ANNUAL REPORT FOR 2002

Mallard Creek Mitigation Site
Mecklenburg County
Project No. 8.U670123
TIP No. R-211 WM

Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
December 2002/March 2003 (Revised)

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Summary

The following report summarizes the monitoring activities that have occurred in the past year at the Mallard Creek Mitigation Site. This site was originally constructed in 1994 and underwent remediation in 1997. Monitoring activities in 2002 represent the fifth year of monitoring following the remediation. The site must demonstrate both hydrologic and vegetation success for a minimum of three years.

The Mallard Creek site is divided into two sites. Site 1 is the smaller of the two, containing three monitoring gauges, one surface gauge, and two vegetation plots. Site 2 contains seven monitoring gauges, a rain gauge, and four vegetation plots. This site, located across Mallard Creek Church Road from Site 1, is at a slightly higher elevation than its counterpart.

Hydrologic data indicated that Site 1 has met the hydrologic success criteria for the fifth full year of monitoring. In 2002, all of the site 1 gauges showed saturation greater than 12.5% of the growing season.

Hydrologic data indicated that Site 2 has not met success criteria. Four gauges showed between 8 and 12.5% saturation, 1 gauge showed between 5 and 8% saturation, with only 2 gauges showing more than 12.5% saturation.

The daily rainfall data depicted on the gauge data graphs is recorded from an on-site rain gauge that was installed on May 4, 2000. Additional Charlotte rainfall data used for the 30-70 graph was provided by the NC State Climate Office. In 2002, Charlotte experienced a dry early growing season, the most critical part of the year to meet hydrologic success criteria for this site.

Vegetation monitoring yielded a successful stem count in 6 of 6 plots with an average density of 539 trees per acre.

The Mallard Creek Church Road widening project, U-2508C, was let for construction on November 20, 2001. Based on the monitoring results from the 2002 growing season and because additional hydrology that will be added during the construction project, NCDOT recommends that monitoring continue.

1.0 Introduction

1.1 PROJECT DESCRIPTION

The Mallard Creek Mitigation Site, located in Mecklenburg County, consists of two separate wetland sites. Both are situated along SR 2833 (Mallard Creek Church Road), just east of US 29 (Figure 1). The two sites mitigate for wetland impacts associated with the Charlotte Outer Loop (R-211 DA, USACE Action I.D. 199200013).

Both sites, totaling 10 acres in size, consist of the creation and restoration of a bottomland hardwood forest. The sites were initially constructed and planted in 1994; however, hydrologic and vegetation problems forced remediation in 1997. Remediation activities involved grading both sites to more accurately reflect groundwater profiles.

The site was developed in cooperation with Mecklenburg County. As a result of this partnership, the county will incorporate the mitigation sites into a greenway plan for the area. A boardwalk has been constructed on Site 2 as part of the Mecklenburg County Parks and Recreation system. An additional section of boardwalk will be constructed adjacent to Site 1 when Mallard Creek Church Road is widened; this project is slated for the year 2002.

1.2 PURPOSE

In order to demonstrate successful mitigation, hydrologic and vegetative criteria must be met for a minimum of three consecutive years. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during the year 2002 at the Mallard Creek Mitigation Site.

Activities in 2002 reflect the fifth year of monitoring following the remediation efforts in 1997. Included in this report are analyses of both hydrologic and vegetative monitoring results as gauge as onsite and local climate conditions throughout the growing season and site photographs.

Figure 1. Site Location Map

1.3 PROJECT HISTORY

October 1994	Site 1&2: Grading Construction
February 1995	Site 2: Planted; Site 1: No planting
September 1995	Vegetation Monitoring (1yr.)
March - November 1996	Hydrologic Monitoring
September 1996	Vegetation Monitoring (2 yr.)
October 1997	Site 1&2: Remediation, Grading Construction
February 1998	Site 2: Boardwalk Construction
January-February 1998	Tree Planting: Site 1&2
May 1998	Monitoring Gauges Installed
May - November 1998	Hydrologic Monitoring (1 yr.)
September 1998	Vegetation Monitoring (1 yr.)
May - November 1999	Hydrologic Monitoring (2 yr.)
September 1999	Vegetation Monitoring (2 yr.)
March - November 2000	Hydrologic Monitoring (3 yr.)
September 2000	Vegetation Monitoring (3 yr.)
December 2000	Water Main Fixed Adjacent to Site 1
March - November 2001	Hydrologic Monitoring (4 yr.)
June 2001	Vegetation Monitoring (4 yr.)
March - November 2002	Hydrologic Monitoring (5 yr.)
August 2002	Vegetation Monitoring (5 yr.)

1.4 DEBIT LEDGER

Table 1. Mallard Creek Mitigation Site Debit Ledger

Mallard Creek	Mit. Plan			Ratios	TIP DEBIT
Mecklenburg Co.					
Habitat	Acres at Start:	Acres Remaining	% Remaining		R-211DA, DD, DB
BLH Restoration/Creation	9.1	0	0.00		9.1
TOTAL		0			

BLH: Bottomland Hardwood

2.0 Hydrology

2.1 SUCCESS CRITERIA

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that the area must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive day percentage of 12.5% of the growing season. Areas inundated or saturated for less than 5% of the growing season are always classified as non-wetlands. Areas inundated or saturated between 5% - 12.5% of the growing season can be classified as wetlands depending upon factors such as the presence of wetland vegetation and hydric soils.

The growing season in Mecklenburg County begins March 22 and ends November 11 (235 days). These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 22 and before November 11.[1] Based on the current guidelines, the optimum hydrology requires 12.5% of this season, or at least 29 consecutive days. Local climate must also represent average conditions for the area.

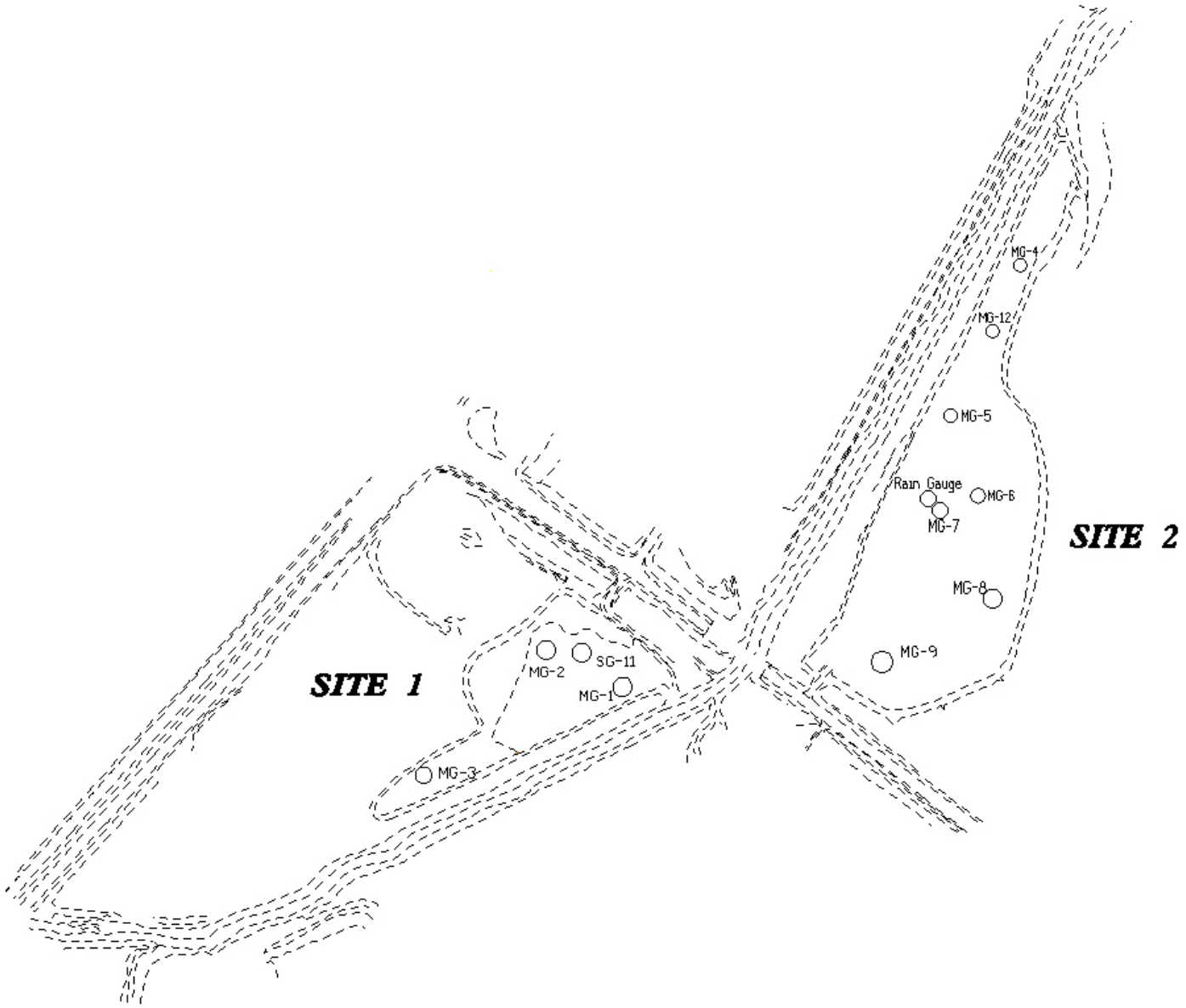
2.2 HYDROLOGIC DESCRIPTION

In May of 1998, ten groundwater gauges, one rain gauge, and one surface water gauge were installed at the Mallard Creek Mitigation Sites (Figure 2). The original rain gauge installed at this time was replaced on May 4, 2000. The automatic groundwater gauges record daily readings of groundwater depth.

The Mallard Creek site was designed to receive hydrologic input from both rainfall and runoff from Mallard Creek Church Road. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events. The 2002 data represents the fifth growing season for hydrologic monitoring following the remediation efforts in 1997.

[1] Natural Resources Conservation Service, Soil Survey of Mecklenburg County, North Carolina, p.61.

Figure 2. Monitoring Gauge Location Map



2.3 RESULTS OF HYDROLOGIC MONITORING

2.3.1 Site Data

To determine if the site met the Federal guidelines, saturation within 12 inches of the surface for at least 12.5% of the growing season, the maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 235-day growing season (March 22 – November 11). The results are presented in Table 2.

Figure 3 is a graphical representation of the hydrologic monitoring results.

Table 2. Hydrologic Monitoring: Mallard Creek Mitigation Site-12" Success Criteria

Monitoring Gauge	<5%	5-8%	8-12.5%	>12.5%	Actual %	Success Dates
Site 1						
MW-1*				✔	13.6	10/11-11/11
MW-2				✔	24.7	9/15-11/11
MW-3*				✔	13.6	(3/22-4/20) (10/11- 11/11)
Site 2						
MW-4			✔		9.8	10/12-11/3
MW-5			✔		10.6	3/22-4/15
MW-6*			✔		12.3	(3/22-4/19) (10/14-11/11)
MW-7*			✔		13.6	10/11-11/11
MW-8		✔			6.4	
MW-9*				✔	13.6	10/11-11/11
MW-12*				✔	13.2	10/12-11/11

* Gauges met the criteria success during an above average rainfall for the month of October.

Additionally, Appendix A contains hydrologic graphs. If greater than 5% of the growing season showed saturation, the maximum number of consecutive days is noted on each graph. The individual precipitation events, shown on the monitoring gauge graphs as bars, represent data collected from the on-site rain gauge. Additionally, precipitation data obtained from a Charlotte weather station was used to generate the 30-70-percentile graph. Historical data was provided by the NC State Climate Office.

Site 1 hydrologic data indicates that the site meets the hydrologic success criteria established by the Federal guidelines. The site was saturated or inundated for more than 12.5% of the growing season within 12" of the ground. All three gauges showed saturation multiple times throughout the growing season. The surface gauge located on Site 1 showed consistent inundation throughout the growing season.

Site 2 hydrologic data indicates that only 2 of the gauges met the Federal guidelines for success. Gauges 9 and 12 showed saturation or inundation greater than 12.5% of the growing season within 12" of the ground. Gauges 4,5,6, and 7 showed saturation for between 8 and 12.5% of the growing season within 12" of the ground. Gauge 8 showed saturation for between 5 and 8% of the growing season. The data for Site 2 still indicates that the groundwater levels drop quickly after rainfall.

For Site 1, all three gauges showed saturation for more than 12.5% of the growing season. Site 2 did not recover from Charlotte's dry early season.

2.3.2 Climatic Data

Figure 4 shows the monthly rainfall totals for the period of November 2001 through October 2002. Months below the normal rainfall include: February, April, June, and July. Months with normal rainfall include January, March, May, August, and September. The only month with above normal rainfall conditions was October. The site experienced below average rainfall for 2002.

2.4 CONCLUSIONS

The year 2002 is the fifth full growing season that the monitoring gauges have been in place since installing them five years ago. Site 1 has exceeded success criteria for the year 2002.

The site experienced below average rainfall for 2002. In the future, the site will receive increased hydrology from the widening of Mallard Creek Church Road (U-2508C, let to construction on November 20, 2001). NCDOT recommends the continued monitoring of the two sites.

Figure 3. Hydrologic Monitoring Results

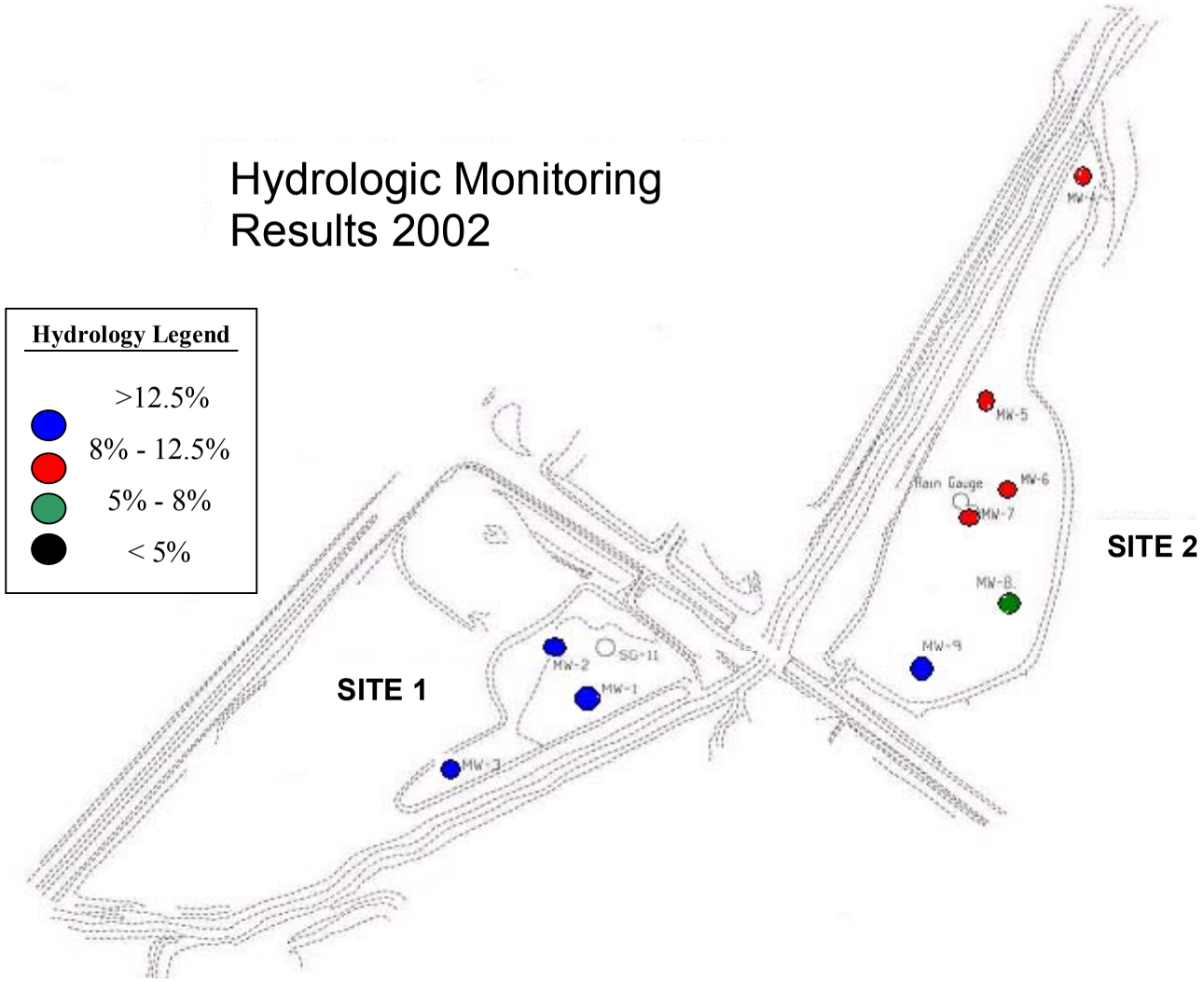
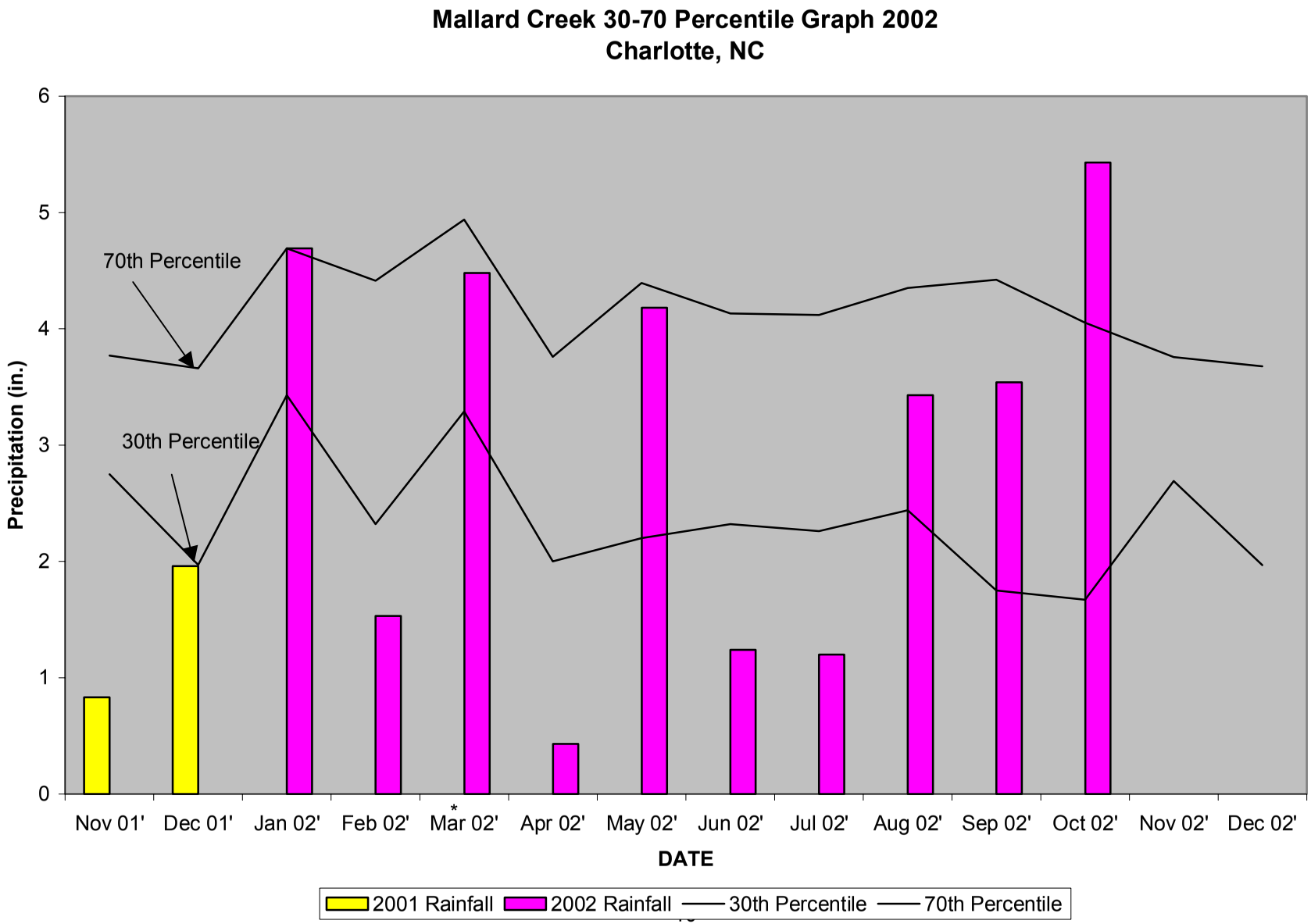


Figure 4.


Mallard Creek 30-70 Percentile Graph 2002
Charlotte, NC
Precipitation (in.)
0
1
2
3
4
5
6
70th Percentile
30th Percentile
Nov 01'
Dec 01'
Jan 02'
Feb 02'
Mar 02'
Apr 02'
May 02'
Jun 02'
Jul 02'
Aug 02'
Sep 02'
Oct 02'
Nov 02'
Dec 02'
DATE
2001 Rainfall
2002 Rainfall
30th Percentile
70th Percentile

3.0 VEGETATION: MALLARD CREEK MITIGATION SITE (YEAR 5 MONITORING)

3.1 Success Criteria

Success criteria states that there must be a minimum of 320 trees per acre surviving for three consecutive years.

3.2 Description of Species

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

Fraxinus pennsylvanica, Green Ash

Nyssa sylvatica var*. sylvatica*, Blackgum

Quercus lyrata, Overcup Oak

Quercus nigra, Water Oak

3.3 Results of Vegetation Monitoring

Table 3. Vegetation Monitoring Statistics

Plot # (Type)	Green Ash	Blackgum	Overcup Oak	Water Oak	Total (5 years)	Total (at planting)	Density (Trees/Acre)
1(BLH)	16	1	4		21	31	461
2(BLH)	8		16	1	25	27	630
3(BLH)	14		15		29	35	563
4(BLH)	9	11	8	3	31	31	680
5(BLH)	18		6	3	27	38	483
6(BLH)	19		2	1	22	36	416
	Average Density						**539**

Site Notes: Other species noted: cottonwood, various grasses, black willow, lespedeza, *Juncus* sp., *Carex* sp., boxelder, horse-nettle, smartweed, foxtail and volunteer green ash and sycamore. Few cattails noted in and around Plot 6. The presence of these species does not appear to be affecting the survival of the planted trees.

3.4 Conclusions

Approximately 10 acres of this site was re-graded in the Fall, 1997. The total site is made up of two wetland mitigation areas. Wetland Mitigation Area #1 is a 2.8 acre site located in the southwest quadrant of the intersection of SR 2833 and Mallard Creek, while the remaining 7.2 acres is located directly across SR 2833 in the northwest quadrant. There were 6 vegetation monitoring plots established throughout the planting areas, 2 plots in mitigation area #1 and 4 plots in mitigation area #2. The 2002 vegetation monitoring revealed an average tree density of 539 trees per acre. This average is well above the minimum success criteria of 320 trees per acre.

NCDOT proposed to discontinue vegetation monitoring at the Mallard Creek mitigation site until completion of the Mallard Creek Church roadway project and a final evaluation of its effect on vegetation survival.

4.0 Overall Conclusions/Recommendations

- The vegetation monitoring plots have indicated an average tree density of over 320 trees per acre.

- All groundwater and surface water gauges located on Site 1 met the hydrologic success criteria as stated in the Federal guidelines. The site continues to show successful hydrology.

- Two of the 7 gauges showed saturation within 12” of the ground greater than 12.5% of the growing season in Site 2.

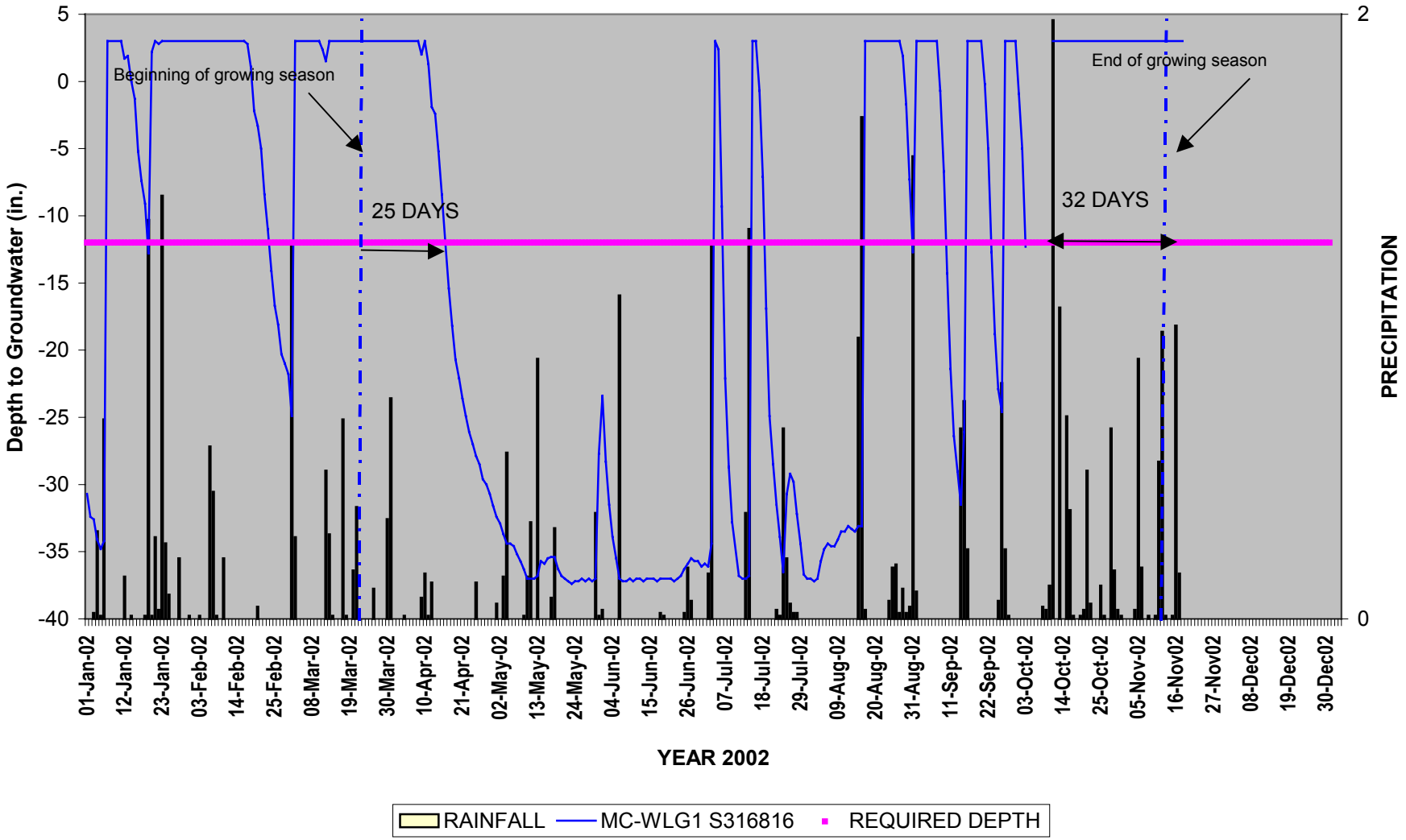
- NCDOT proposes to continue hydrologic monitoring and to discontinue vegetation monitoring until completion of the Mallard Creek Church roadway project.

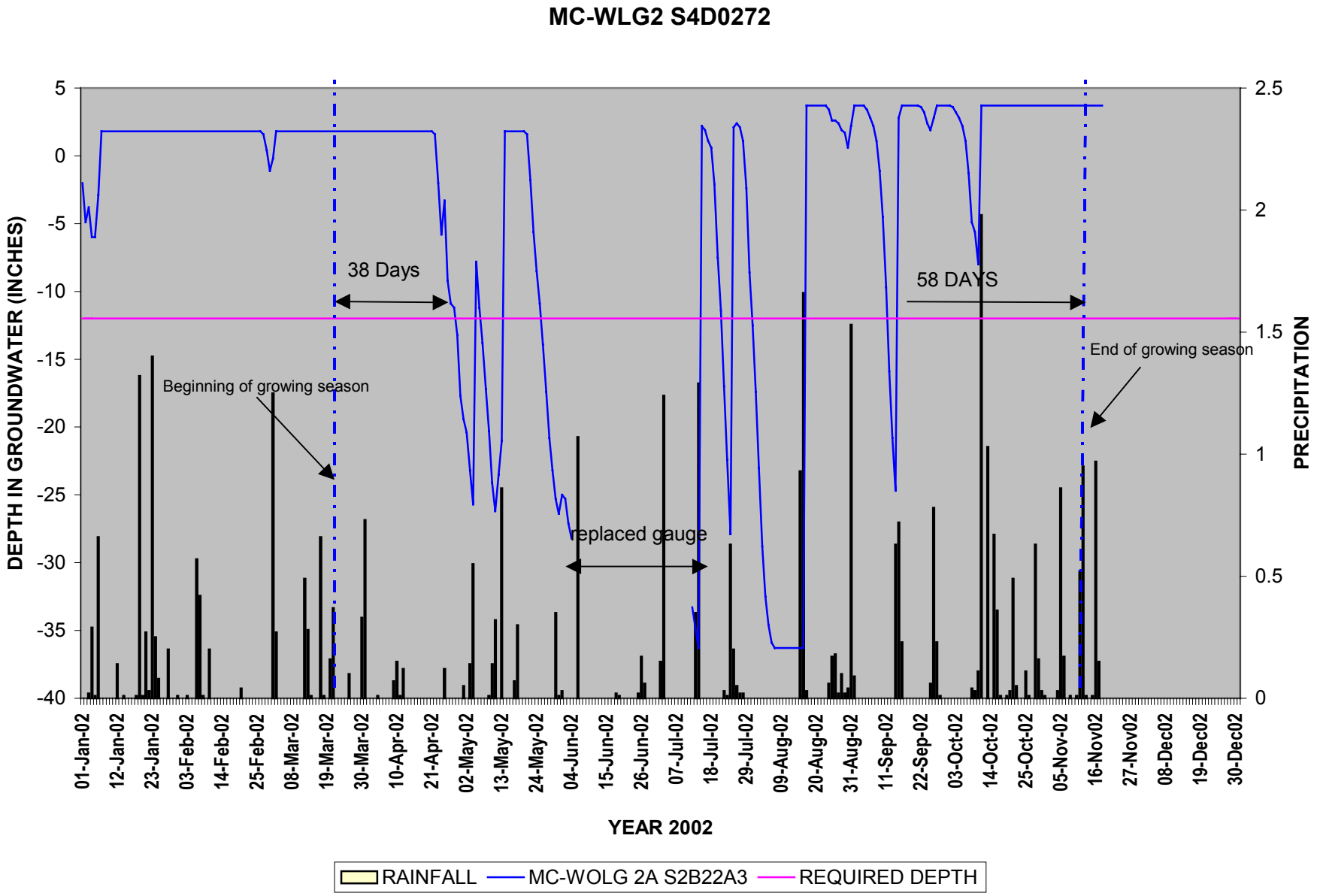
APPENDIX A

DEPTH TO GROUNDWATER & SURFACE GAUGE PLOTS

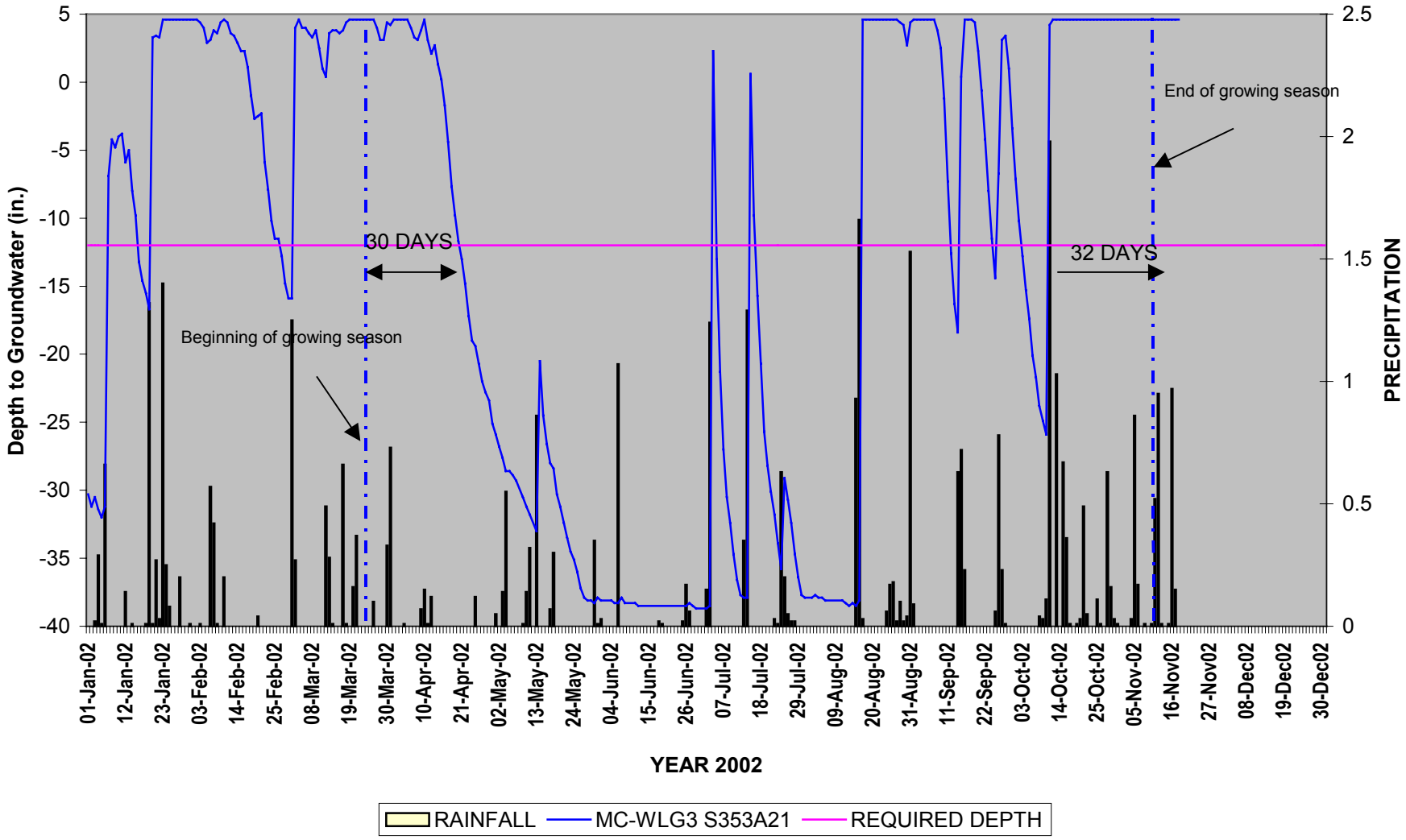
MALLARD CREEK GROUNDWATER GAUGE GRAPHS

MC-WLG1 S316816

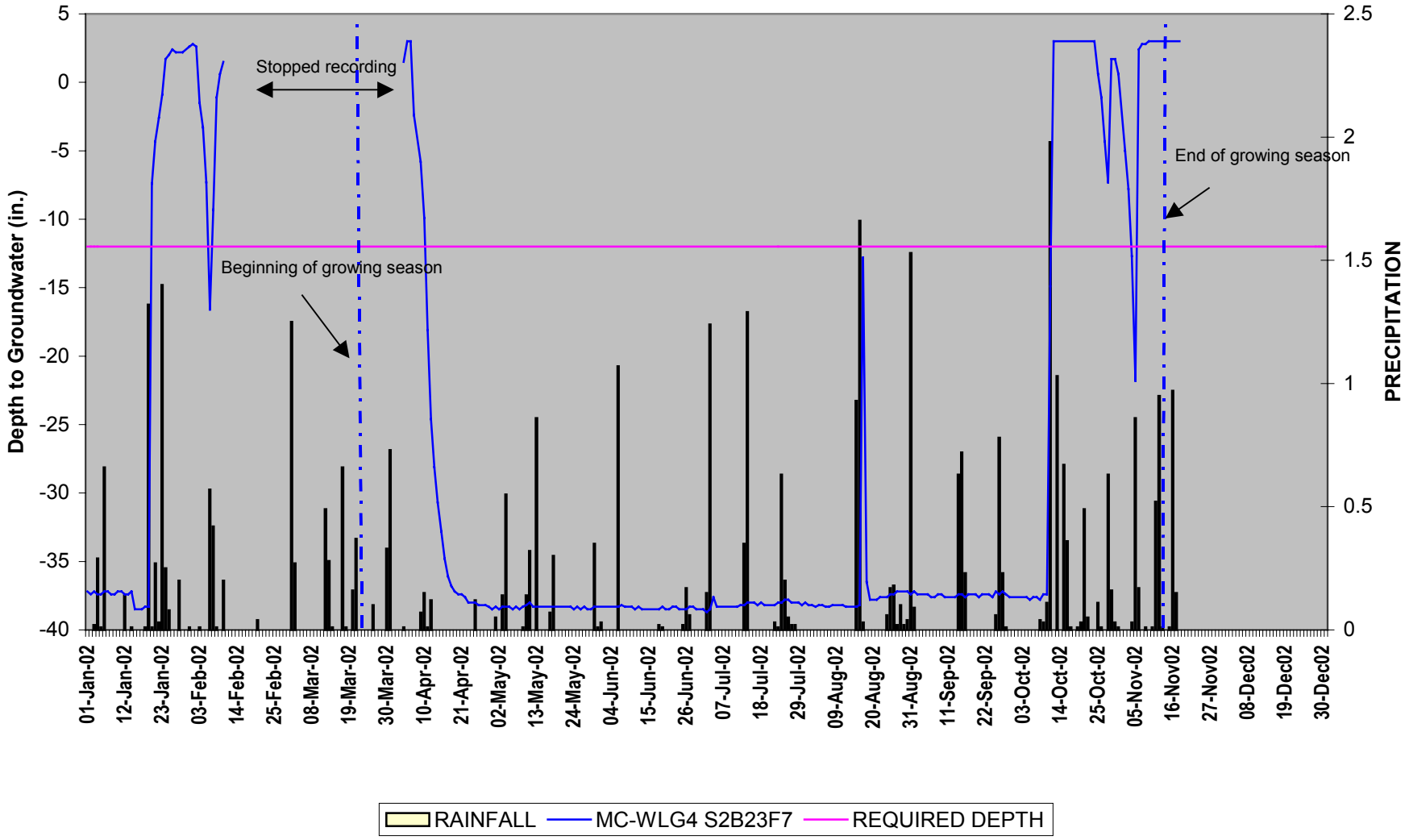


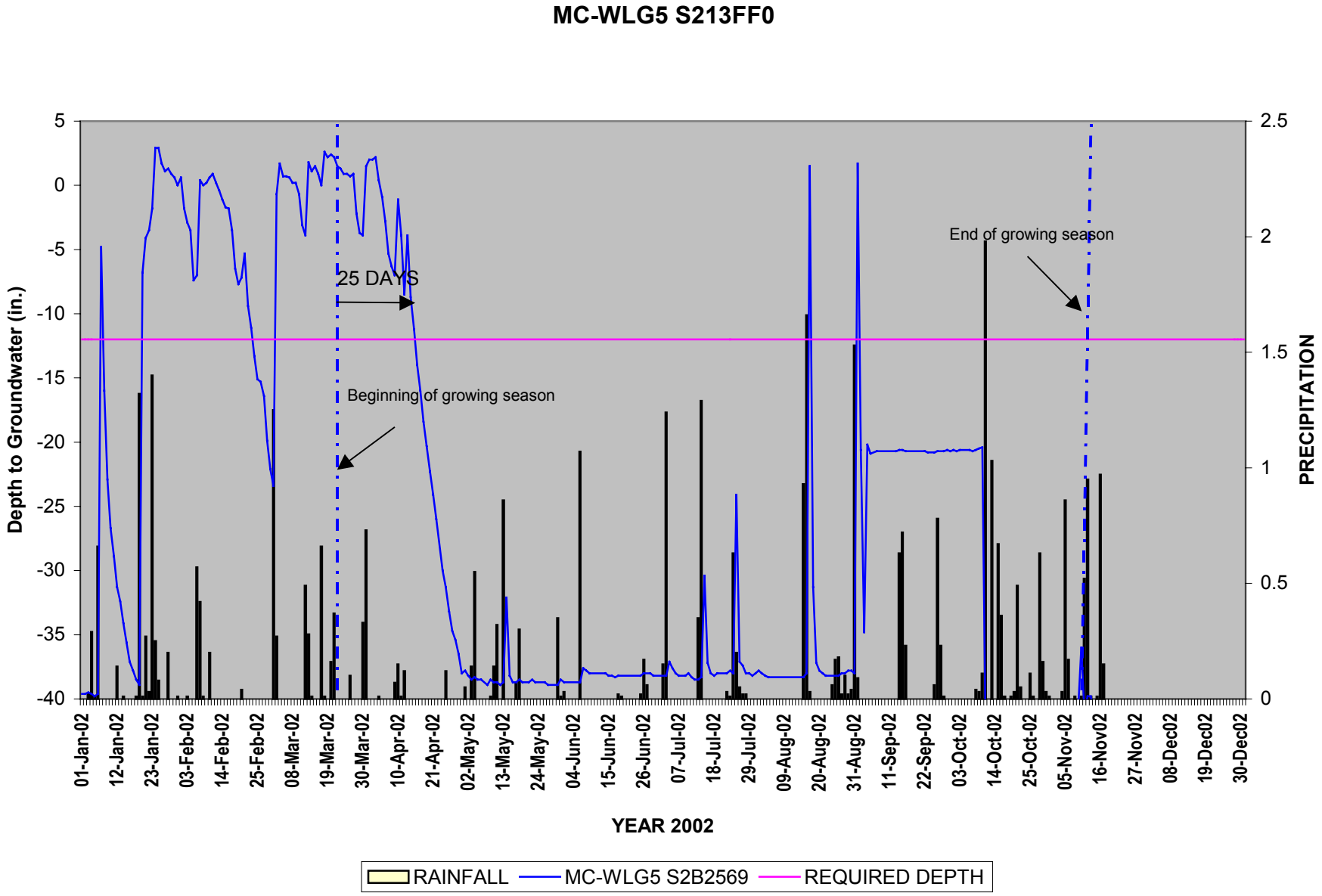

MC-WLG2 S4D0272
DEPTH IN GROUNDWATER (INCHES)
PRECIPITATION
YEAR 2002
38 Days
58 DAYS
Beginning of growing season
End of growing season
replaced gauge
RAINFALL
MC-WOLG 2A S2B22A3
REQUIRED DEPTH

MC-WLG3 S353A21

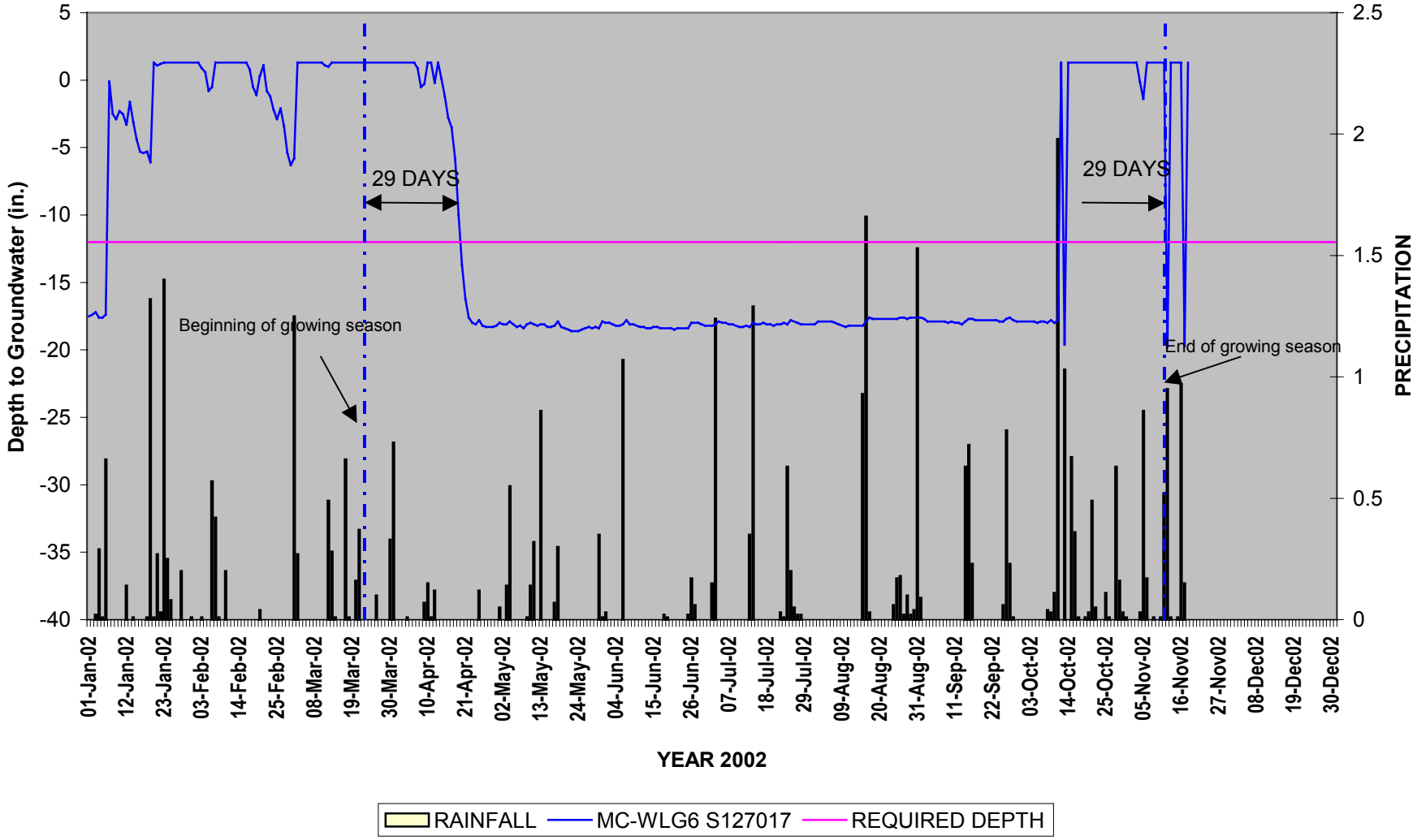


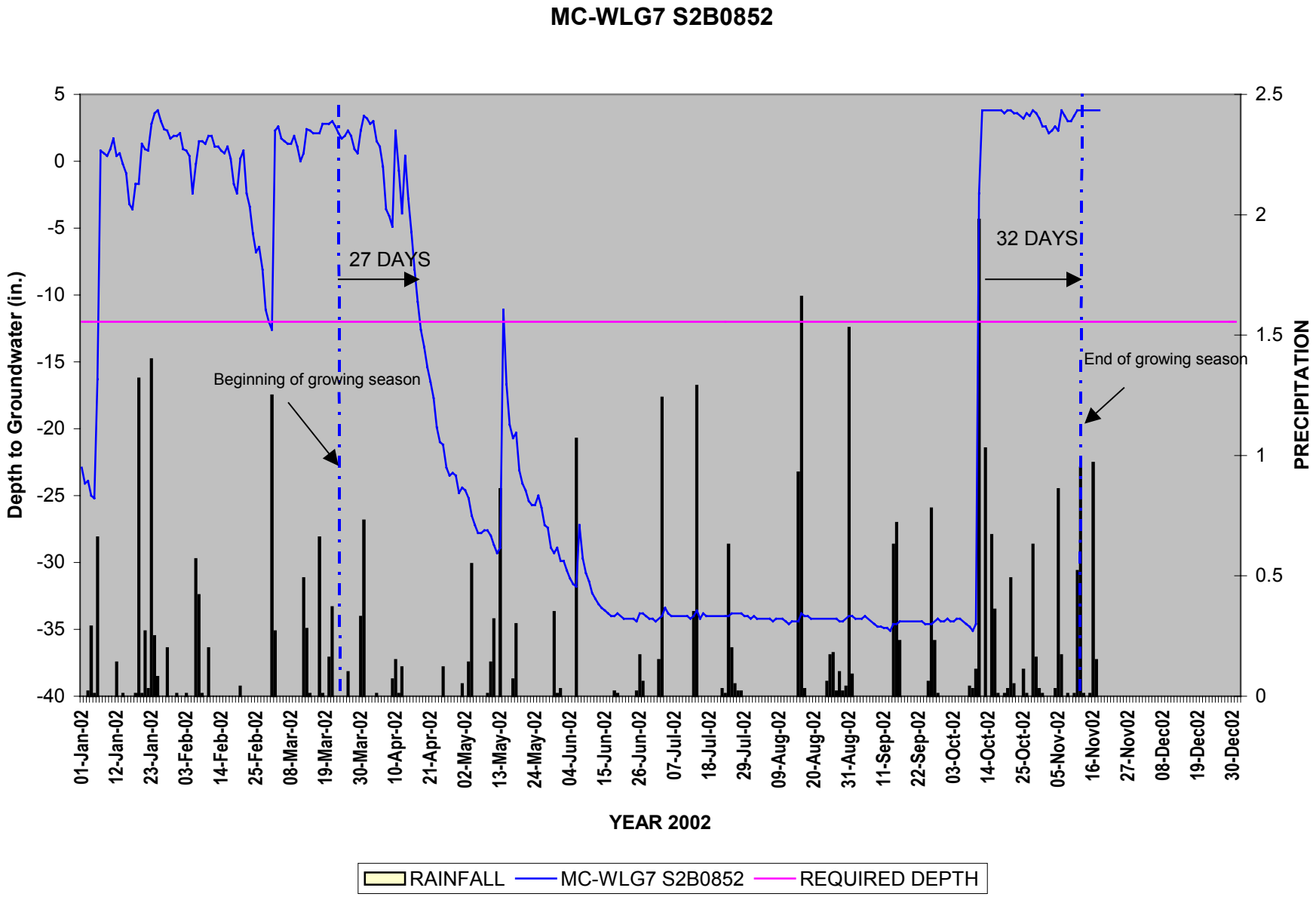
MC-WLG4 S2B23F7



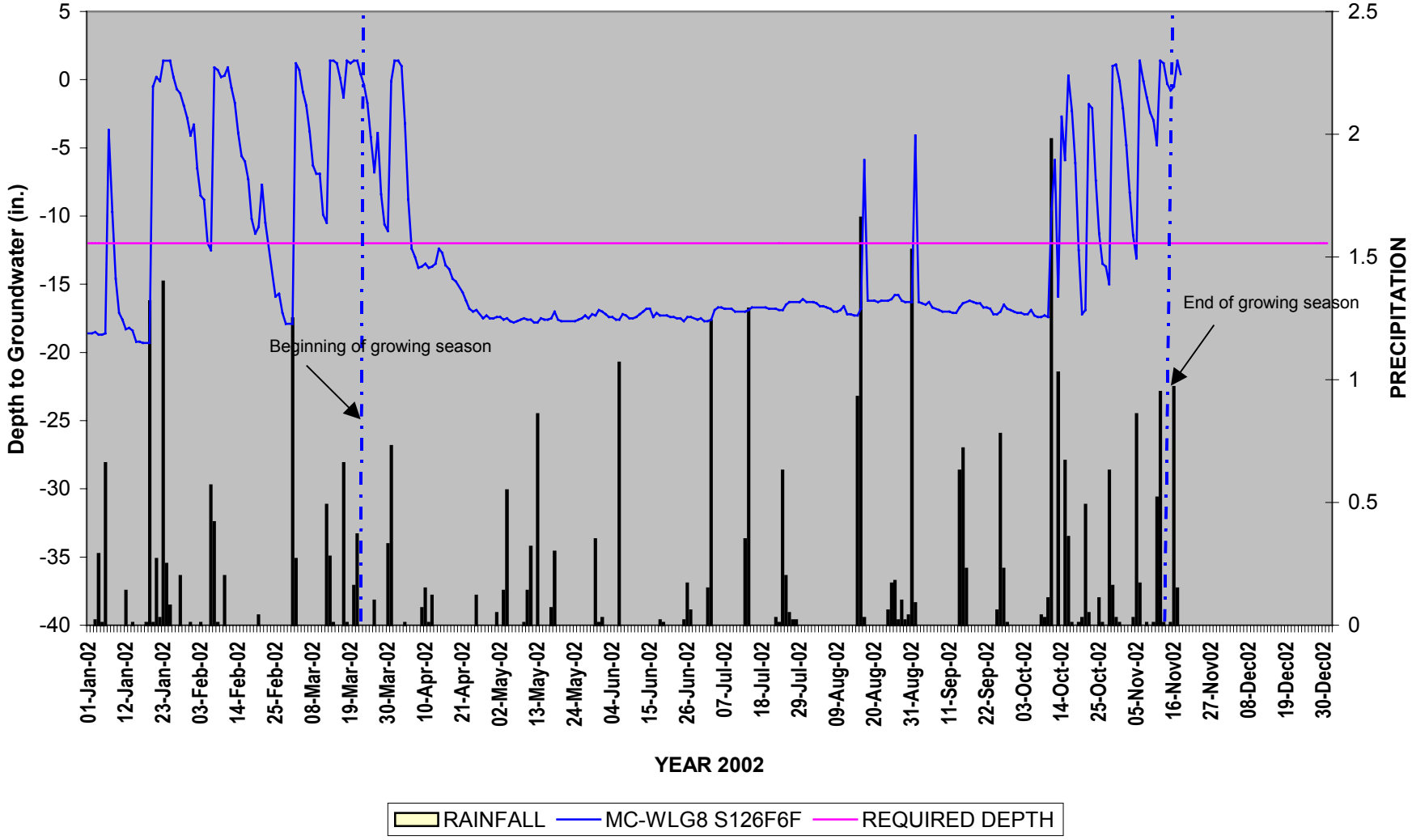

MC-WLG5 S213FF0
Depth to Groundwater (in.)
PRECIPITATION
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
25 DAYS
Beginning of growing season
End of growing season
01-Jan-02
12-Jan-02
23-Jan-02
03-Feb-02
14-Feb-02
25-Feb-02
08-Mar-02
19-Mar-02
30-Mar-02
10-Apr-02
21-Apr-02
02-May-02
13-May-02
24-May-02
04-Jun-02
15-Jun-02
26-Jun-02
07-Jul-02
18-Jul-02
29-Jul-02
09-Aug-02
20-Aug-02
31-Aug-02
11-Sep-02
22-Sep-02
03-Oct-02
14-Oct-02
25-Oct-02
05-Nov-02
16-Nov02
27-Nov02
08-Dec02
19-Dec02
30-Dec02
YEAR 2002
RAINFALL
MC-WLG5 S2B2569
REQUIRED DEPTH

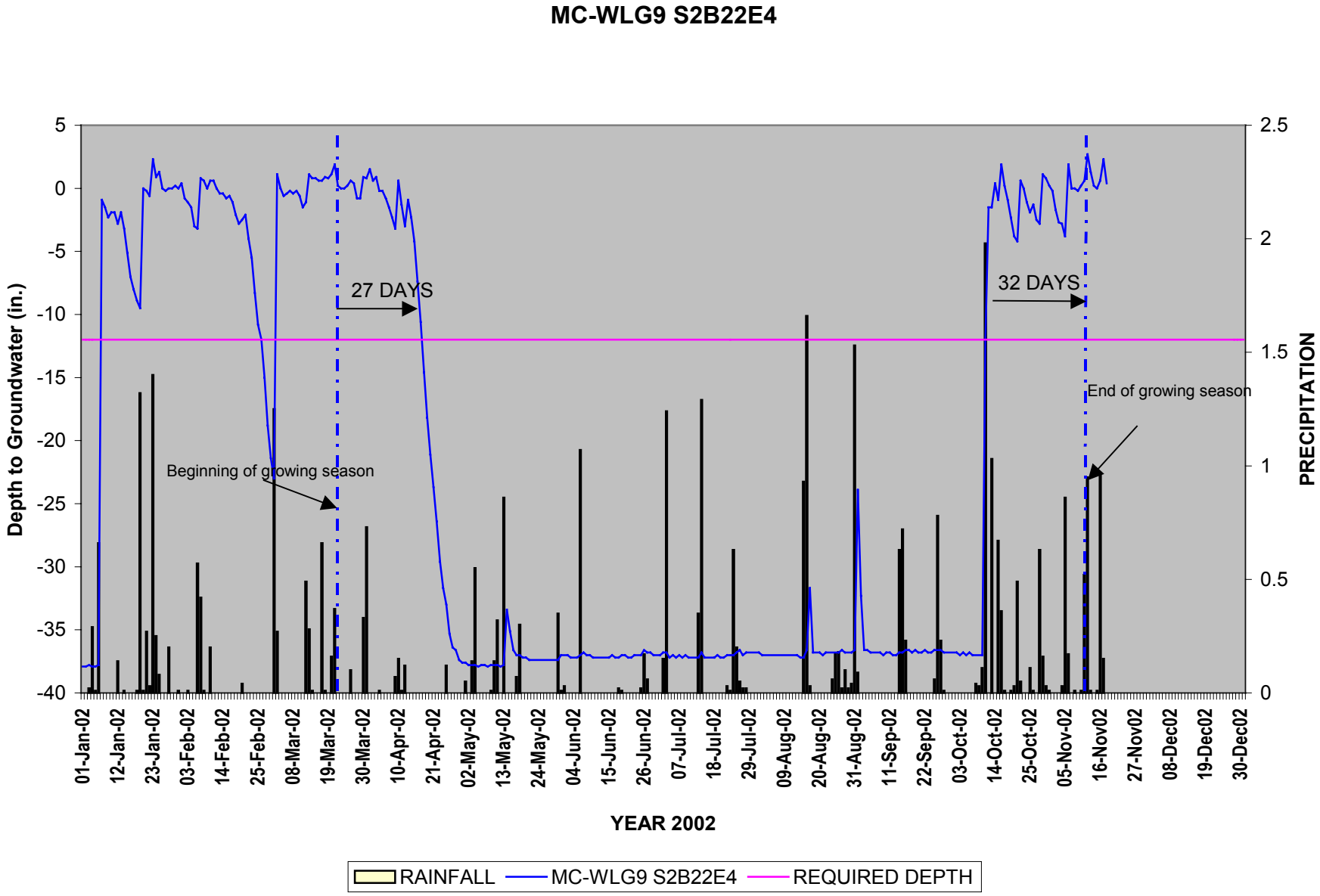
MC-WLG6 S127017



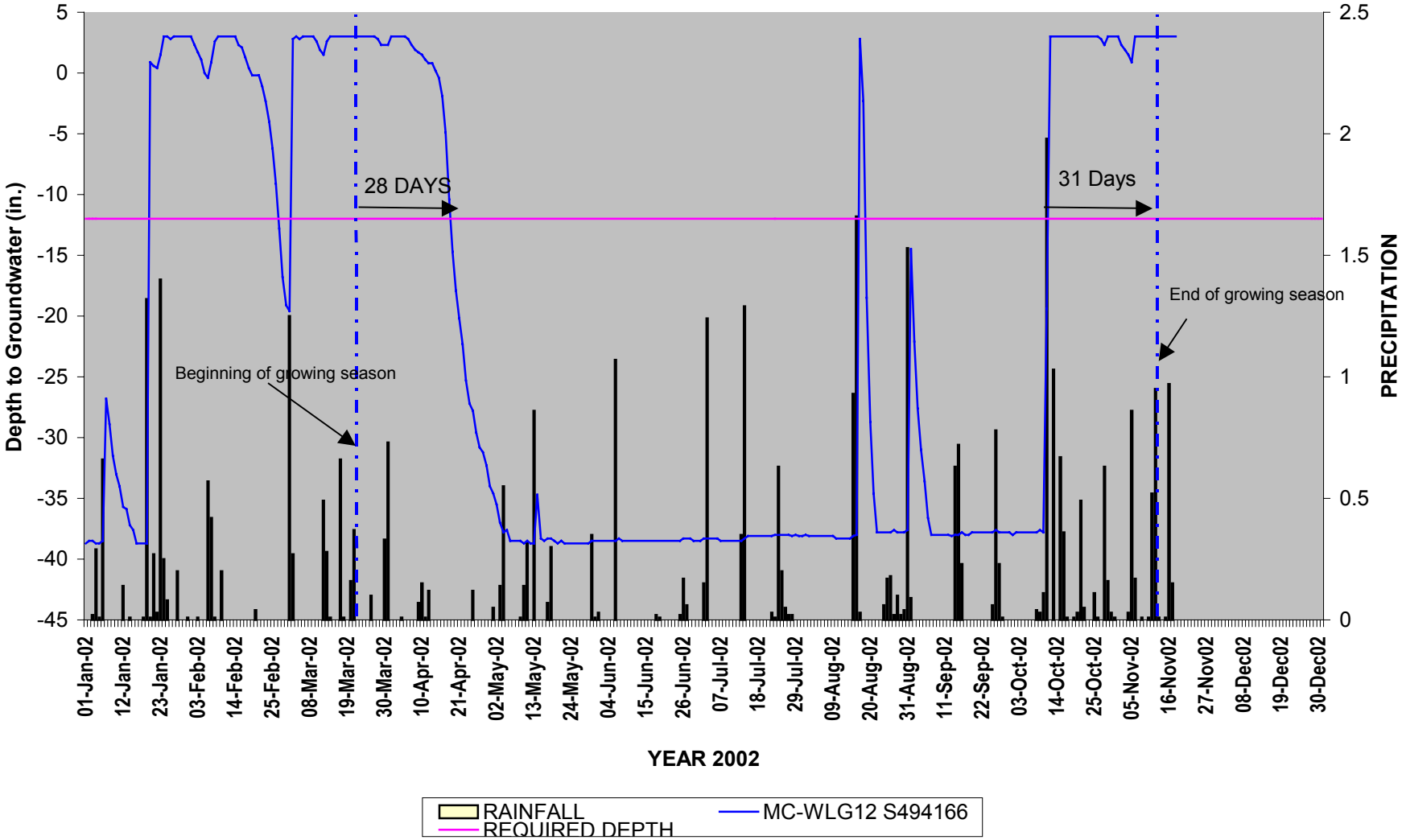

MC-WLG7 S2B0852
Depth to Groundwater (in.)
PRECIPITATION
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
27 DAYS
32 DAYS
Beginning of growing season
End of growing season
01-Jan-02
12-Jan-02
23-Jan-02
03-Feb-02
14-Feb-02
25-Feb-02
08-Mar-02
19-Mar-02
30-Mar-02
10-Apr-02
21-Apr-02
02-May-02
13-May-02
24-May-02
04-Jun-02
15-Jun-02
26-Jun-02
07-Jul-02
18-Jul-02
29-Jul-02
09-Aug-02
20-Aug-02
31-Aug-02
11-Sep-02
22-Sep-02
03-Oct-02
14-Oct-02
25-Oct-02
05-Nov-02
16-Nov02
27-Nov02
08-Dec02
19-Dec02
30-Dec02
YEAR 2002
RAINFALL
MC-WLG7 S2B0852
REQUIRED DEPTH

MC-WLG8 S126F6F



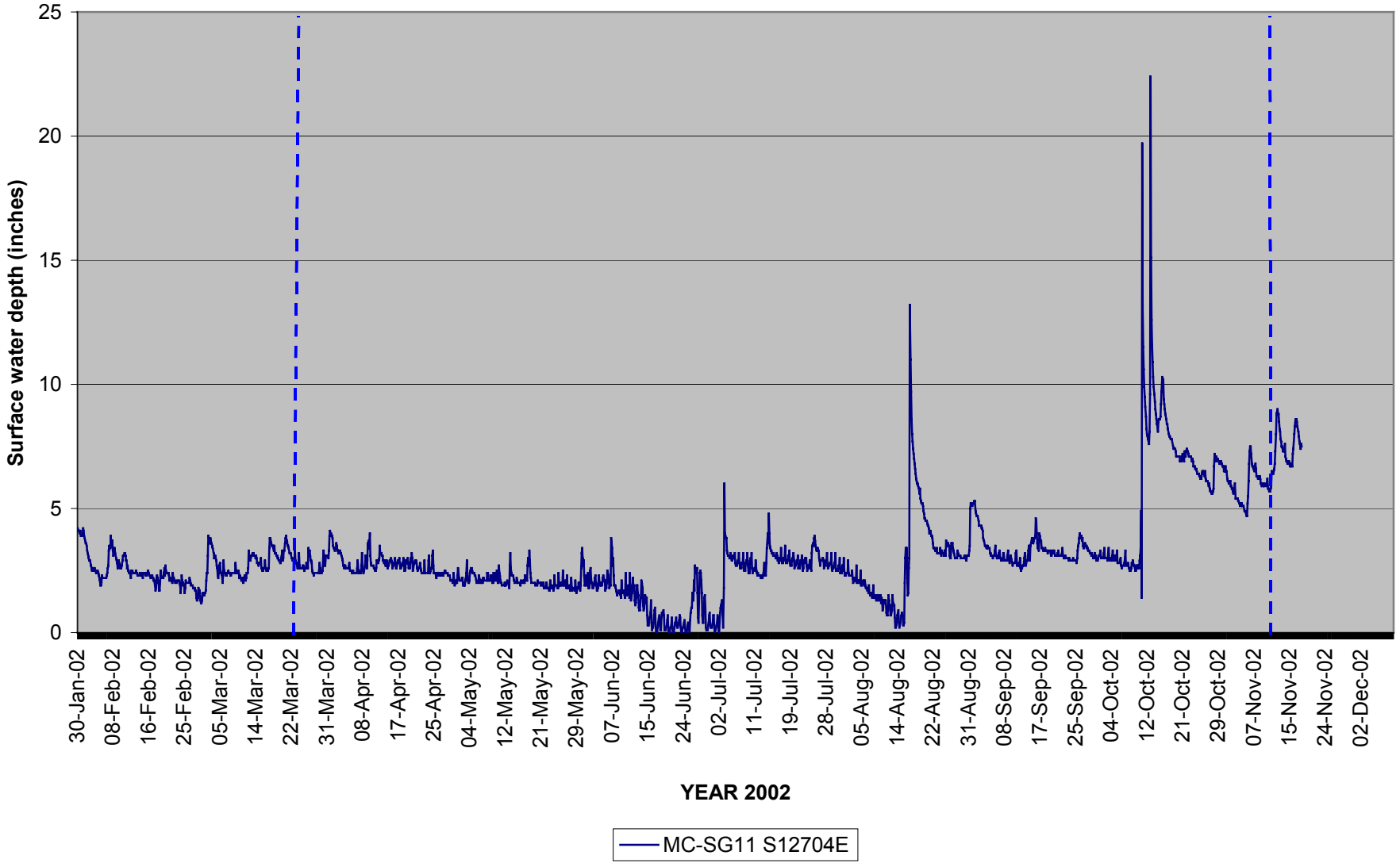

MC-WLG9 S2B22E4
Depth to Groundwater (in.)
PRECIPITATION
YEAR 2002
27 DAYS
32 DAYS
Beginning of growing season
End of growing season
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
01-Jan-02
12-Jan-02
23-Jan-02
03-Feb-02
14-Feb-02
25-Feb-02
08-Mar-02
19-Mar-02
30-Mar-02
10-Apr-02
21-Apr-02
02-May-02
13-May-02
24-May-02
04-Jun-02
15-Jun-02
26-Jun-02
07-Jul-02
18-Jul-02
29-Jul-02
09-Aug-02
20-Aug-02
31-Aug-02
11-Sep-02
22-Sep-02
03-Oct-02
14-Oct-02
25-Oct-02
05-Nov-02
16-Nov02
27-Nov02
08-Dec02
19-Dec02
30-Dec02
RAINFALL
MC-WLG9 S2B22E4
REQUIRED DEPTH

MC-WLG12 S494166



MALLARD CREEK SURFACE GAUGE GRAPH

MC-SG11 S12704E



APPENDIX B

SITE PHOTOS

MALLARD CREEK

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

2002

MALLARD CREEK

Photo 7

Photo 8

2002

Mallard Creek Mitigation Site
Photo and Plot Locations