ANNUAL REPORT FOR 2001

Mallard Creek Mitigation Site
Mecklenburg County
Project No. 8.1999974 (M-316)
TIP No. R-211 WM

Natural Systems Unit & Roadside Environmental Unit
North Carolina Department of Transportation
December 2001

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

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 2001 represent the fourth 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 six 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 third full year of monitoring. There was, however, additional hydrologic input provided by a 12" water main leak located adjacent to the mitigation site through December 2000. The leak was fixed on December 2, 2000, by the Charlotte-Mecklenberg Utility District (CMUD). In 2001, 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, 2 gauges showed between 5 and 8% saturation, with one gauge showing less than 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 rainfall data used for the 30-70 graph was provided by the NC State Climate Office. In 2001, 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 517 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 2001 growing season and because additional hydrology 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 2001 at the Mallard Creek Mitigation Site.

Activities in 2001 reflect the fourth 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.)

1.4 DEBIT LEDGER

Table 1. Mallard Creek Mitigation Site Debit Ledger

Site Habitat	Mitigation Plan			TIP Debit
	Acres at Start	Acres Remaining	% Remaining	R-211DA, DD, DB
BLH Restoration/ Creation	9.1	3.0	32.97	6.1

BLH: Bottomland Hardwood

2.0 Hydrology

2.1 SUCCESS CRITERIA

In accordance with 404 Permit issued May 19, 1992 (Action I.D. 199200013), the success criteria for hydrology states that wetland hydrology will be established when the mitigation areas exceed the 1987 Wetland Manual criterion for hydrology (i.e. be saturated within 10 inches of the surface, ponded, or flooded for at least 26 consecutive days of the growing season). These site-specific criteria are more stringent than the current federal guidelines that require a site to be inundated or saturated (within 12" of the surface) by surface or groundwater for a consecutive 5 - 12.5% of the growing season. A permit modification dated December 13, 2001 has been requested to update this standard to show saturation within 12 inches for 12% of the growing season. See Appendix C for letter to the US Army Corps of Engineers.

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.

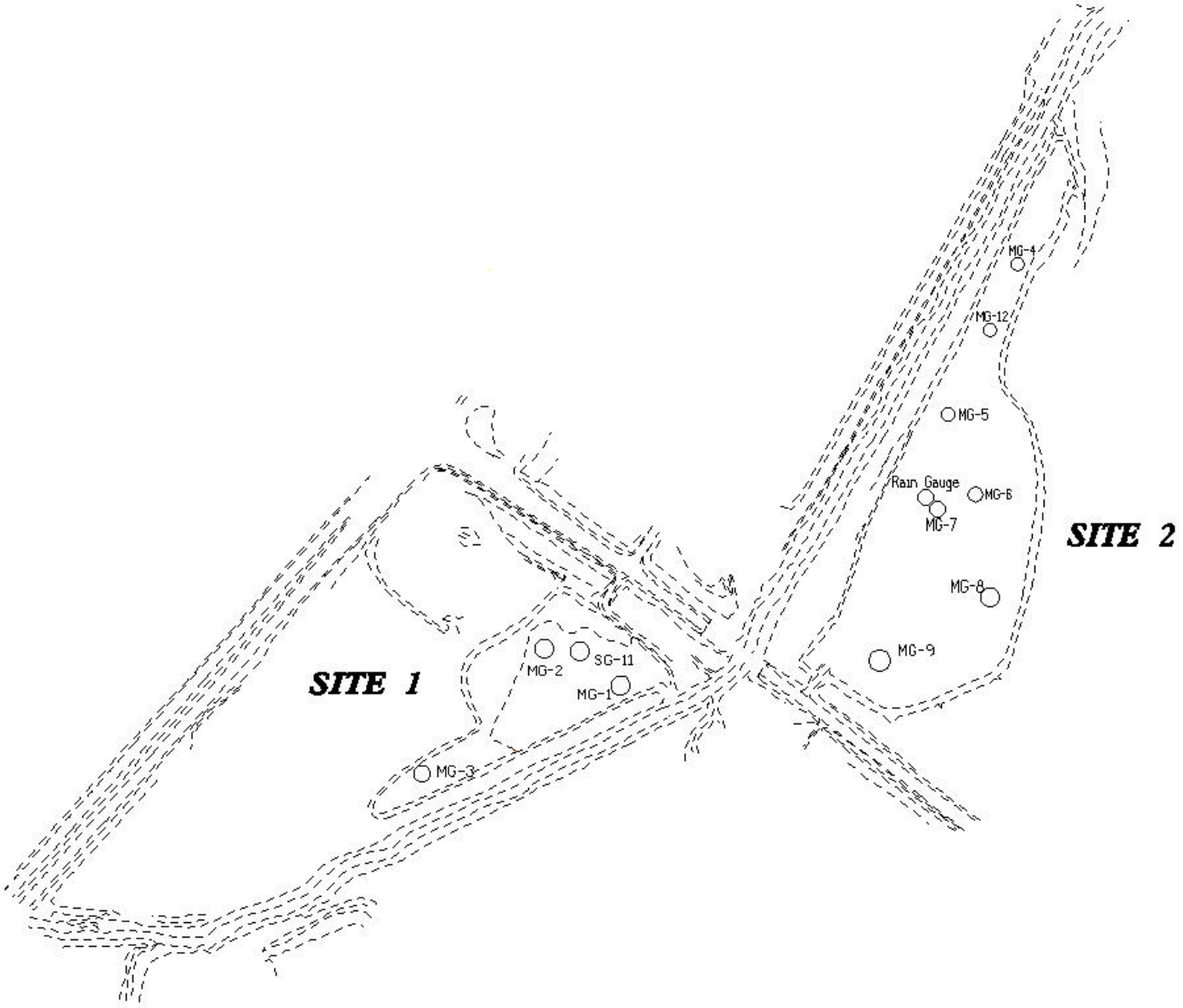
2.2 HYDROLOGIC DESCRIPTION

In May of 1998, nine 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 2001 data represents the fourth 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 permit conditions, “saturation within 10 inches of the surface, ponded or flooded for at least 26 consecutive days of the growing season,” the maximum number of consecutive days that the groundwater was within ten inches of the surface was determined for each gauge. The results are presented in Table 2.

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 3.

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

Table 2. Hydrologic Monitoring: Mallard Creek Mitigation Site-10” Success Criteria

Monitoring Gauge	Meets Success Criteria?		Success Dates
	No—< 26 days	Yes— 26 days	
Site 1			
MW-1		✓	Mar 22 – Apr 20
MW-2		✓	Mar 22 – May 8
MW-3		✓	Mar 22 – Apr 23
Site 2			
MW-4	✓		Mar 22 – Apr 11
MW-5		✓	Mar 22 – Apr 16
MW-6		✓	Mar 22 – Apr 19
MW-7		✓	Mar 22 – Apr 17
MW-8	✓		Mar 22 – Apr 10
MW-9		✓	Mar 22 – Apr 18
MW-12	✓		Sept 25 – Sept 30

Table 3. 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				✓	12.8	Mar 22 – Apr 20
MW-2				✓	20.8	Mar 22 – May 8
MW-3				✓	16.6	Mar 22 – Apr 23
Site 2						
MW-4			✓		9.4	Mar 22 – Apr 11
MW-5			✓		11.1	Mar 22 – Apr 16
MW-6			✓		12.3	Mar 22 – Apr 19
MW-7			✓		11.5	Mar 22 – Apr 17
MW-8			✓		8.5	Mar 22 – Apr 9
MW-9			✓		11.9	Mar 22 – Apr 18
MW-12	✓				2.1	Sept 25 – Sept 30

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 USACE permit and the Federal guidelines. The site was saturated or inundated for more than 26 consecutive days within 10" of the ground and 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. A leak in a 12" water main adjacent to this site affected the hydrology at this location prior to 2001; however, the leak was repaired 4 months prior to the growing season.

Site 2 hydrologic data indicates that four of six gauges met the hydrologic success criteria established by the permit for the site and none of the gauges met the Federal guidelines for success. Gauges 5, 6, 7, and 9 showed saturation or inundation greater than 8% of the growing season within 12" of the ground. Gauges 4 and 8 showed saturation for between 5 and 8% of the growing season within 12" of the ground.

Gauge 12 showed saturation for less than 5% of the growing season. The data for Site 2 still indicates that the groundwater levels drop quickly after rainfall.

2.3.2 Climatic Data

Figure 4 represents an examination of the local climate in comparison with historical data in order to determine whether 2000-2001 was "average" in terms of climate conditions. The figure compares the rainfall from 2000-2001 with that of historical rainfall (data collected between 1948 and 2000). Historical rainfall data was obtained from the NC State Climate Office.

Figure 4 shows the monthly rainfall totals for the period of November 2000 through October 2001. The data for this period shows above average rainfall for two months (March and September) and below average rainfall for six months (January, February, April, May, August, and October). The site experienced below average rainfall for 2001.

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.

2.4 CONCLUSIONS

The year 2001 is the fourth full growing season that the monitoring gauges have been in place since installing them four years ago. Site 1 has exceeded success criteria for the year 2001. Even though the hydrology may have been altered by a water main leak located adjacent to the site; the leak was repaired by the City of Charlotte December 2, 2000, and the site maintained successful status in 2001.

Wetland hydrology was not observed in the six groundwater gauges for Site 2. The site experienced below average rainfall for 2001. 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

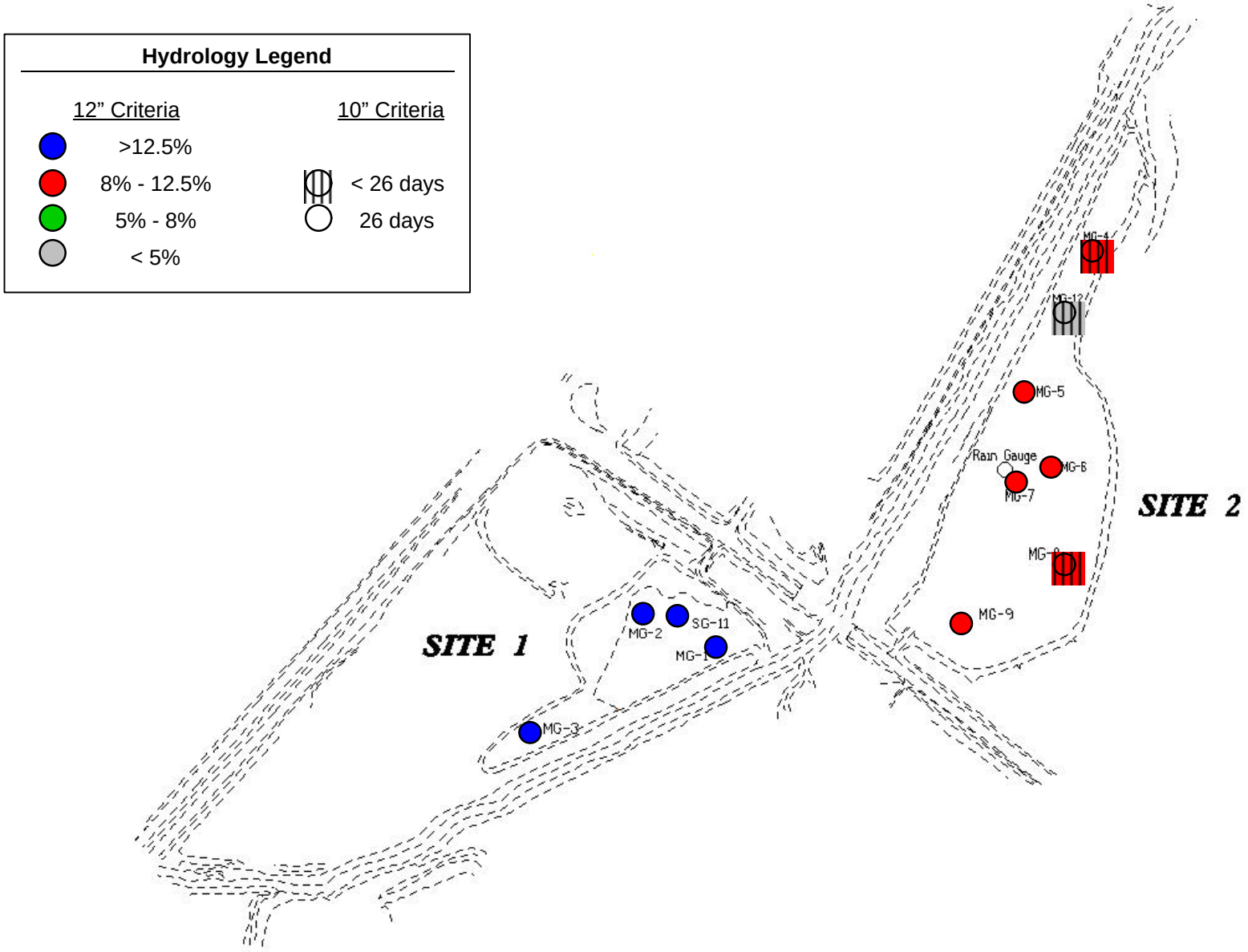
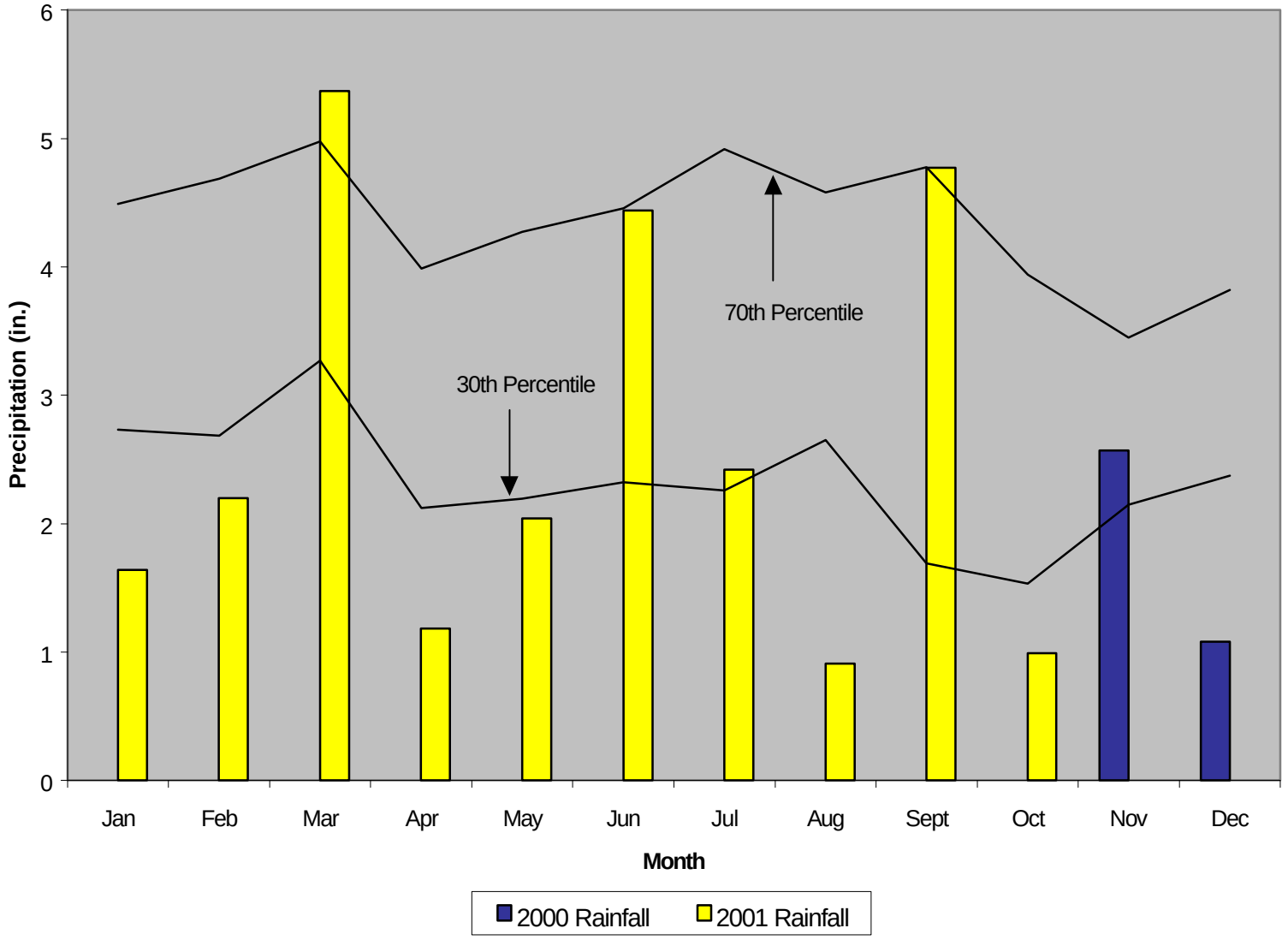


Figure 4. Mallard Creek 30-70 Percentile Graph, Charlotte, NC



3.0 Vegetation: Mallard Creek Mitigation Site (Year 4 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, Blackgum
Quercus lyrata, Overcup Oak
Quercus nigra, Water Oak

3.3 RESULTS OF VEGETATION MONITORING

Table 4. Vegetation Monitoring Statistics, by zone and plot

Plot # (Type)	Green Ash	Blackgum	Overcup Oak	Water Oak	Total	Total (at planting)	Density (Tree/Acre)
1(BLH)	16	1	2		19	31	417
2(BLH)	6		16	1	23	27	579
3(BLH)	14		15		29	35	563
4(BLH)	9	11	8	3	31	31	680
5(BLH)	18		4	4	26	38	465
6(BLH)	19		1	1	21	36	397
	Average Density						**517**

Site Notes: Other species noted: cottonwoods, various grasses, black willow, lespedeza, sycamore, *Juncus* sp., *Carex* sp., boxelder, and volunteer green ash. One willow oak and one swamp chestnut oak found in Plot 1. Few cattails in and around Plot 6. The presence of these species does not appear to be affecting the survival of the planted trees. 2 inches of standing water noted in part of Plot 6.

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 2001 vegetation monitoring revealed an average tree density of 517 trees per acre. This average is well above the minimum success criteria of 320 trees per acre.

4.0 Overall Conclusions/Recommendations

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

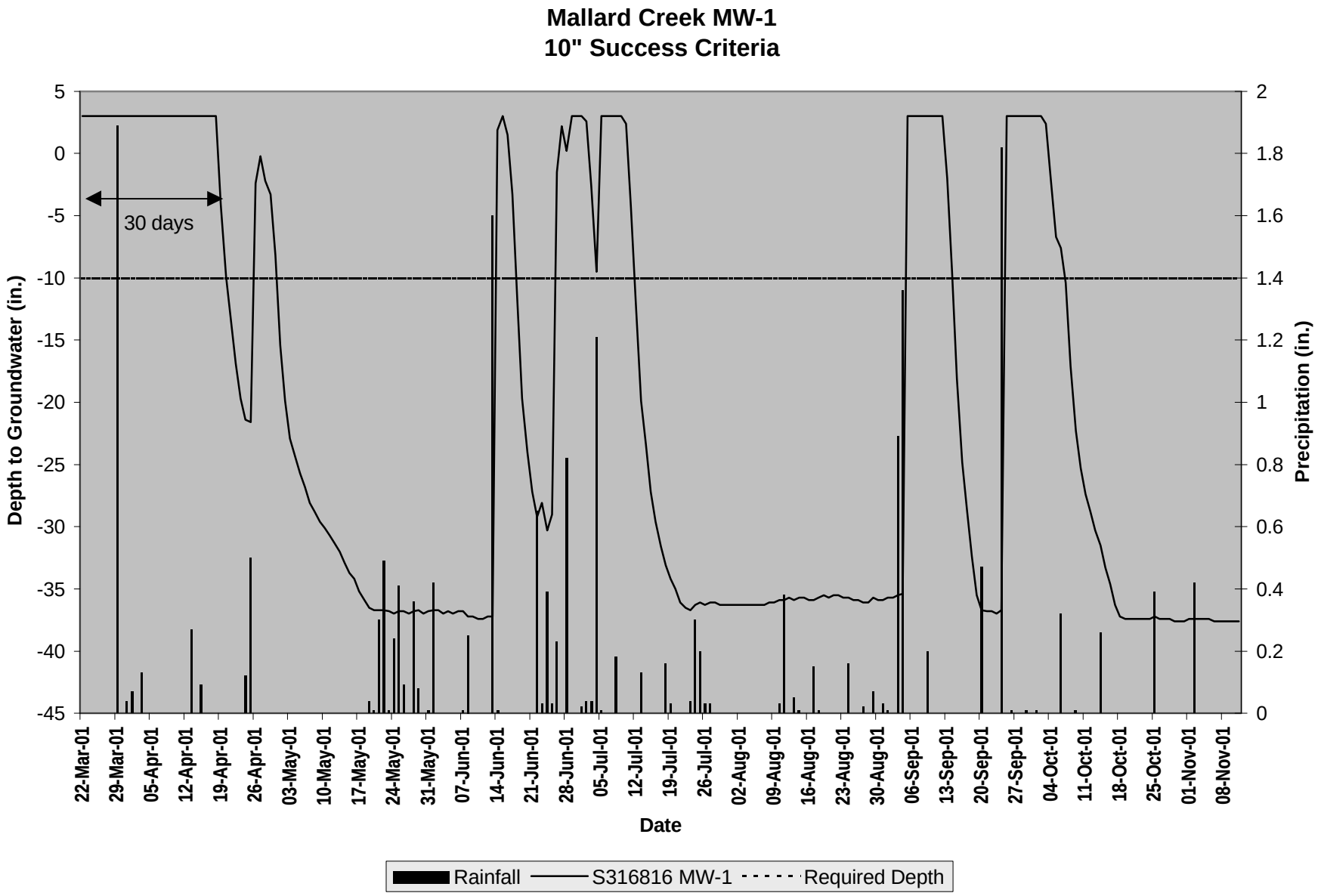
- All groundwater and surface water gauges located on Site 1 met the hydrologic success criteria as stated in the May 19, 1992 USACE permit and in the Federal guidelines. The leaking water main located adjacent to the mitigation site was repaired on December 2, 2002. The site continues to show successful hydrology.

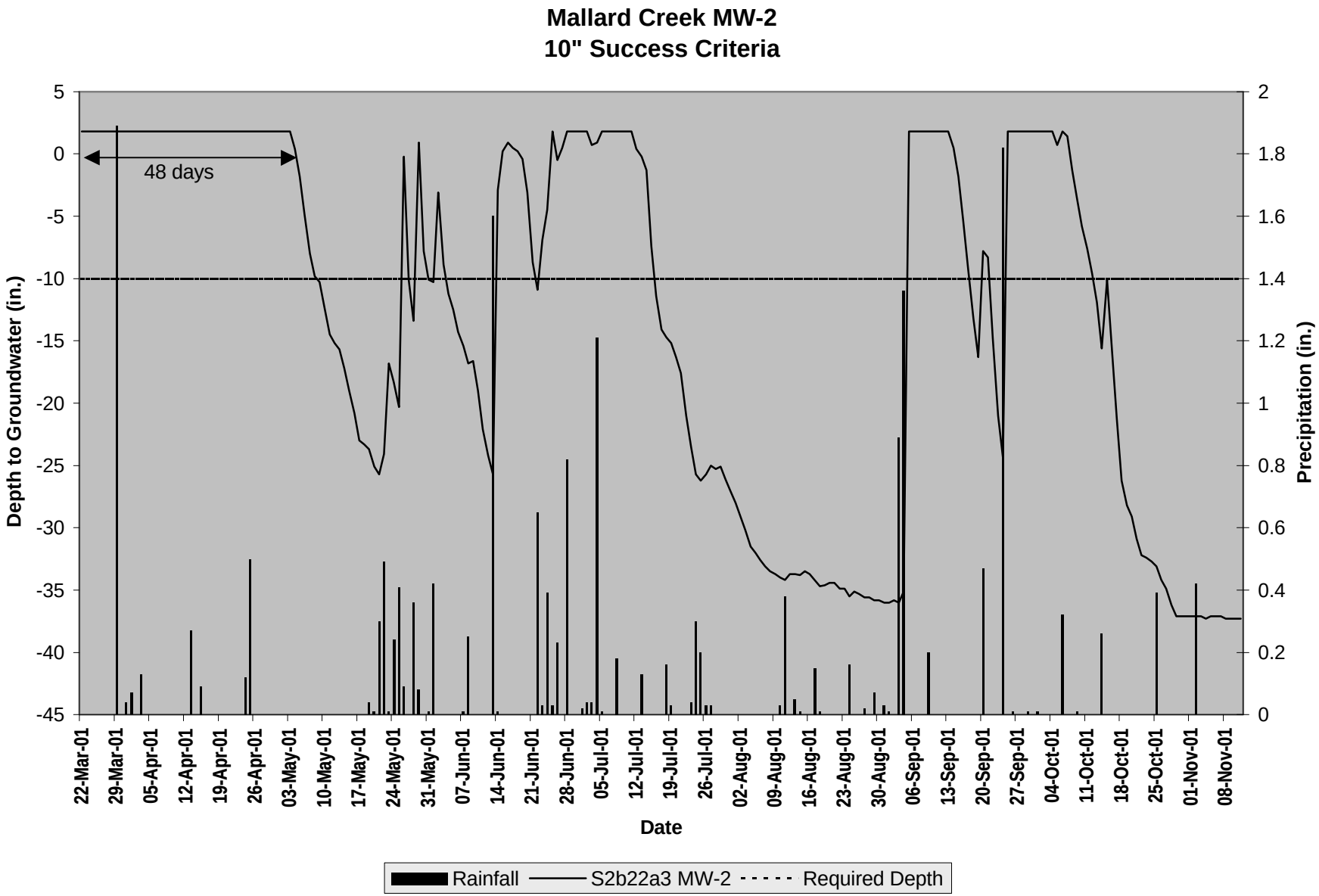
- Four of the 7 gauges showed saturation within 10” of the ground for 26 consecutive days; however, no gauges showed saturation within 12” of the ground longer than 12.5% of the growing season in Site 2.

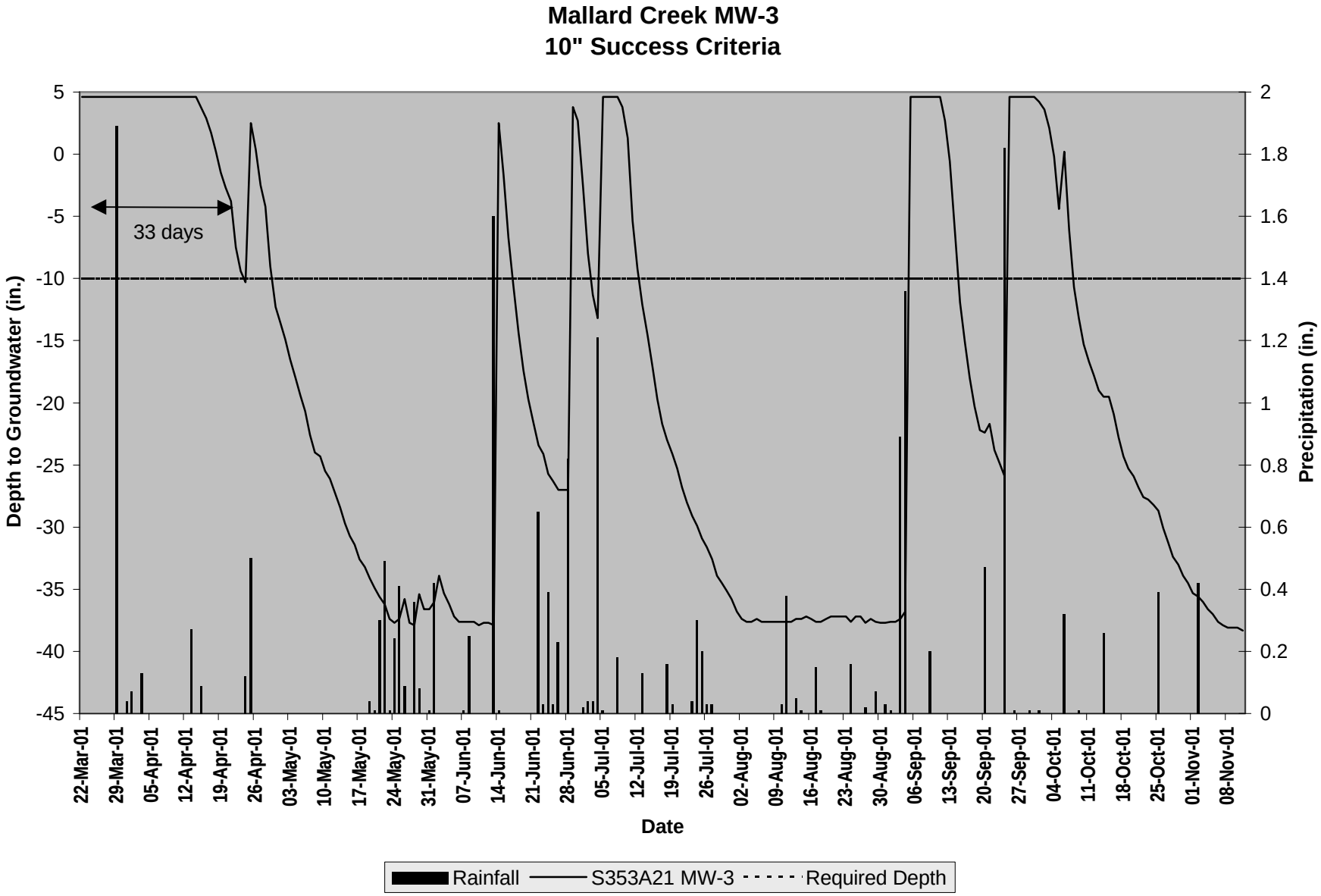
- Continue annual hydrologic and vegetation monitoring.

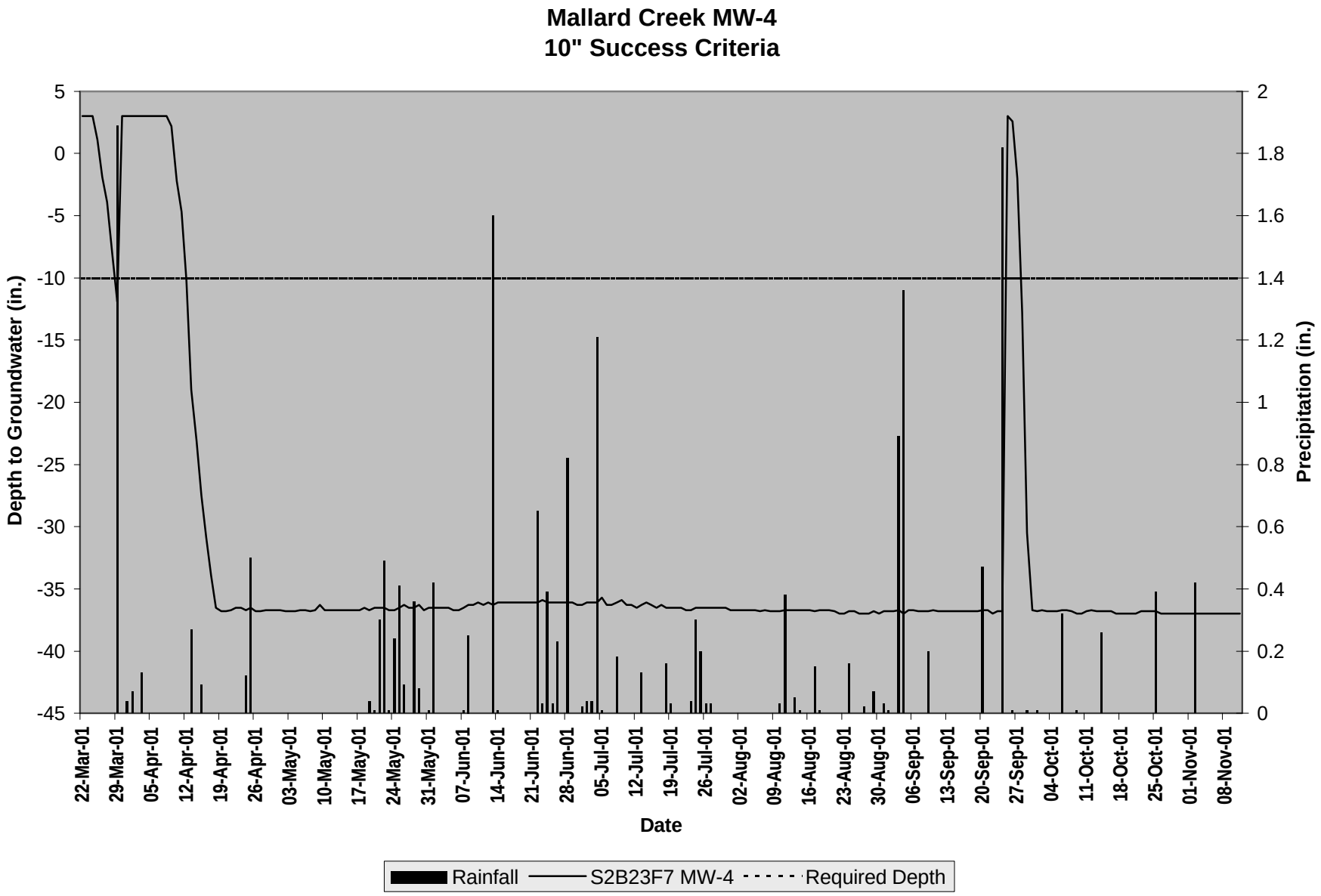
APPENDIX A

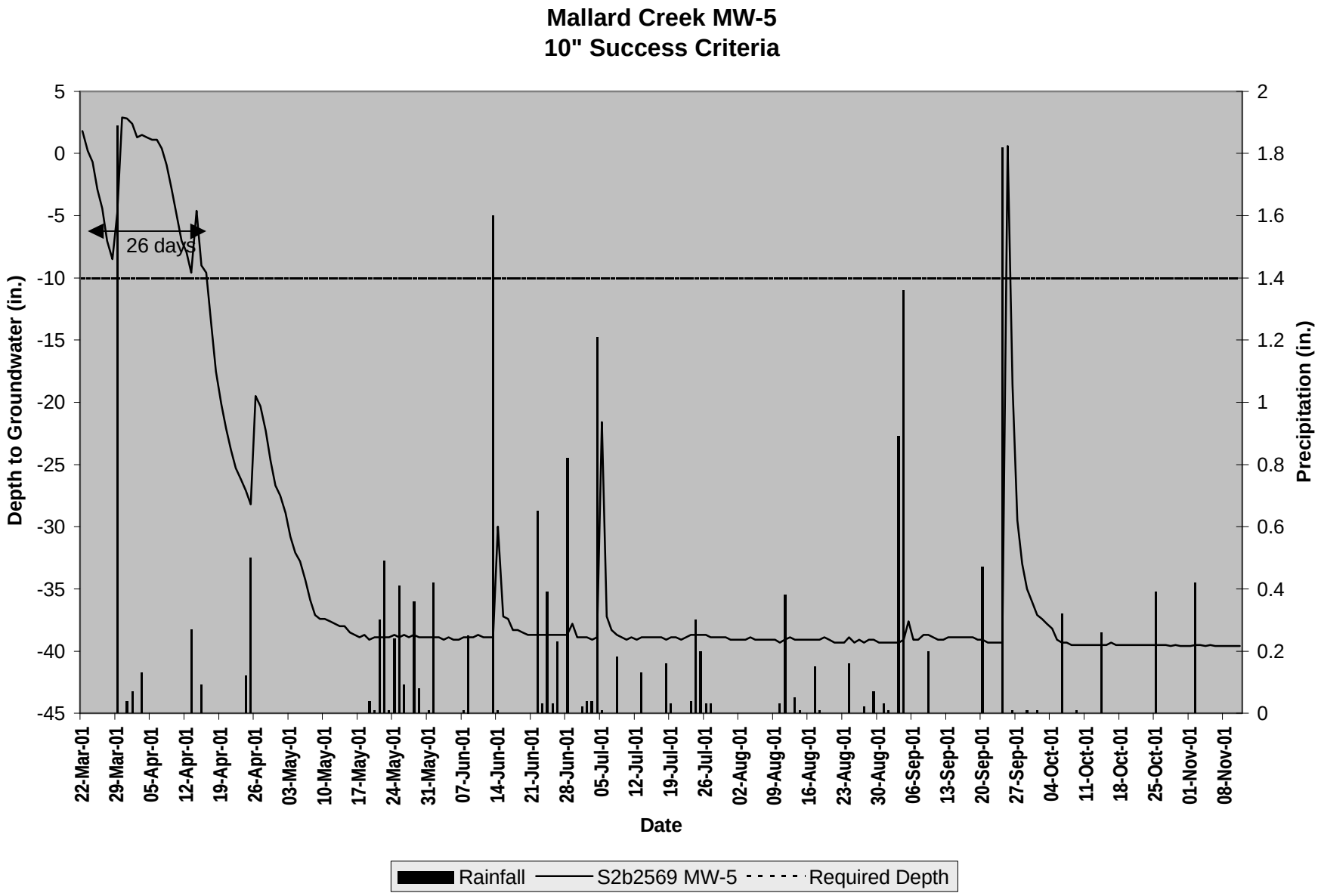
DEPTH TO GROUNDWATER PLOTS

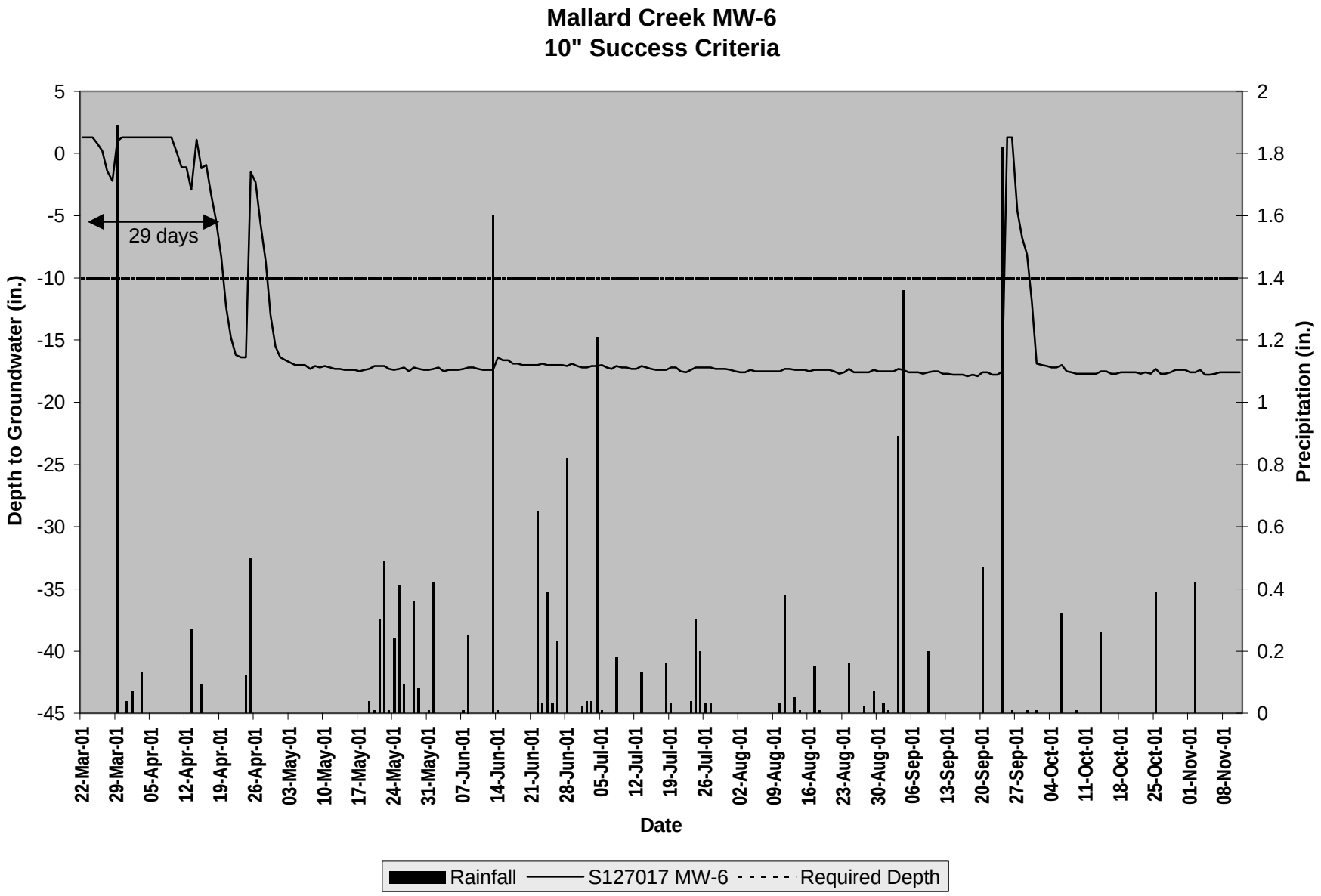

Mallard Creek MW-1
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
30 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S316816 MW-1
Required Depth

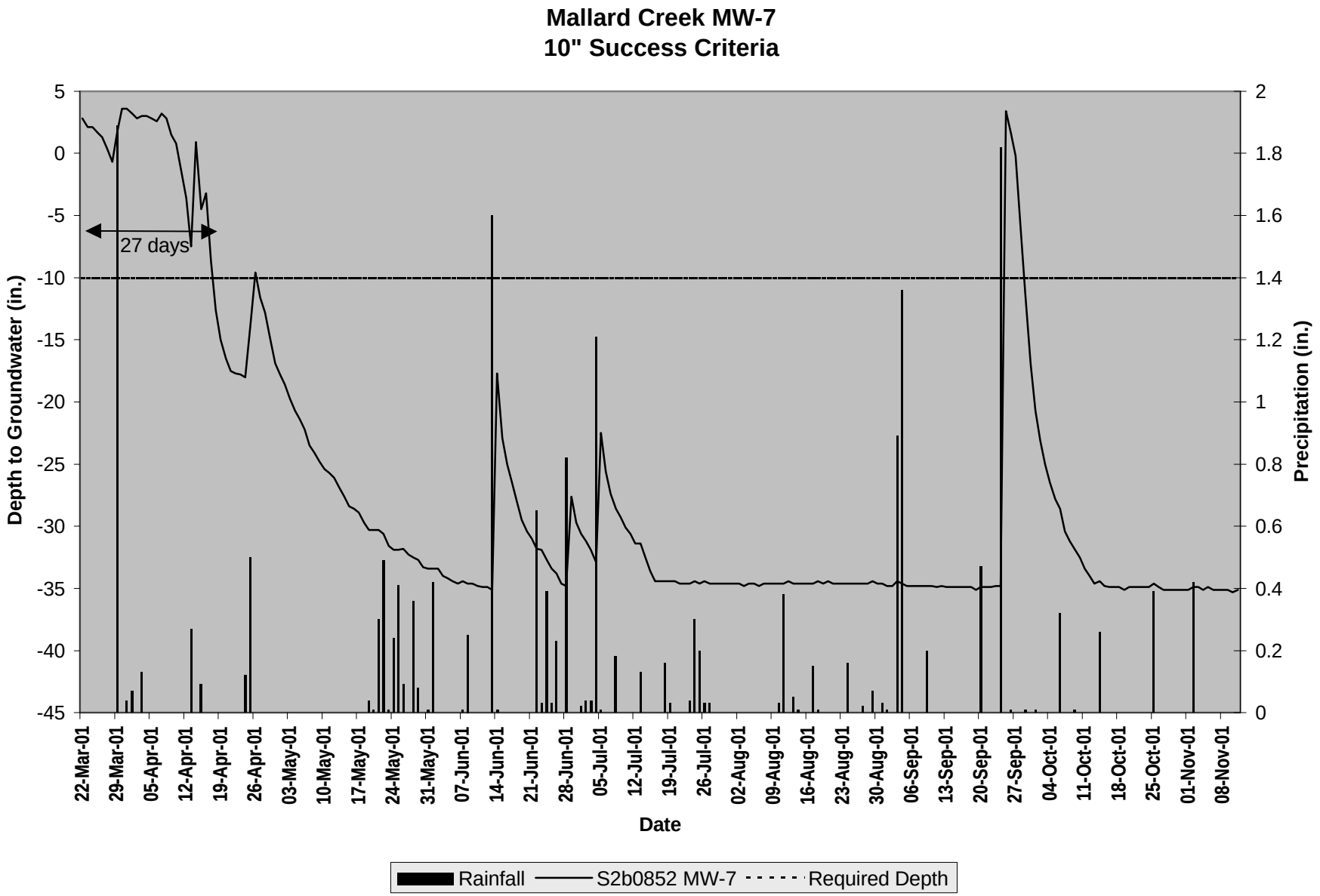

Mallard Creek MW-2
10" Success Criteria
48 days
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2b22a3 MW-2
Required Depth

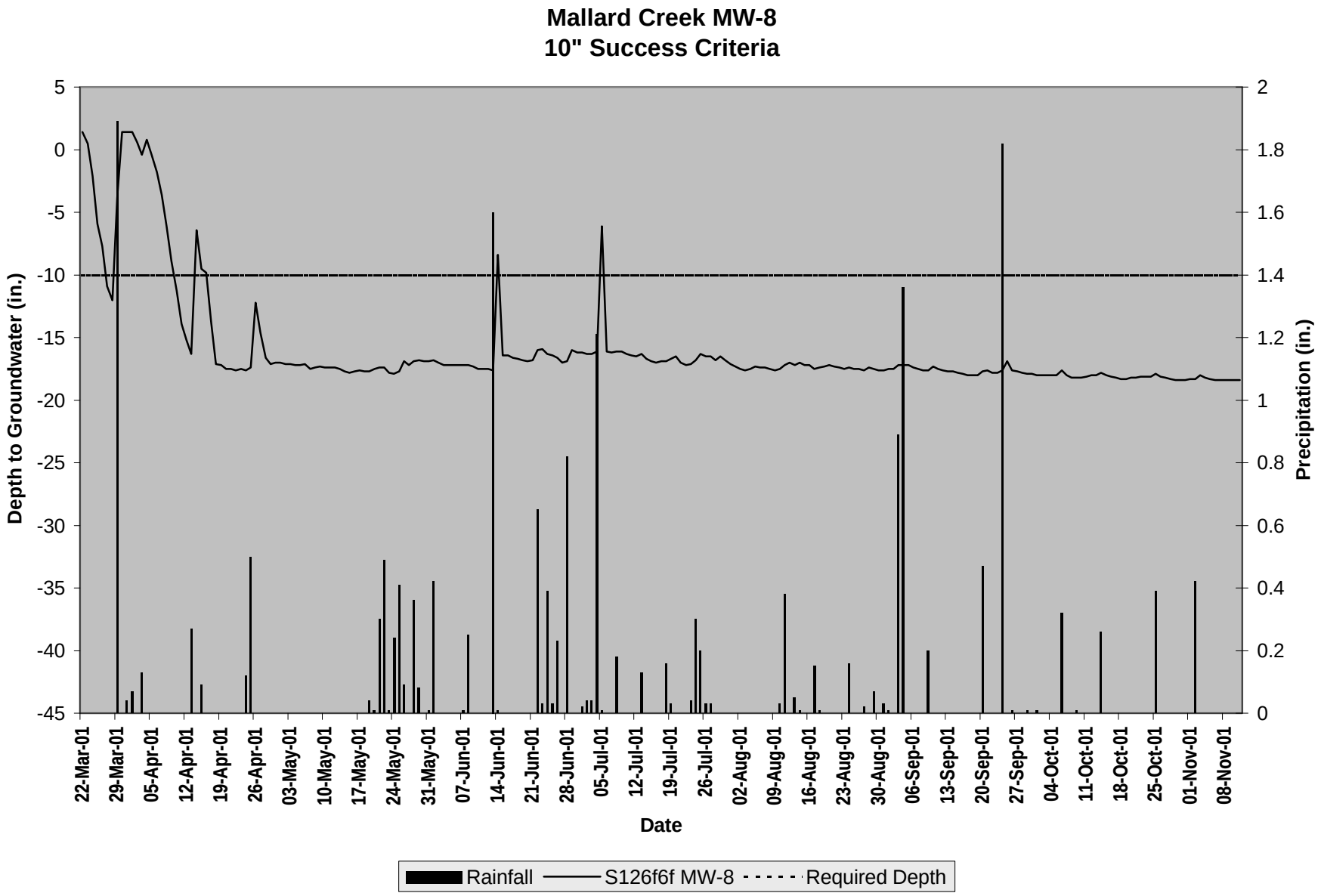

Mallard Creek MW-3
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
Date
33 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Rainfall
S353A21 MW-3
Required Depth

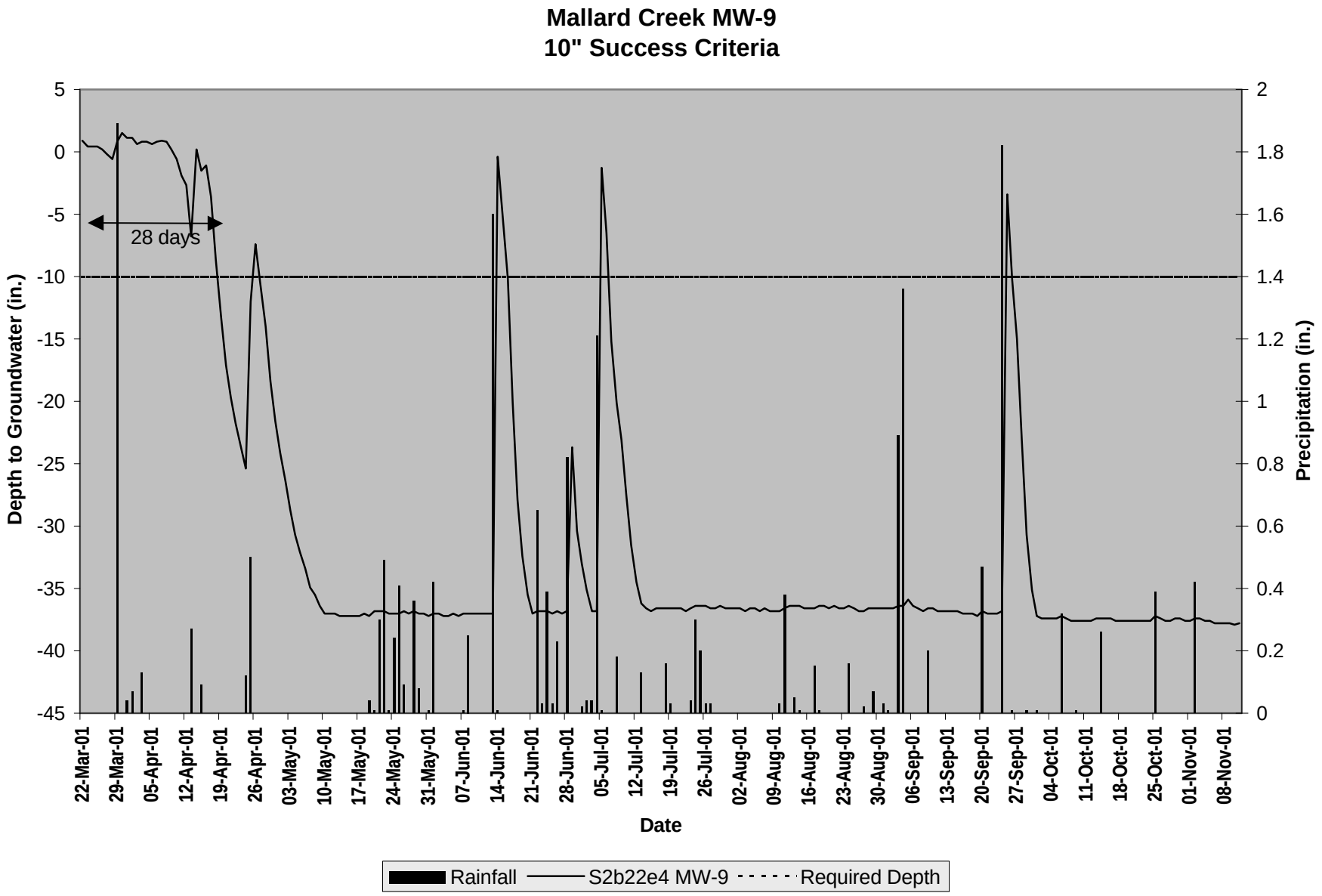

Mallard Creek MW-4
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2B23F7 MW-4
Required Depth

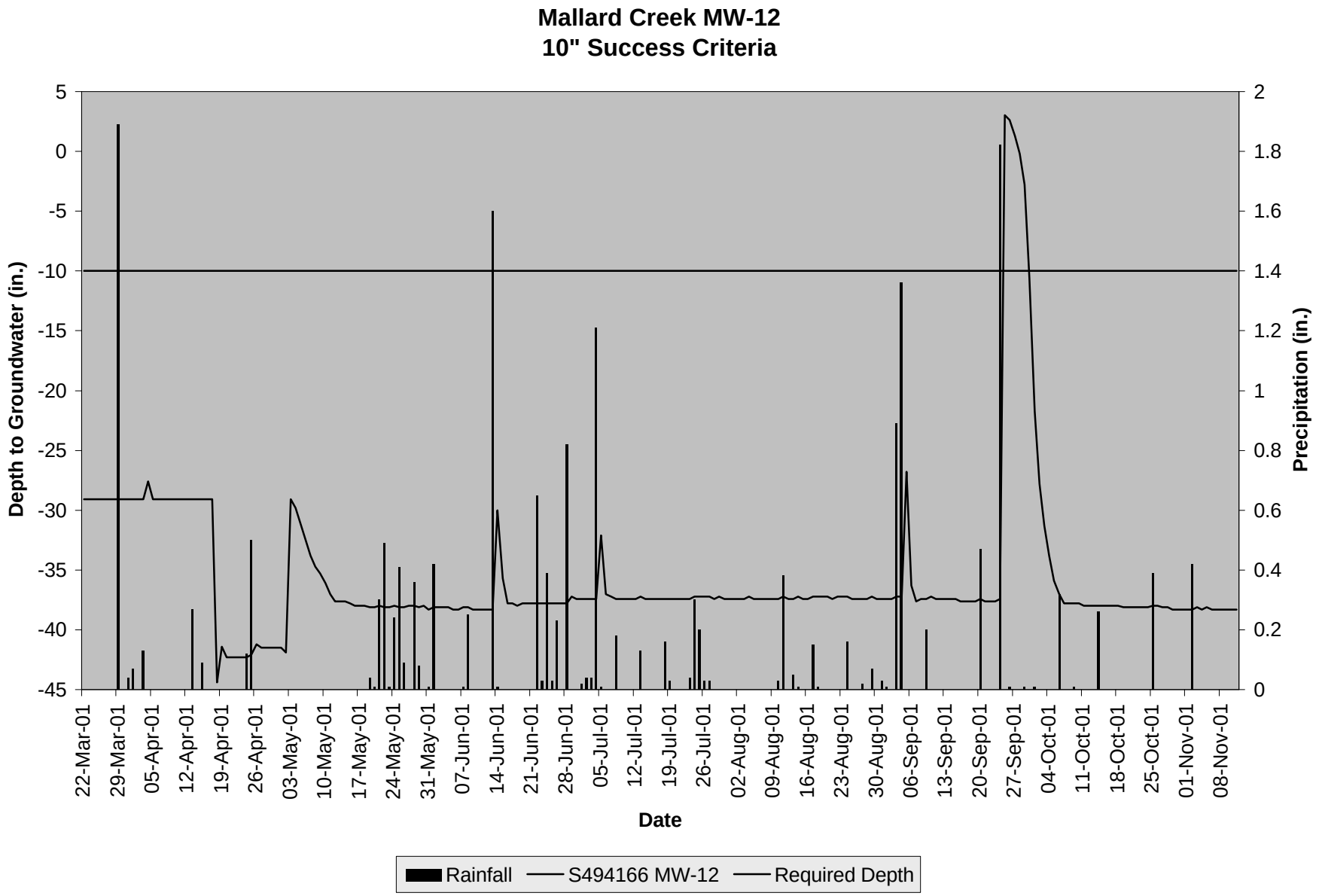

Mallard Creek MW-5
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
26 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2b2569 MW-5
Required Depth

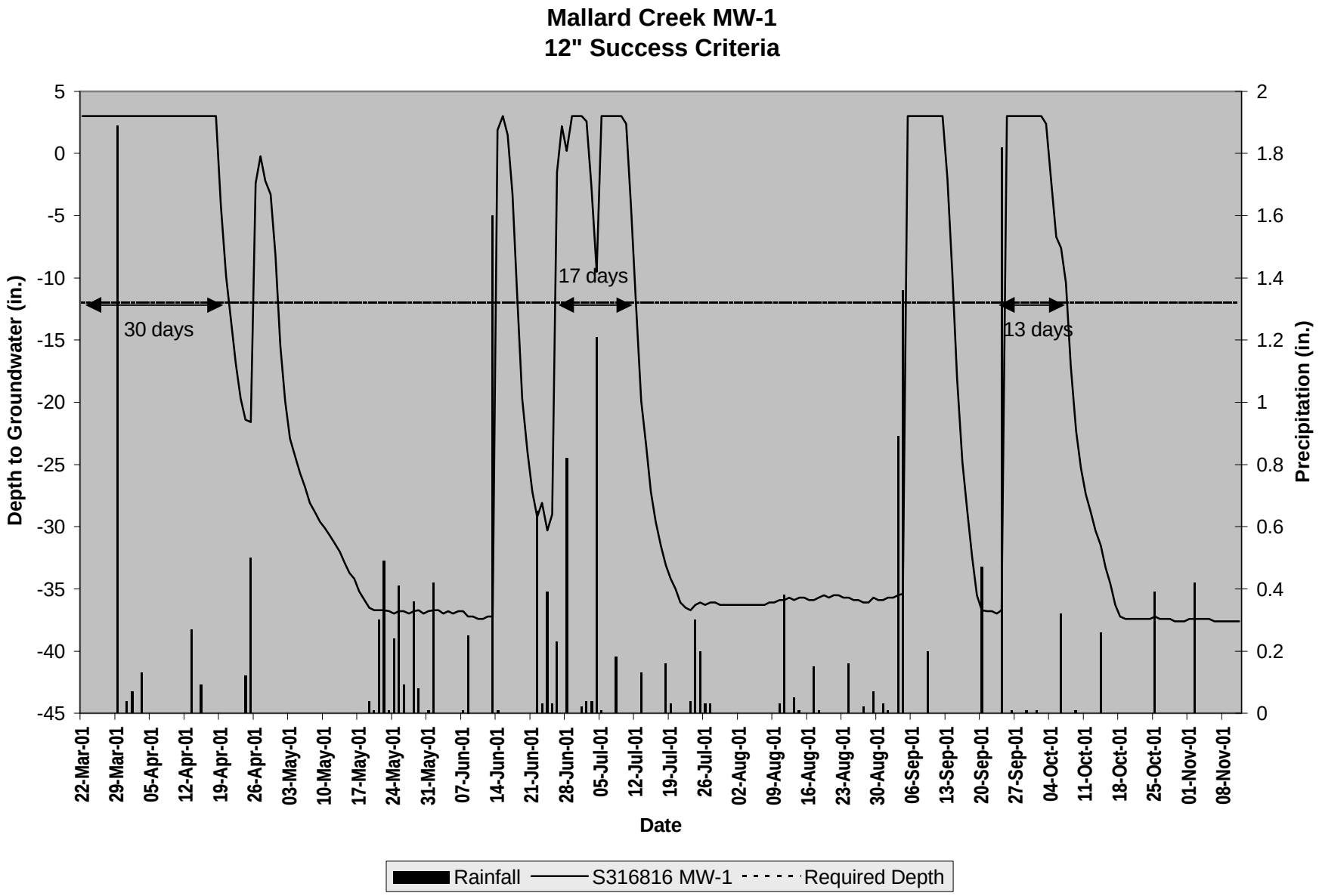

Mallard Creek MW-6
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
29 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S127017 MW-6
Required Depth

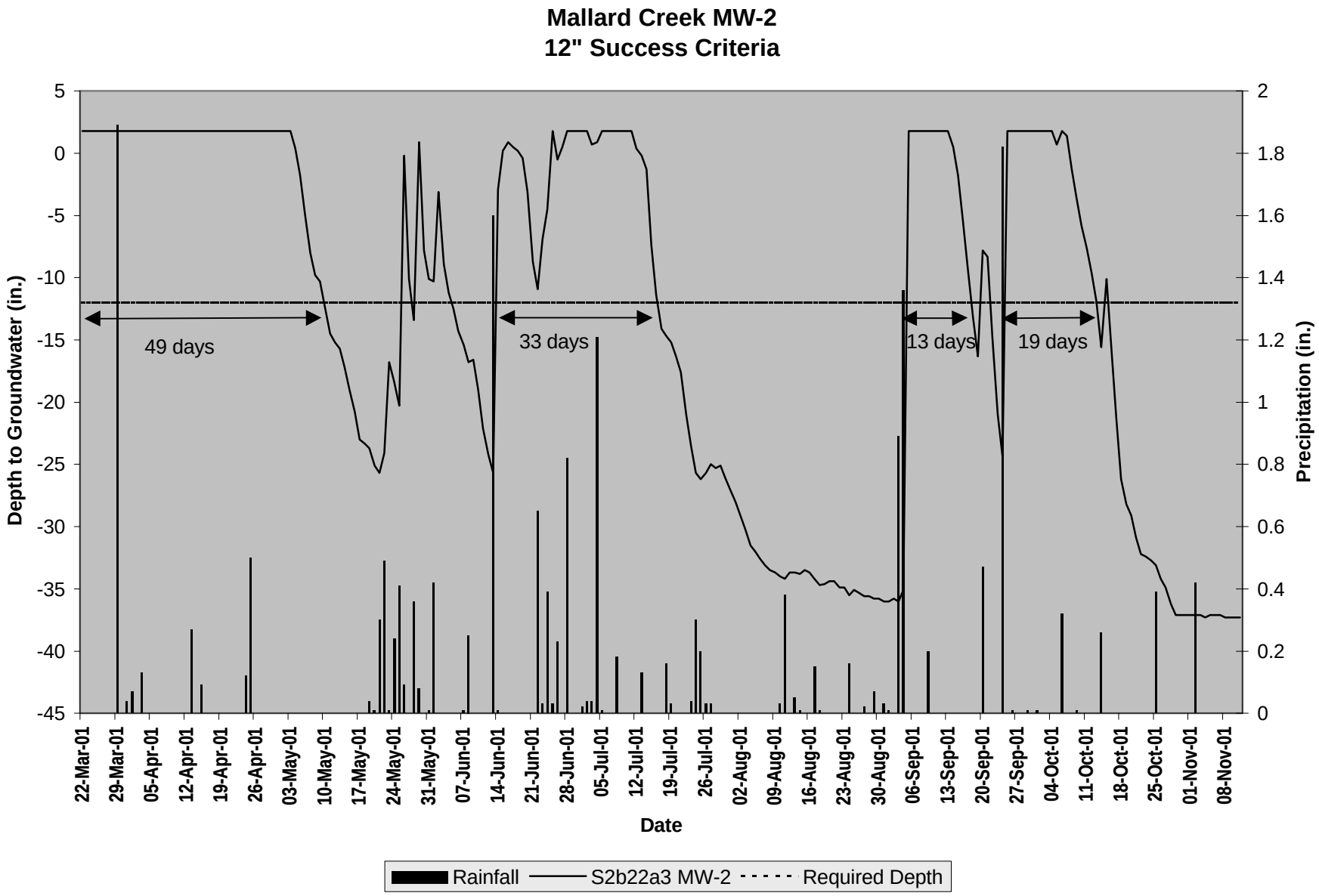

Mallard Creek MW-7
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
Date
27 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Rainfall
S2b0852 MW-7
Required Depth

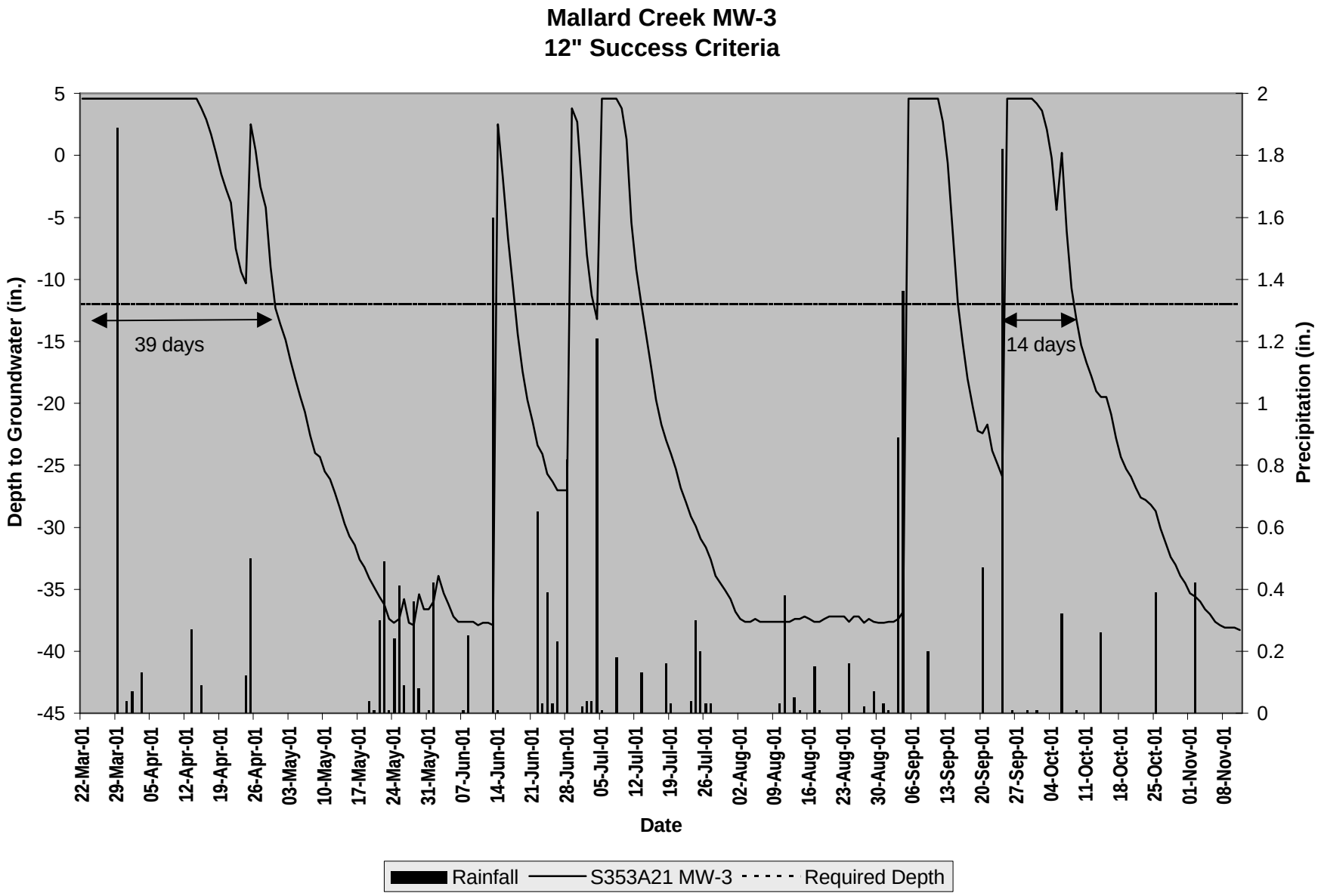

Mallard Creek MW-8
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Rainfall
S126f6f MW-8
Required Depth

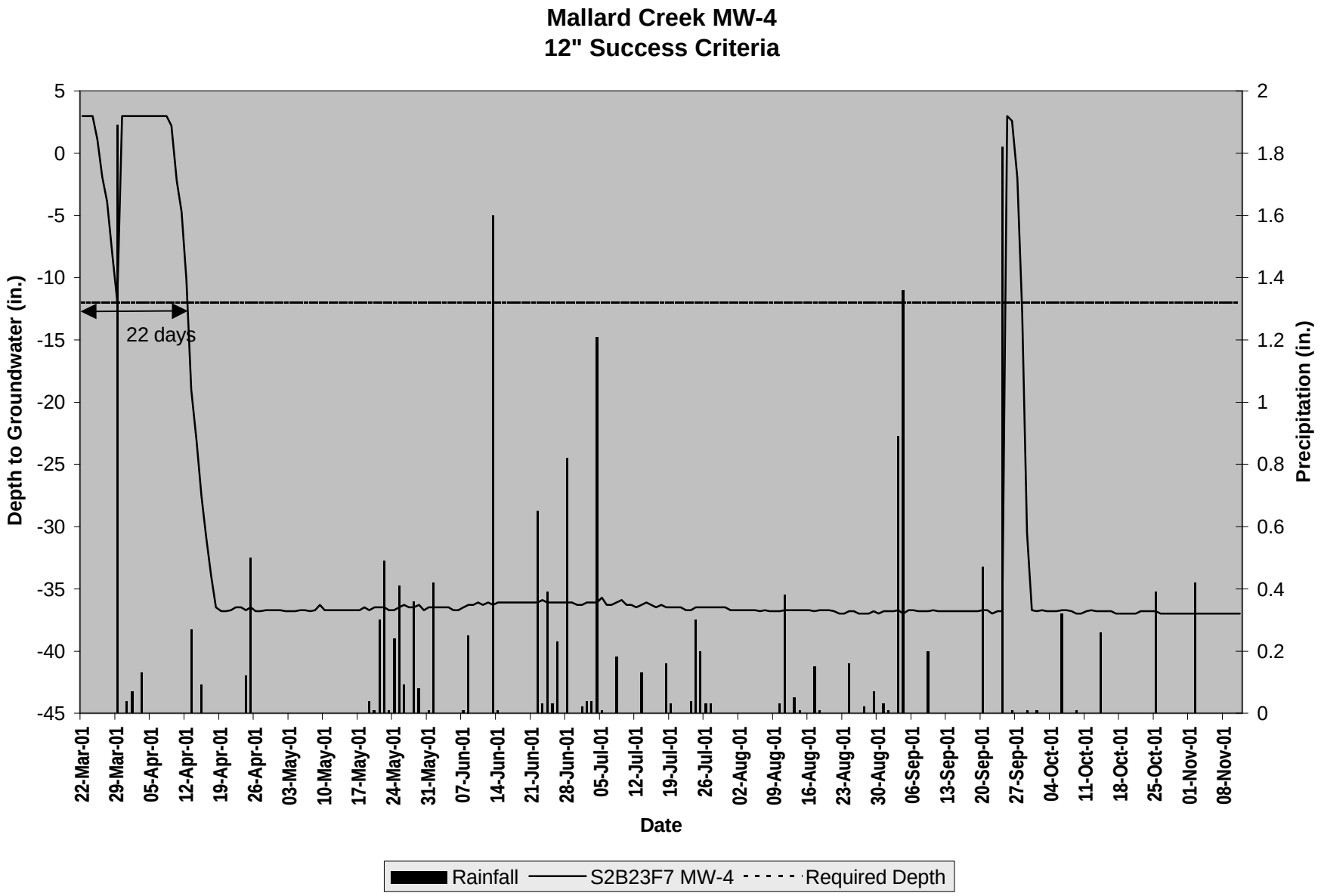

Mallard Creek MW-9
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
28 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2b22e4 MW-9
Required Depth

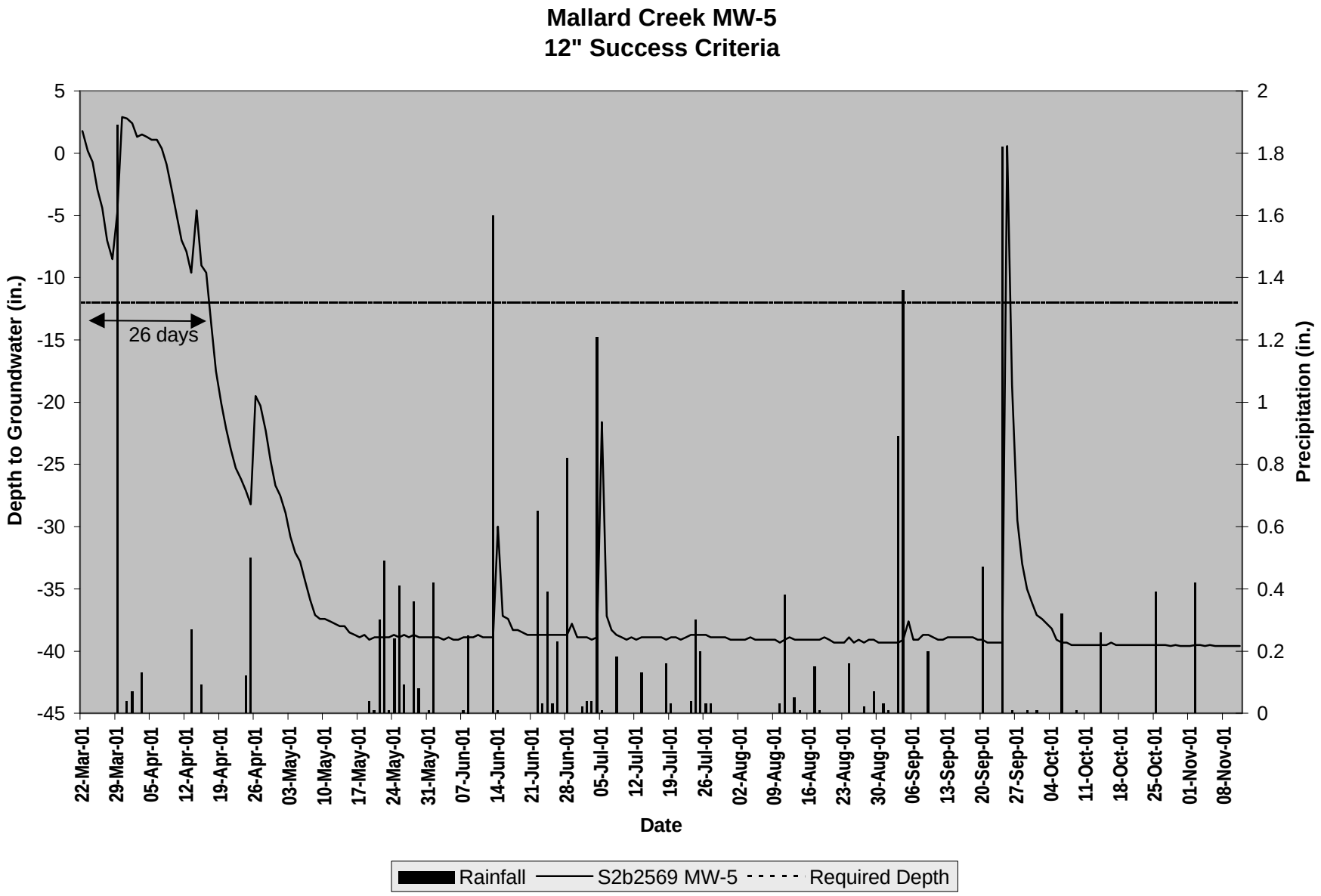

Mallard Creek MW-12
10" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S494166 MW-12
Required Depth

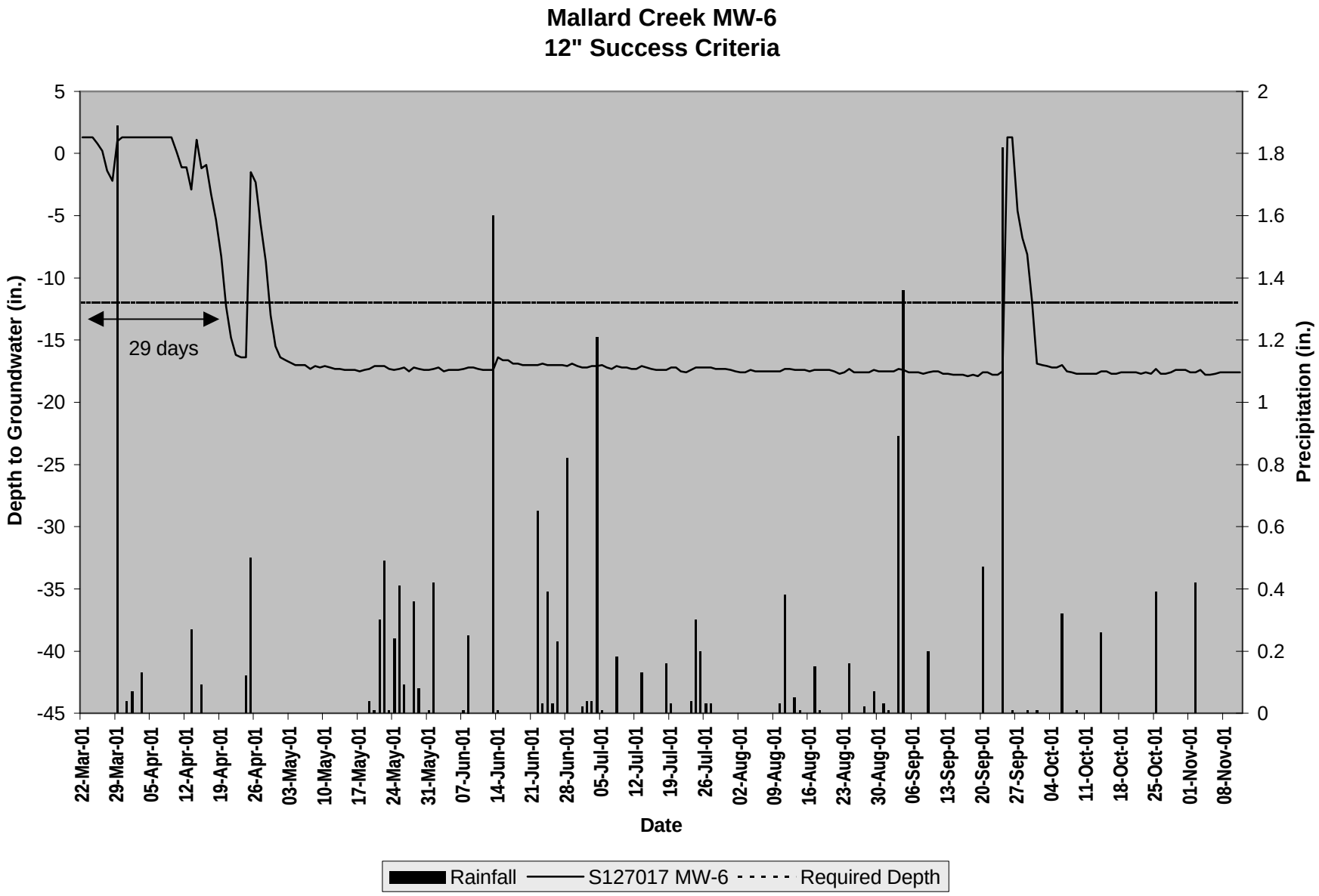

Mallard Creek MW-1
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
Date
30 days
17 days
13 days
Rainfall
S316816 MW-1
Required Depth

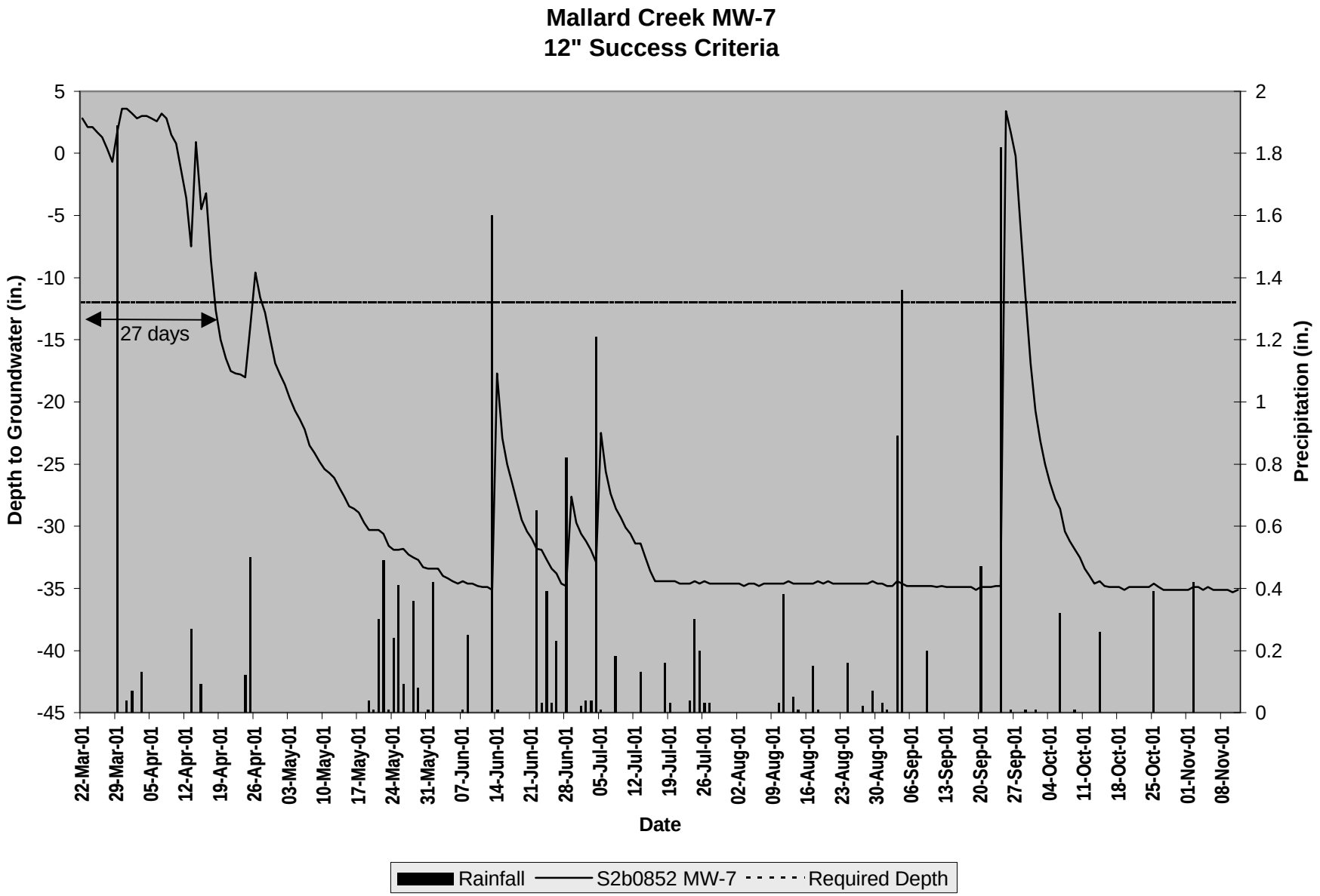

Mallard Creek MW-2
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
49 days
33 days
13 days
19 days
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2b22a3 MW-2
Required Depth

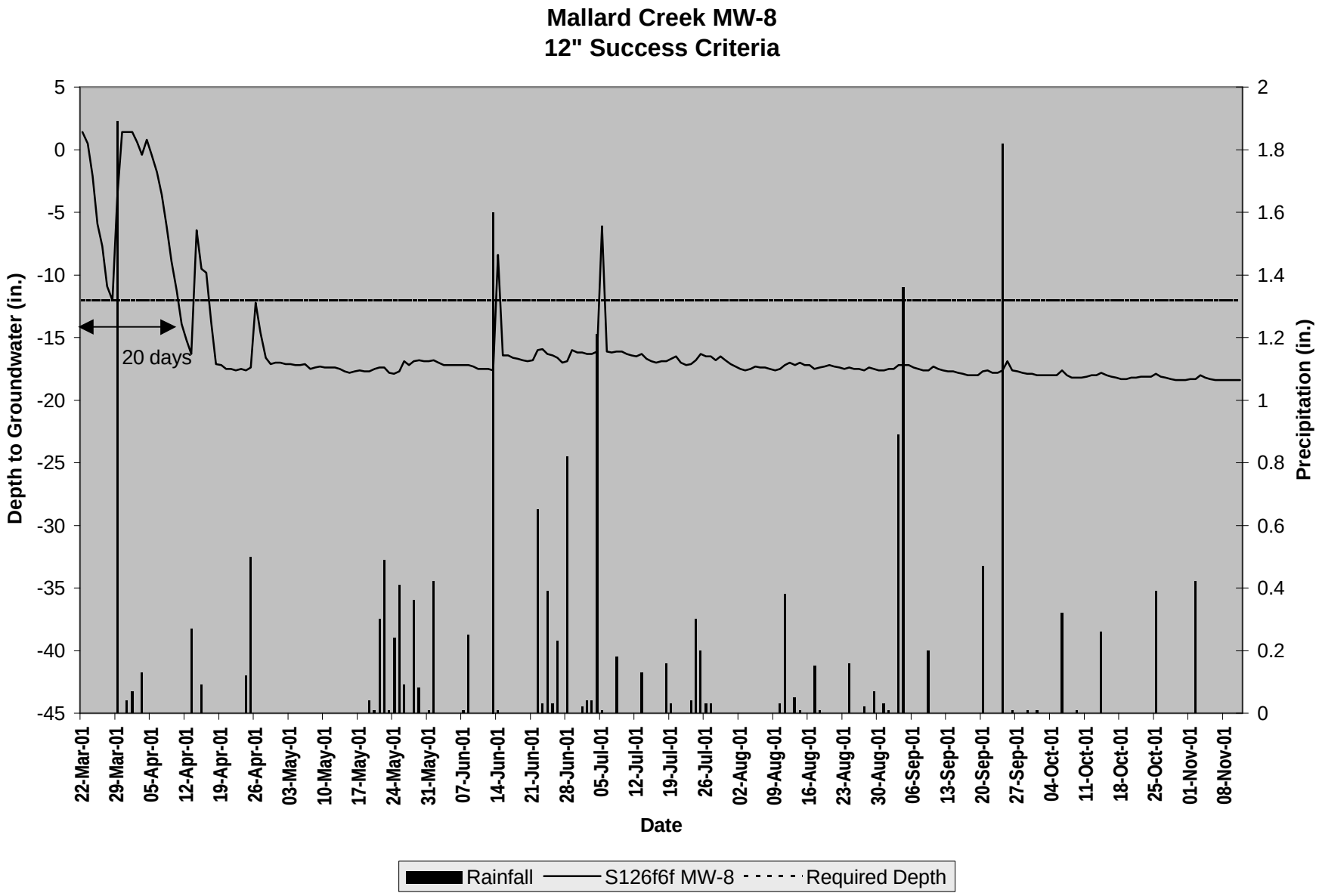

Mallard Creek MW-3
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
39 days
14 days
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S353A21 MW-3
Required Depth

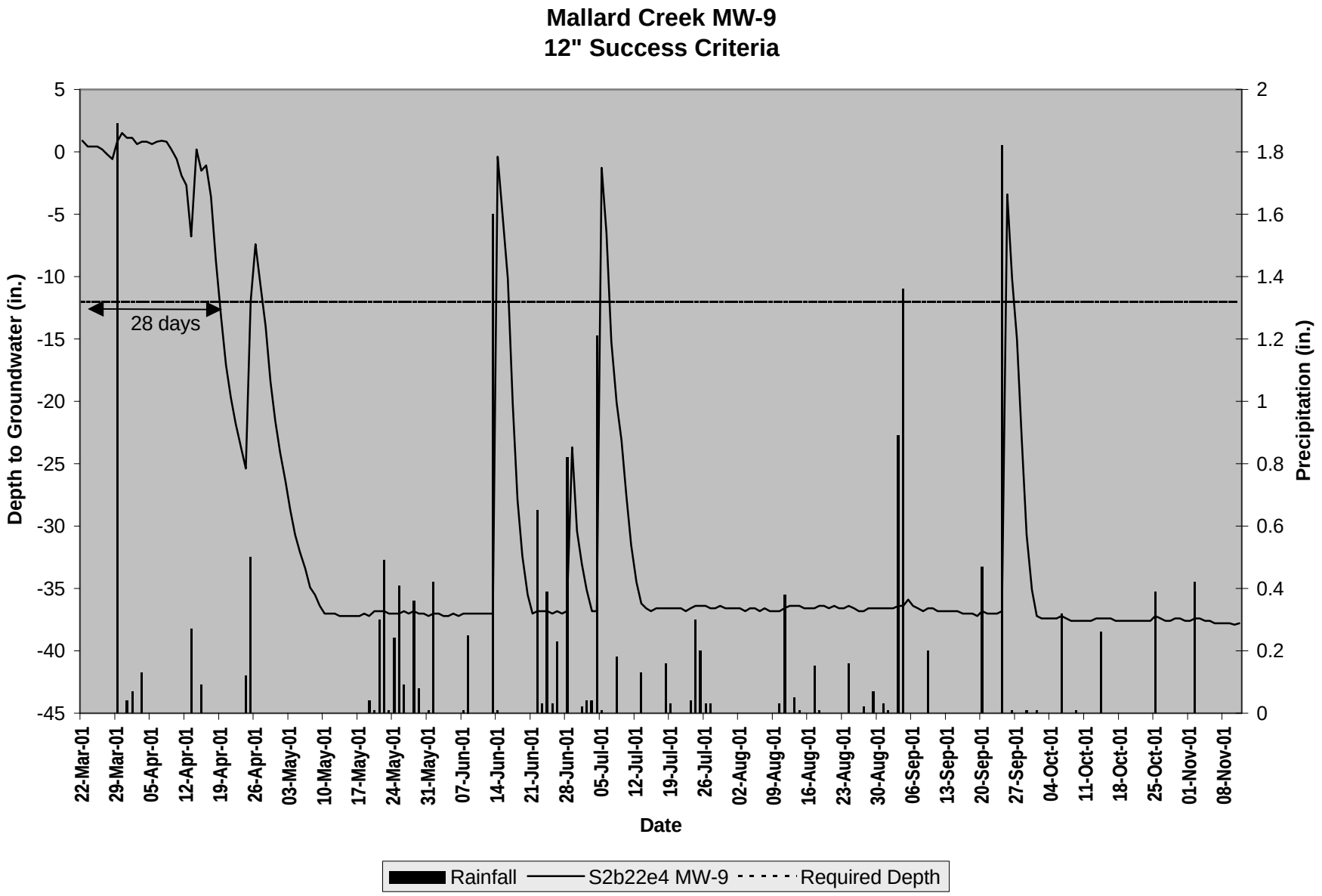

Mallard Creek MW-4
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
Date
22 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Rainfall
S2B23F7 MW-4
Required Depth

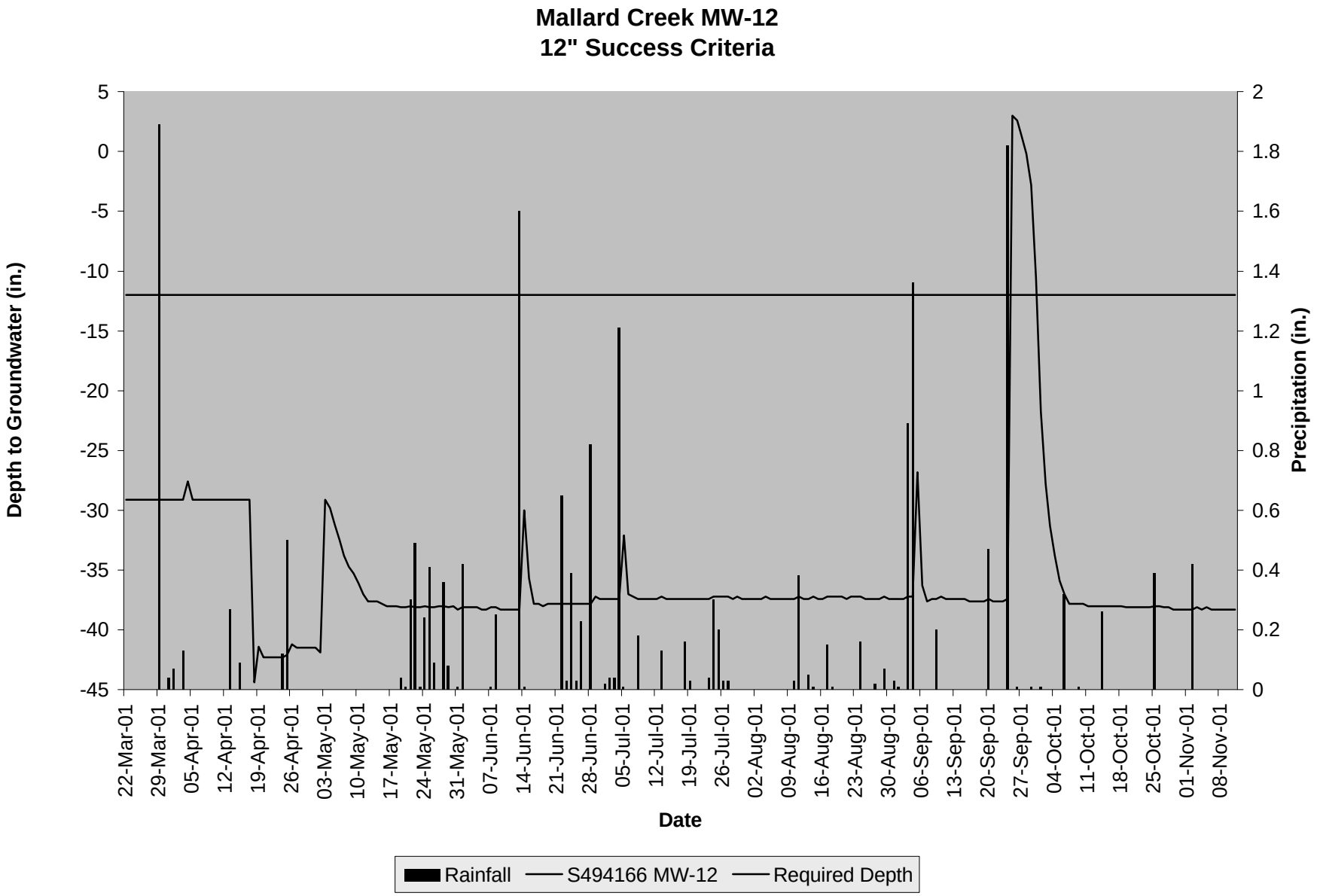

Mallard Creek MW-5
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
26 days
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2b2569 MW-5
Required Depth

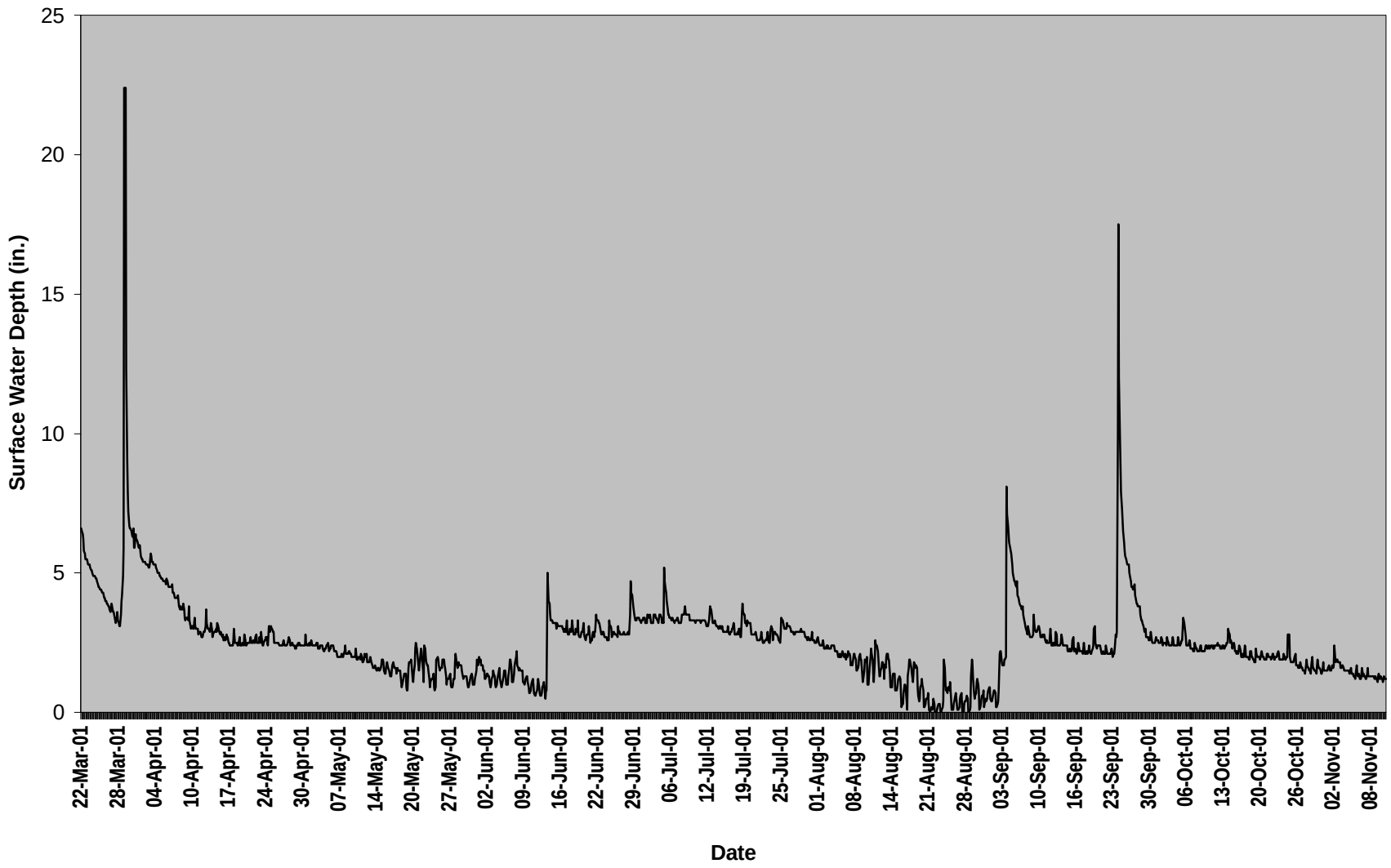

Mallard Creek MW-6
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
29 days
Date
Rainfall
S127017 MW-6
Required Depth


Mallard Creek MW-7
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
27 days
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2b0852 MW-7
Required Depth


Mallard Creek MW-8
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
Date
20 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Rainfall
S126f6f MW-8
Required Depth


Mallard Creek MW-9
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
28 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S2b22e4 MW-9
Required Depth


Mallard Creek MW-12
12" Success Criteria
Depth to Groundwater (in.)
Precipitation (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
22-Mar-01
29-Mar-01
05-Apr-01
12-Apr-01
19-Apr-01
26-Apr-01
03-May-01
10-May-01
17-May-01
24-May-01
31-May-01
07-Jun-01
14-Jun-01
21-Jun-01
28-Jun-01
05-Jul-01
12-Jul-01
19-Jul-01
26-Jul-01
02-Aug-01
09-Aug-01
16-Aug-01
23-Aug-01
30-Aug-01
06-Sep-01
13-Sep-01
20-Sep-01
27-Sep-01
04-Oct-01
11-Oct-01
18-Oct-01
25-Oct-01
01-Nov-01
08-Nov-01
Date
Rainfall
S494166 MW-12
Required Depth


Mallard Creek SG-11
Surface Water Depth (in.)
25
20
15
10
5
0
22-Mar-01
28-Mar-01
04-Apr-01
10-Apr-01
17-Apr-01
24-Apr-01
30-Apr-01
07-May-01
14-May-01
20-May-01
27-May-01
02-Jun-01
09-Jun-01
16-Jun-01
22-Jun-01
29-Jun-01
06-Jul-01
12-Jul-01
19-Jul-01
25-Jul-01
01-Aug-01
08-Aug-01
14-Aug-01
21-Aug-01
28-Aug-01
03-Sep-01
10-Sep-01
16-Sep-01
23-Sep-01
30-Sep-01
06-Oct-01
13-Oct-01
20-Oct-01
26-Oct-01
02-Nov-01
08-Nov-01
Date

APPENDIX B

SITE PHOTOS

MALLARD CREEK

Photo 1

Photo 2

Photo 3

Photo 4

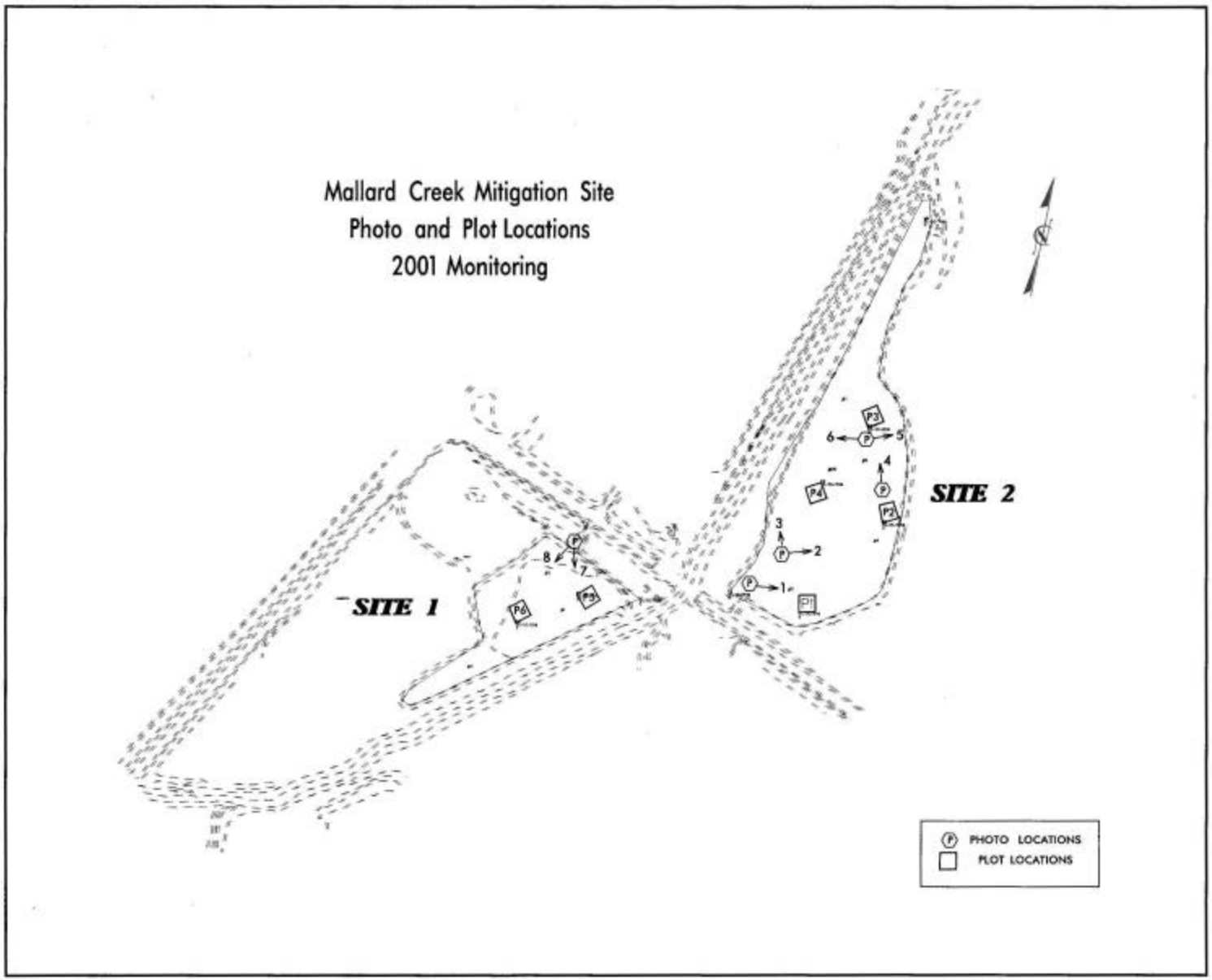
Photo 5

Photo 6

MALLARD CREEK

Photo 7

Photo 8


Mallard Creek Mitigation Site
Photo and Plot Locations
2001 Monitoring
SITE 1
SITE 2
P1
P2
P3
P4
P5
P6
1
2
3
4
5
6
7
8
PHOTO LOCATIONS
PLOT LOCATIONS

APPENDIX C

LETTER TO U.S. ARMY CORPS OF ENGINEERS, DECEMBER 13, 2001

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

December 13, 2001

Mr. Steve Lund
U. S. Army Corps of Engineers
Asheville Regulatory Field Office
151 Patton Avenue, Room 143
Asheville, North Carolina 28801-5006

SUBJECT: Request for Permit Modification for R-211 DA (Charlotte Outer Loop), Mecklenburg County, Action ID No. 199200013

Dear Mr. Lund:

This is to request a special condition modification for the Charlotte Outer Loop (TIP Project No. R-211 DA). The permit for R-211 DA contains a special condition for the Mallard Creek and Little Sugar Creek Wetland Mitigation Sites requiring wetland hydrology to be "established within 10 inches of the surface, ponded or flooded, for 26 consecutive days of the growing season". Based on the 1987 Wetland Delineation Manual, success criteria for hydrology states that hydrology shall be within 12 inches of the surface. Therefore, NCDOT requests that the special permit condition be changed to require the hydrology to be within 12 inches of the surface.

If you have any questions are desire more information, do not hesitate to contact Heather Montague at (919) 733-1175.

Sincerely,

William D. Gilmore, P. E., Manager
Project Development and Environmental Analysis Branch

attachments

Cc: Bruce Ellis, P.W.S., C.L.M.
Heather Montague
Mary Frazer

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS
1548 MAIL SERVICE CENTER
RALEIGH NC 27699-1548

TELEPHONE: 919-733-3141
FAX: 919-733-9794

WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC