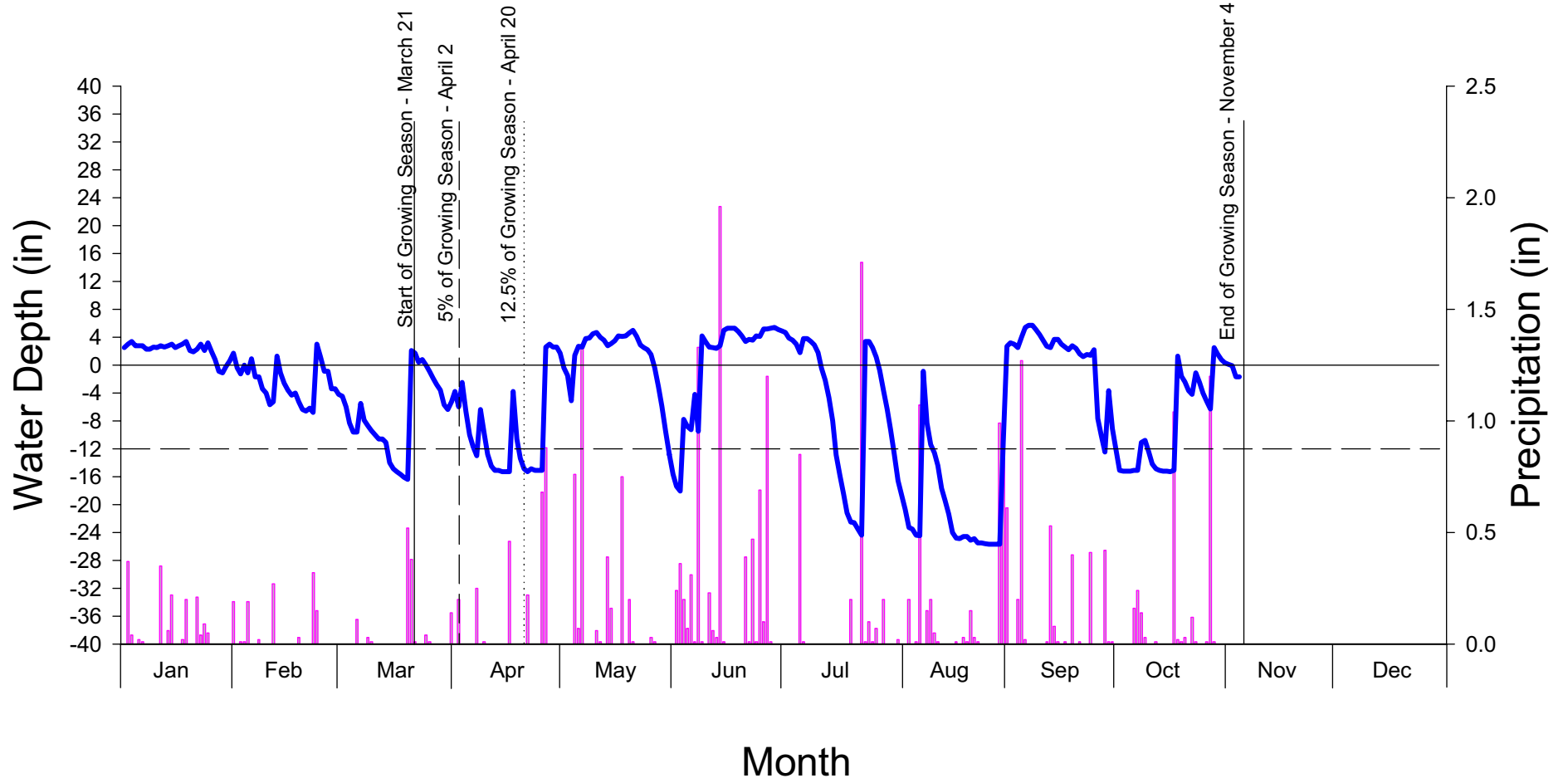
Monitoring Gauge 2 - 9BEBE69



Benson Grove

2006

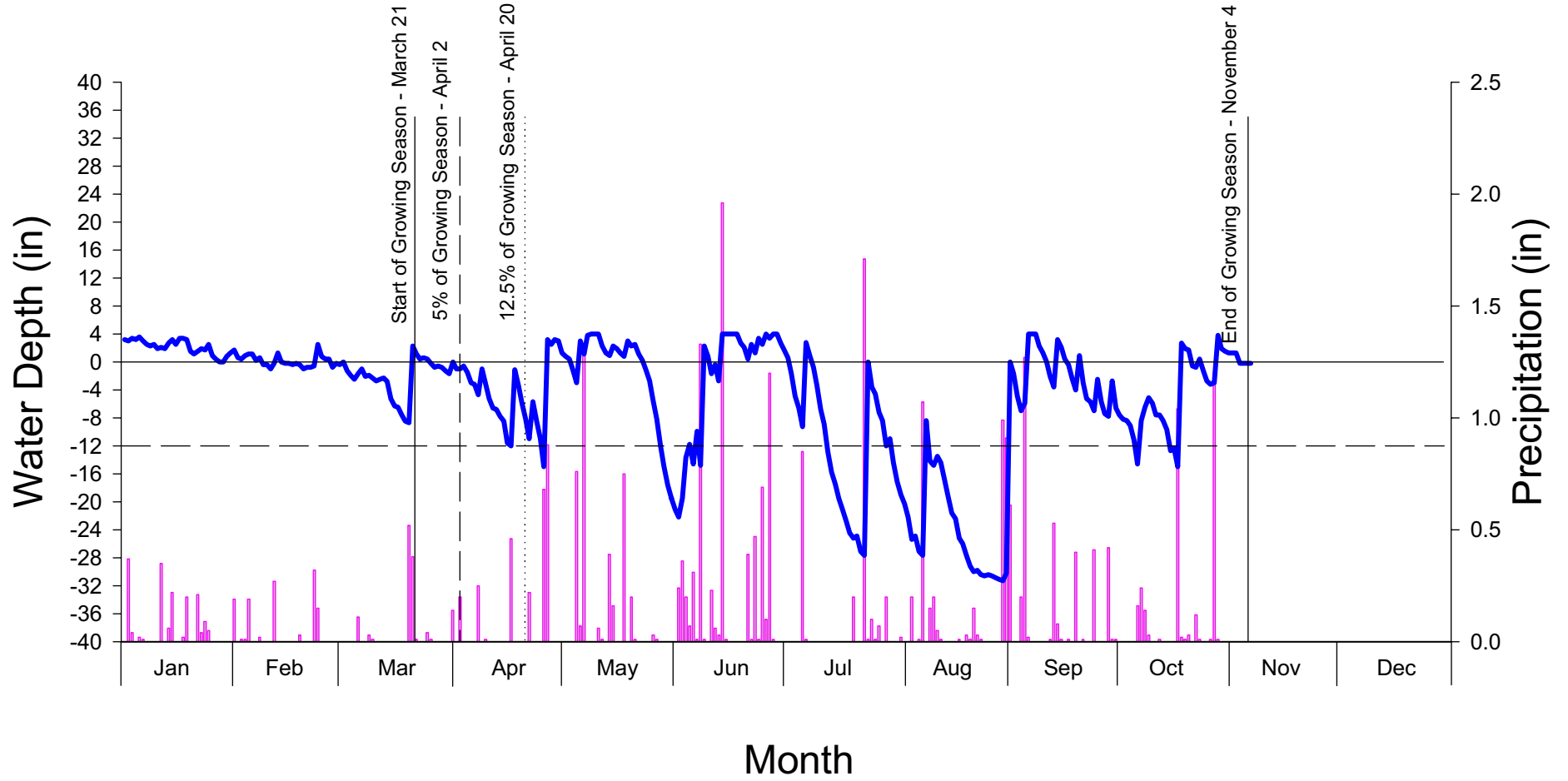
Monitoring Gauge 3 - 04CDAE8



Benson Grove

2006

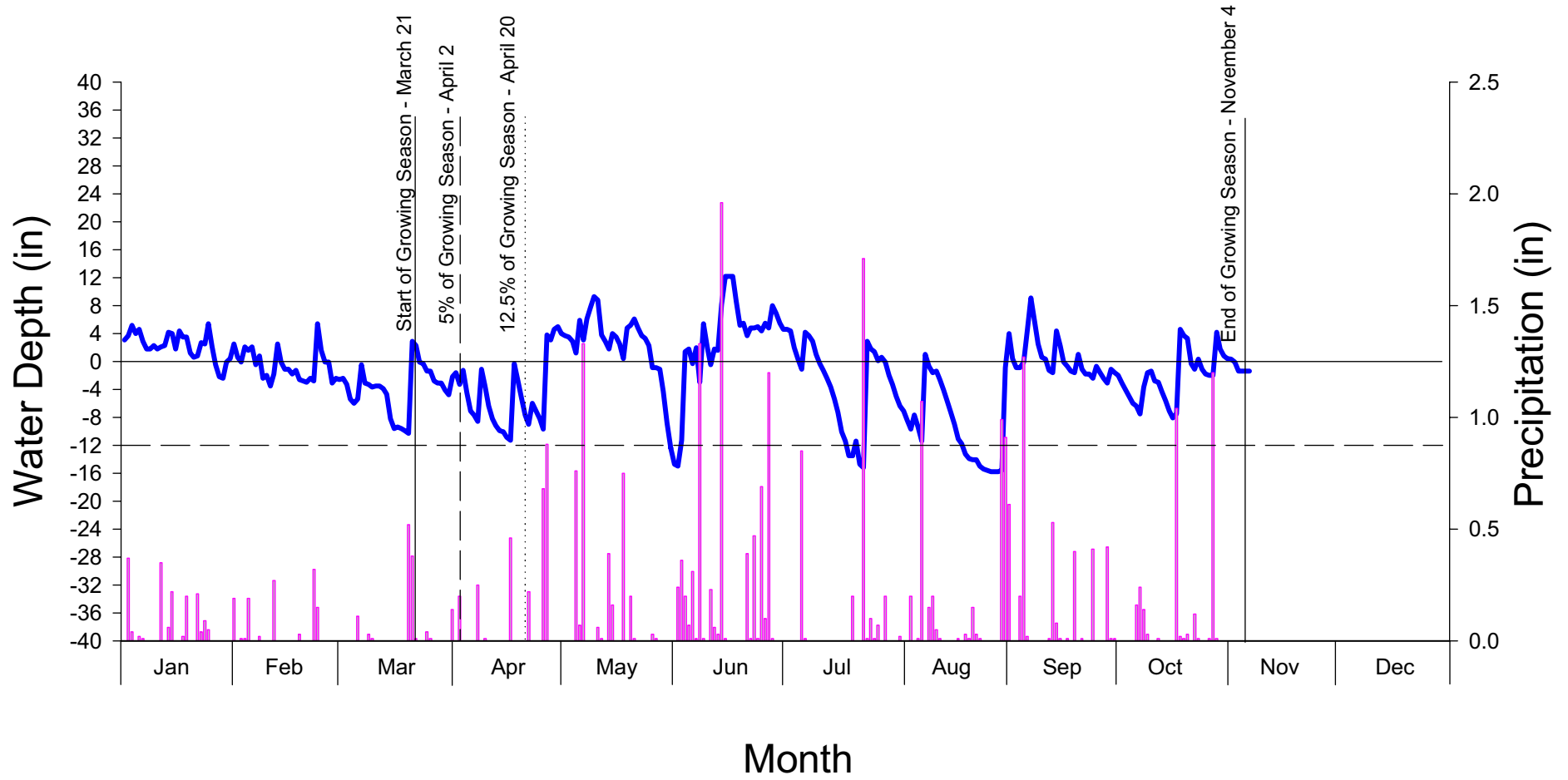
Monitoring Gauge 4 - 04CDAAF



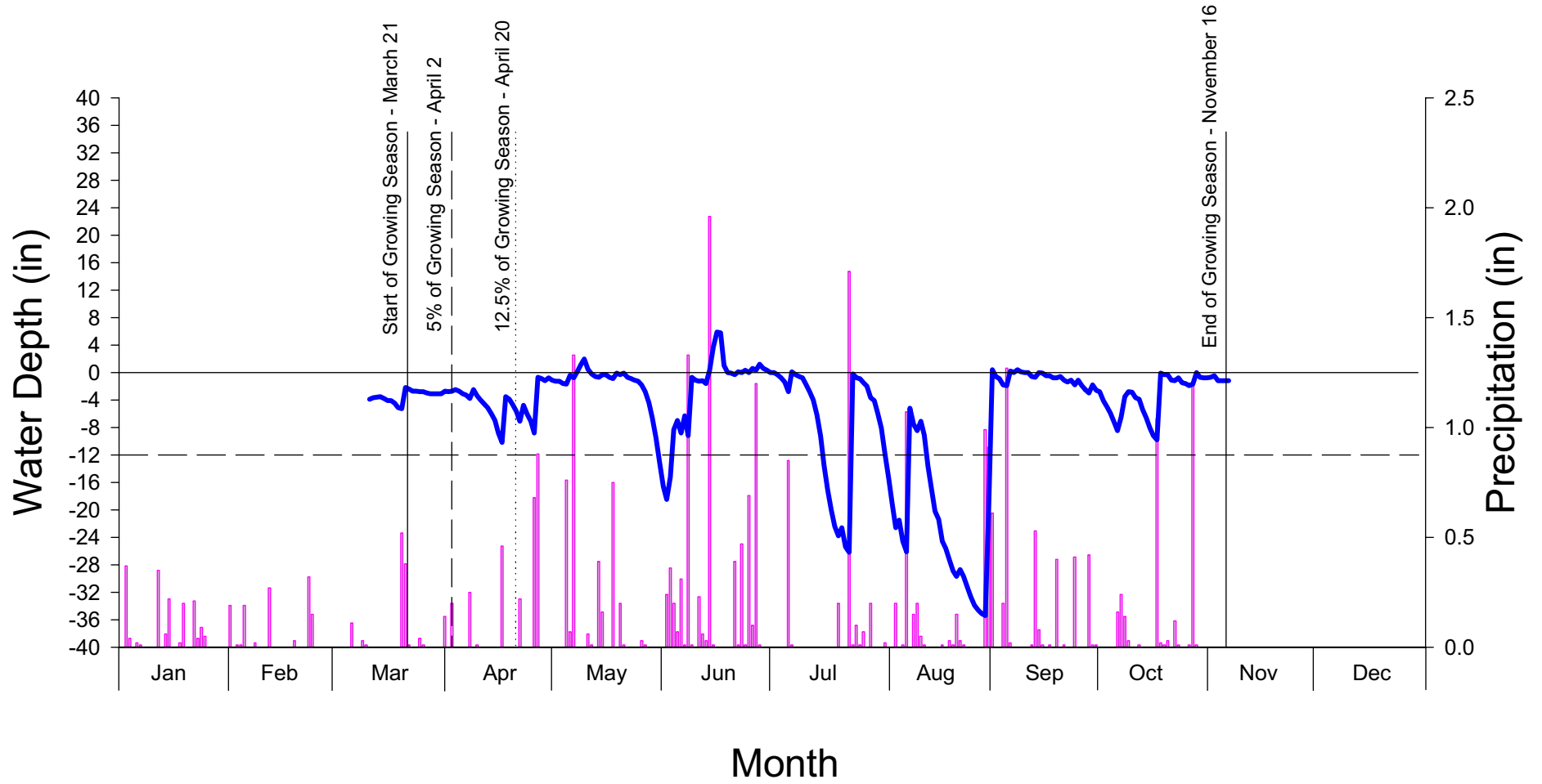
Benson Grove

2006

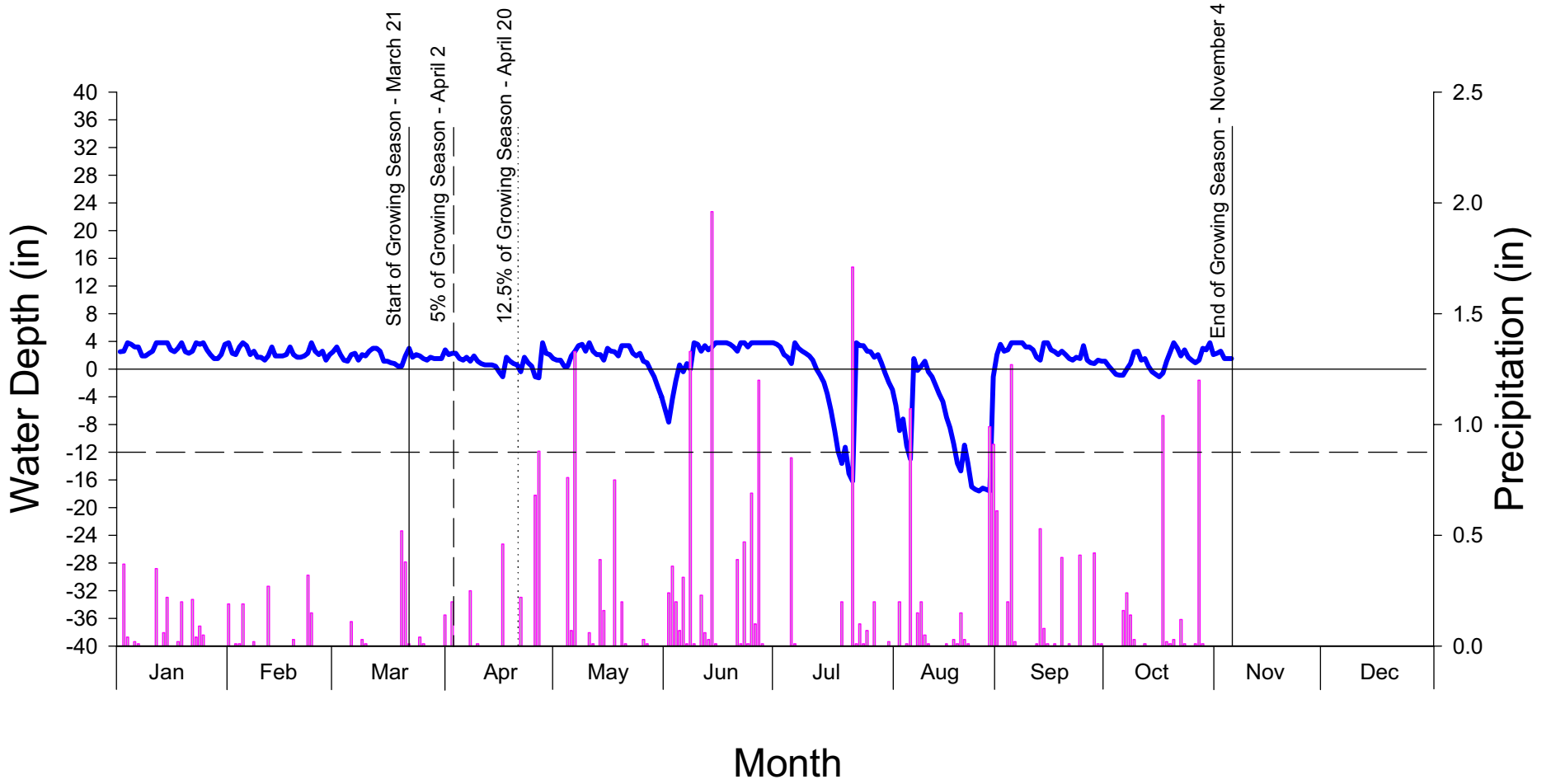
Monitoring Gauge 5 - 04CD984



Benson Grove 2006 Monitoring Gauge 6 - 04CD8F0



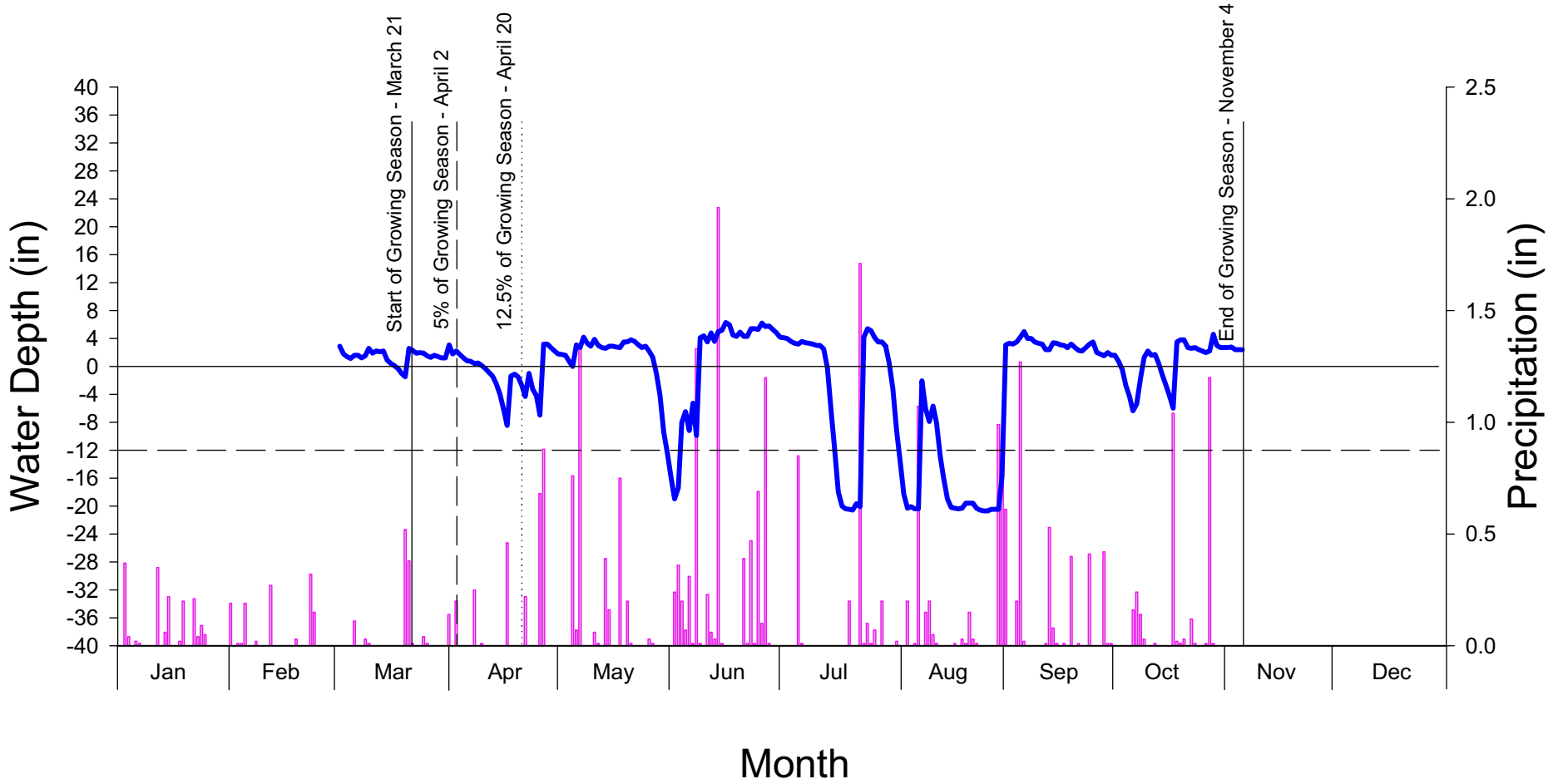
Benson Grove 2006 Monitoring Gauge 7 - 04CD8CD



Benson Grove

2006

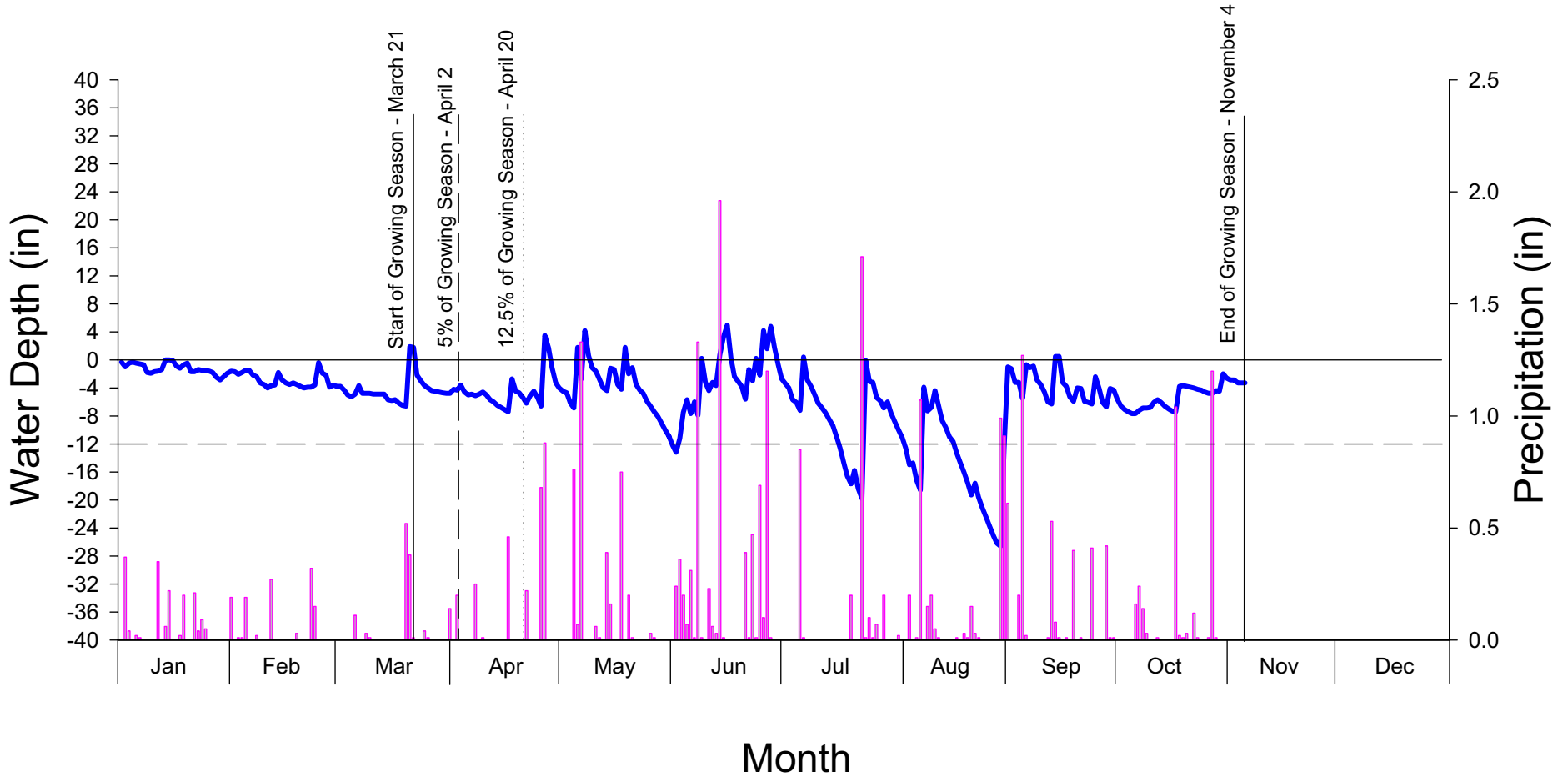
Monitoring Gauge 8 - 9D7E820



Benson Grove

2006

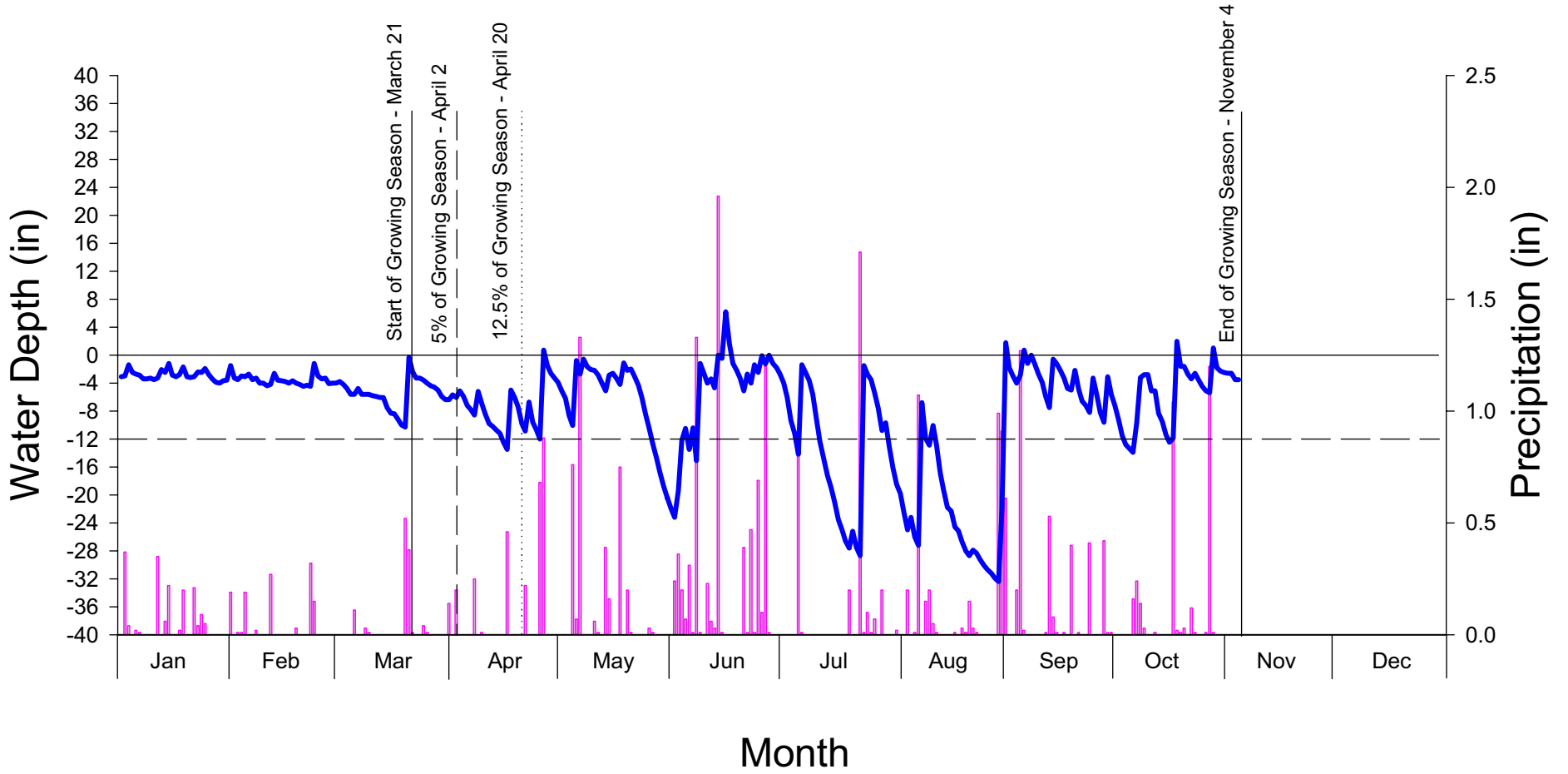
Monitoring Gauge 9 - B6B8E7D



Benson Grove

2006

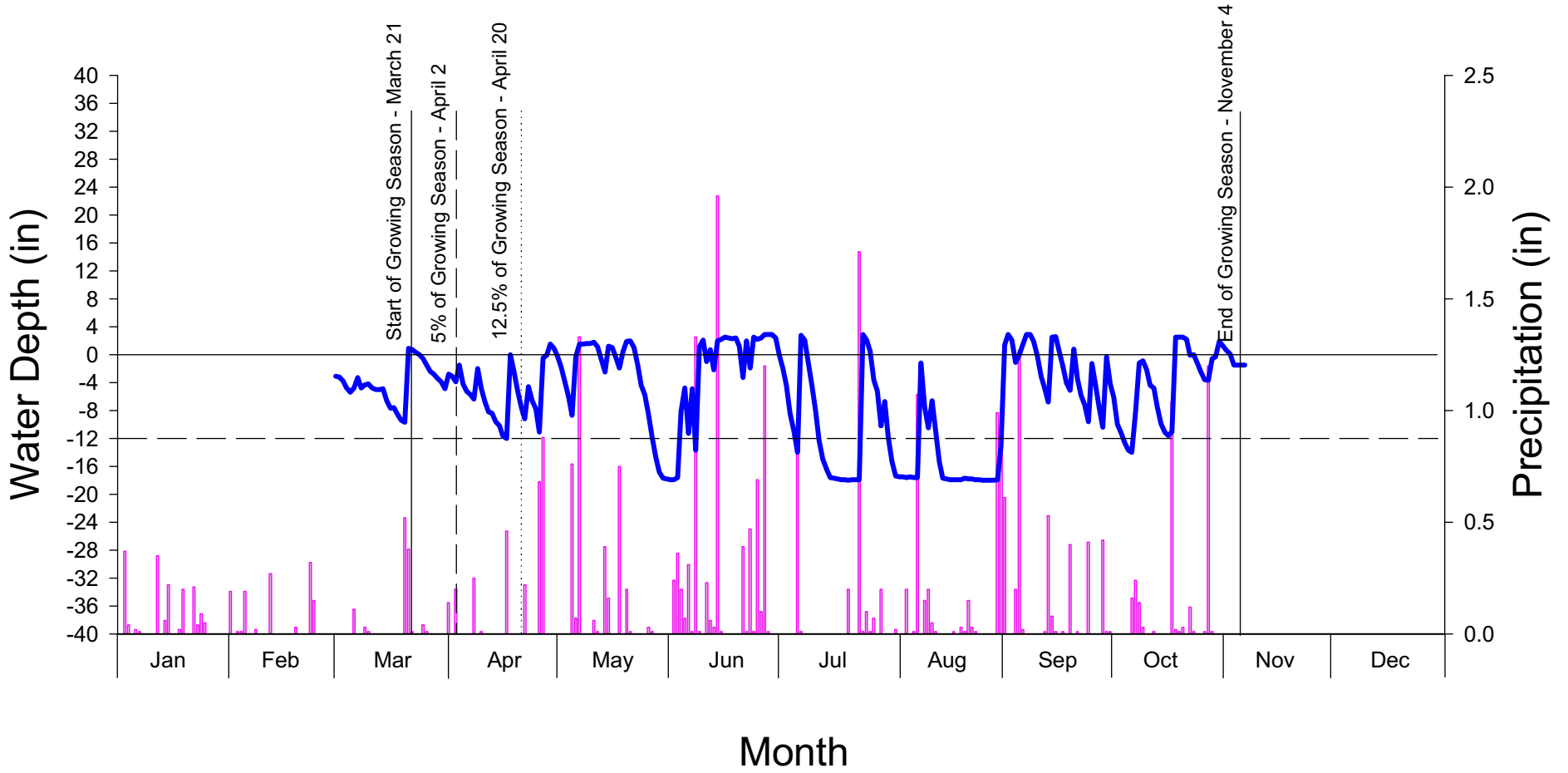
Monitoring Gauge 10 - B6B4A4B



Benson Grove

2006

Monitoring Gauge 11 - 1D34155



APPENDIX C

SITE PHOTOS

Benson Grove
Fixed Station Photos
October 10, 2006 – Year 5



Photo Plot 1



Photo Plot 2



Photo Plot 3



Photo Plot 4



Photo Plot 5



Photo Plot 6



Photo Plot 7



Photo Plot 8



Photo Plot 9



Photo Plot 10



Photo Plot 11



Photo Plot 12

Benson Grove
Vegetation Plot Photos
October 10, 2006 – Year 5



Plot 1



Plot 2



Plot 3



Plot 4



Plot 5



Plot 6



Plot 7



Plot 8



Plot 9



Plot 10

APPENDIX D
RESTORATION PLAN

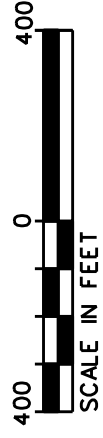
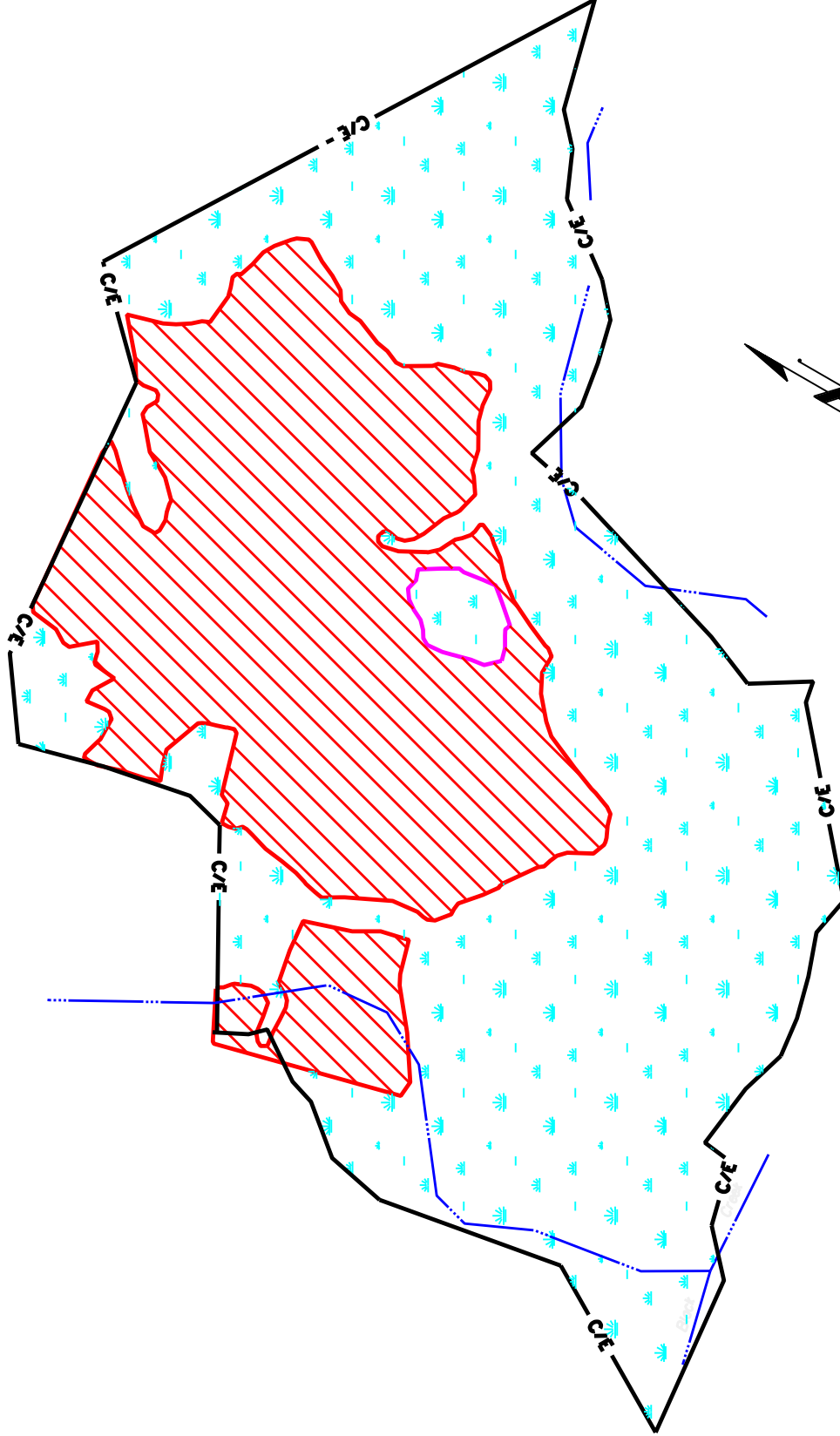


WETLAND PRESERVATION 50.7± ac.



WETLAND RESTORATION 31.5± ac.

Total 82.2± ac.



Client: **WETLAND RESTORATION AREA**
Benson Grove Mitigation Site

Project: **EEP Project No. 32**
JOHNSTON COUNTY, NORTH CAROLINA

Drawn By:	GWN	Date:	DEC 2006
Clad By:	JWG	Scale:	1" = 400'
ESC Project No.:			06-282.02

FIGURE **D**