ANNUAL REPORT FOR 2003

Grimesland Sand Pit Phase II Site
Pitt County
Project No. 8.T221801
TIP No. R-2510 WM

Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
December 2003

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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year for Phase II of the Grimesland Sand Pit Mitigation Site. This site is being constructed to serve as a wetland mitigation site for road projects taking place in the Lower Tar River portion of the Tar-Pamlico River Basin in North Carolina. The site is to be constructed in three phases, with Phase II construction activities having been completed in 2003 and planting occurring in February of 2003.

The site is monitored for hydrology using twenty groundwater-monitoring gauges and one rain gauge. The site is monitored for vegetation using seven vegetation plots, which are representative of the 48.8 acres planted in trees on the Grimesland Sand Pit Site Phase II.

The 2003-year represents the first year of hydrology and vegetation monitoring following construction. The site must demonstrate hydrologic and vegetation success for a minimum of five years or until the project is deemed successful.

Results for both hydrologic and vegetation monitoring indicate that the site is meeting success. The hydrologic data for 2003 demonstrates that the Phase II site was saturated and met jurisdictional success with all twenty groundwater gauges meeting the 12.5% success criteria. Vegetation monitoring for the first year yielded 440 trees per acre, which is above the minimum success criteria for the first year of monitoring.

NCDOT recommends that monitoring continue at the Grimesland Sand Pit Phase II Mitigation Site.

1.0 INTRODUCTION

1.1 Project Description

The 550-acre Grimesland Sand Pit Mitigation Site (herein after referred to as “the site”) is located in Pitt County near the community of Grimesland. The site is currently owned and mined by NCDOT. The site is bounded on the north and the east by Grindle Creek, on the west by croplands and pine plantation, and on the south by the floodplain of the Tar River and the Tar River itself (Figure 1). The site serves as a regional wetland mitigation site for NCDOT roadway projects that would impact similar sites located in the Lower Tar River Sub-Basin. The site includes the creation of 58 acres of forested riverine wetlands (cypress-gum swamp and coastal plain bottomland hardwoods), the creation of 2 acres of emergent wetlands on submerged benches, the preservation of 348 acres of riverine wetland ecosystem, the preservation of 29.59 acres of riparian buffer and the enhancement of aquatic habitat within 80 acres of flooded abandoned borrow pits.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five years or until success criteria are satisfied. 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 2003-growing season at the Grimesland Sand Pit Site.

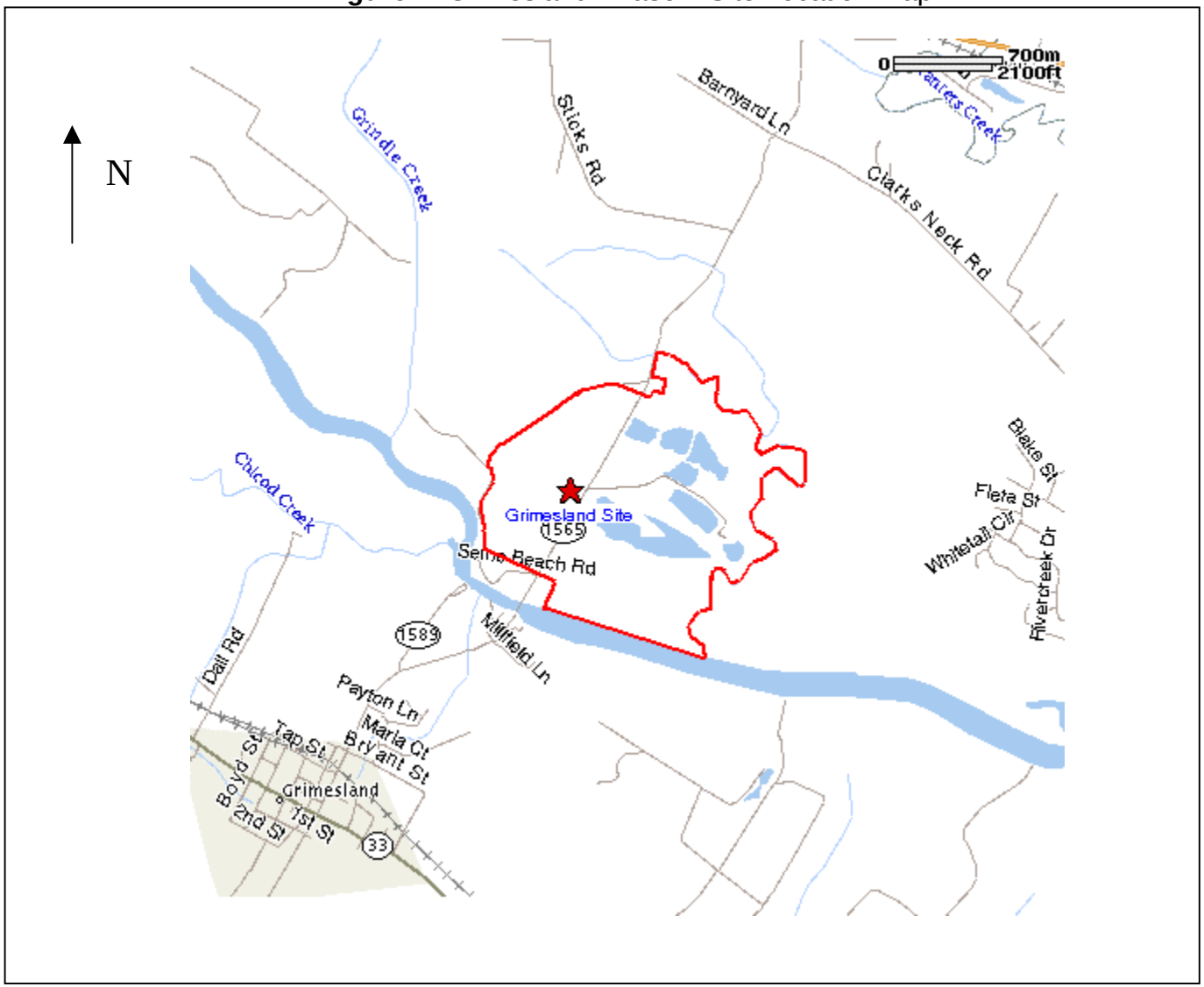
1.3 Project History

2003	Construction-Phase 2
February 2003	Phase II Planted
March- November 2003	Hydrologic Monitoring (1 yr.)
June 2003	Vegetation Monitoring (1 yr.)

1.4 Debit Ledger

There have been no debits from this site to compensate for impacts.

Figure 1. Grimesland Phase II Site Location Map



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 ground water for at least a consecutive 12.5% of the growing season. Areas inundated less than 5% of the growing season are always classified as non-wetlands. Areas inundated between 5% - 12.5% of the growing season can be classified as wetlands depending upon other factors, such as the presence of hydrophytic vegetation and hydric soils.

The growing season in Pitt County begins March 15 and ends November 16. These dates correspond to a 50% probability that temperatures will remain above 28^{o} F or higher after March 15 and before November 16.[1] The growing season is 247 days; therefore, the optimum duration for wetland hydrology is 31 days. Also, local climate must represent average conditions for the area.

2.2 Hydrologic Description

Twenty groundwater gauges were installed in the Phase II area in April 2003 (Figure 2). The automatic monitoring gauges record daily readings of the groundwater depth. The 2003 data represents the first full growing season during which the water table was monitored in the Phase II area. A rain gauge installed onsite records daily rainfall totals; these rain events are incorporated into the monitoring results to examine how the site's groundwater level responds to rainfall.

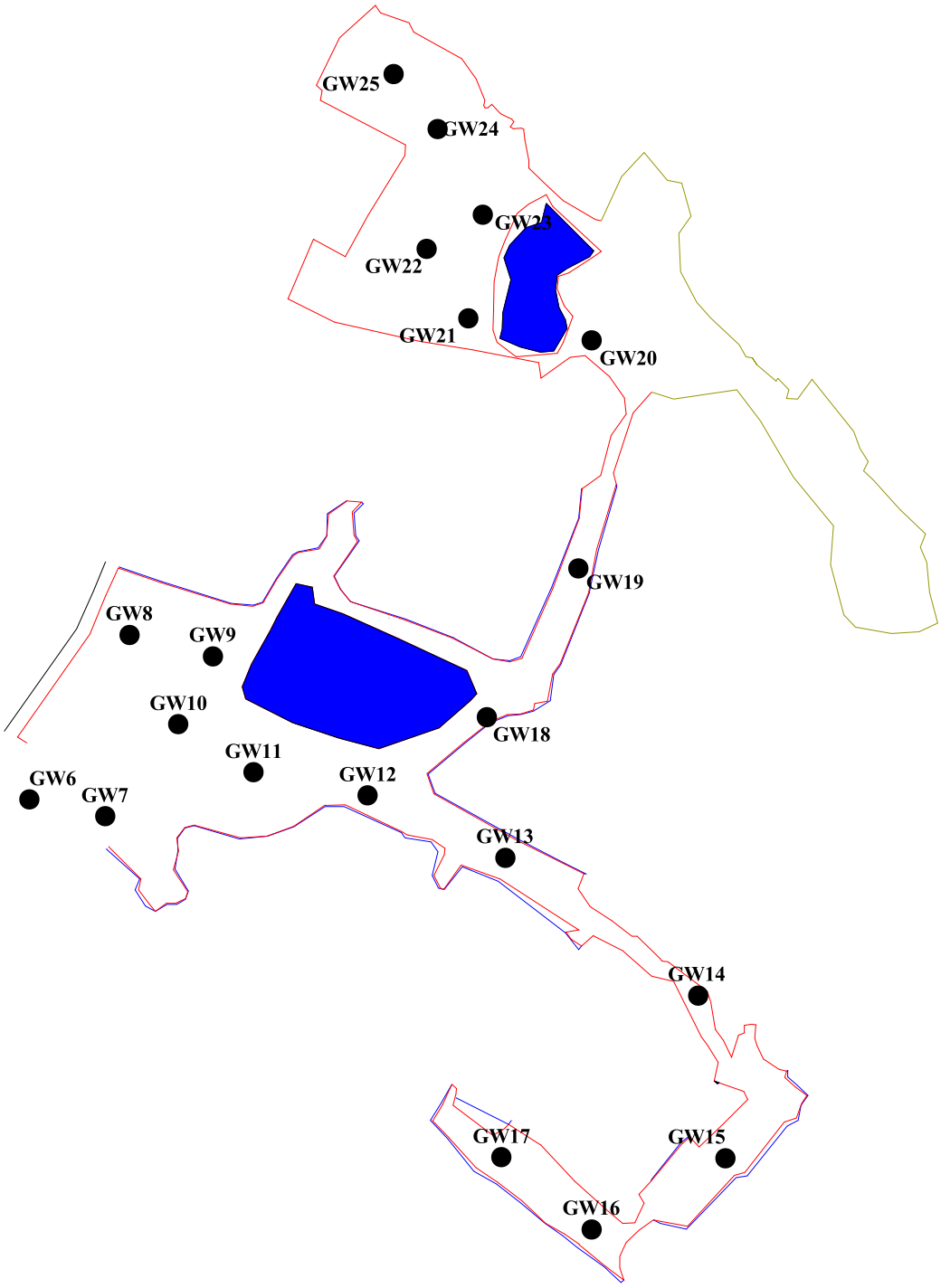
2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each groundwater-monitoring gauge. This number was converted into a percentage of the 247-day growing season (March 15 – November 16).

Table 1 shows the hydrologic results for 2003; Figure 3 is a graphical representation of these results. In Figure 3, a blue dot indicates the gauge showed success for more than 12.5% of the growing season; a red dot, between 8 and 12.5%; a green dot, between 5 and 8%, and a black dot, less than 5%.

[1] Soil Conservation Service, Soil Survey of Pitt County, North Carolina, p.71.



Phase II

Figure 2. Gauge Location Map

N

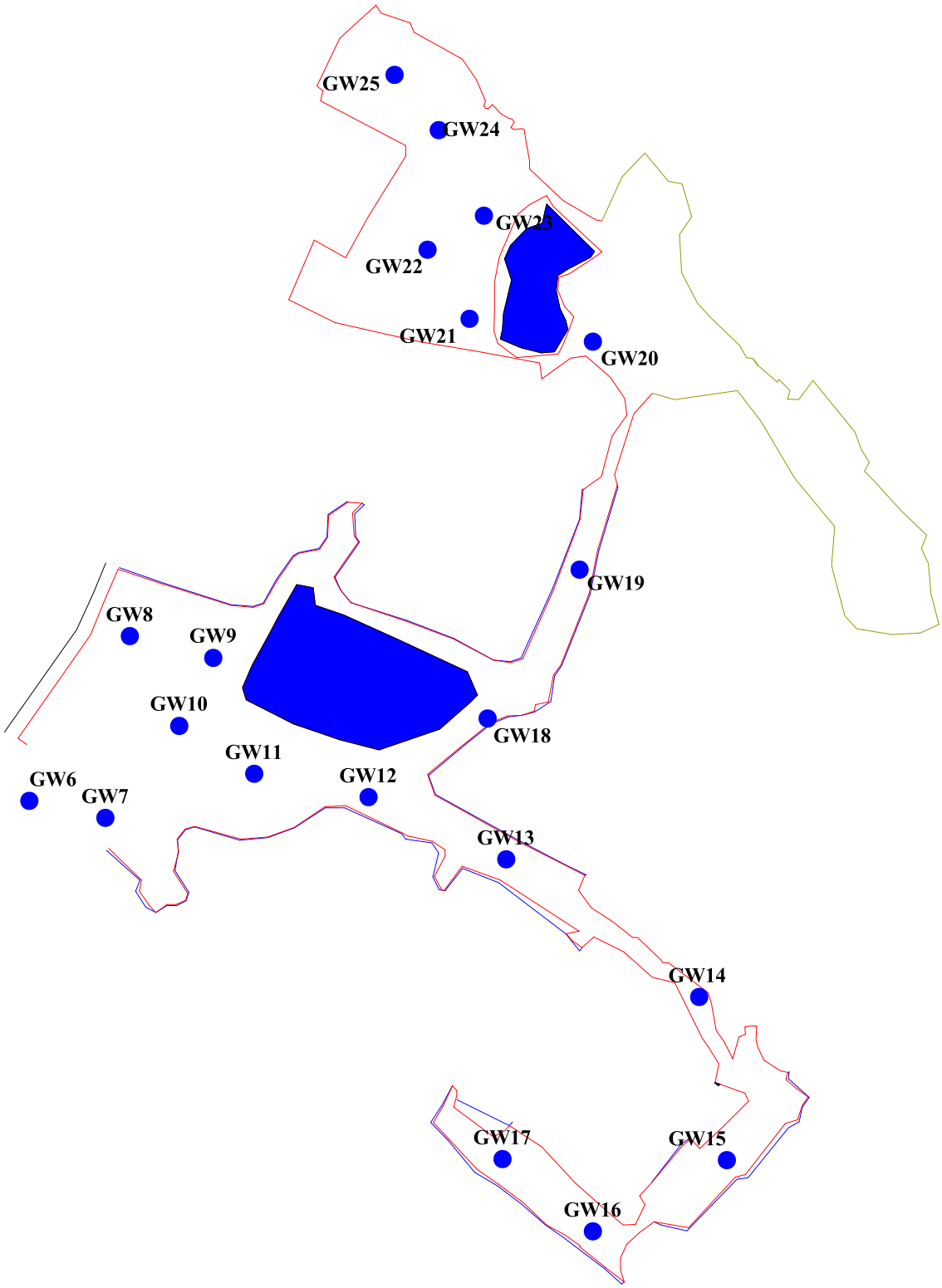
300 0 300 Feet

Table 1. 2003 Phase II Hydrologic Monitoring Results

Monitoring Gauge	< 5%	5 – 8%	8 – 12%	> 12.5%	Actual %	Success Dates
GSP-GW6+				✕	20.6	July 11-August 30
GSP-GW7+				✕	81.4	April 30-Nov 16
GSP-GW8+				✕	81.4	April 30-Nov 16
GSP-GW9+				✕	81.4	April 30-Nov 16
GSP-GW10+				✕	81.4	April 30-Nov 16
GSP-GW11+				✕	20.6	July 22-Sept 10
GSP-GW12+				✕	81.4	April 30-Nov 16
GSP-GW13+				✕	81.4	April 30-Nov 16
GSP-GW14+				✕	81.4	April 30-Nov 16
GSP-GW15+				✕	81.4	April 30-Nov 16
GSP-GW16+				✕	81.4	April 30-Nov 16
GSP-GW17+				✕	57.1	April 30-Sept 17
GSP-GW18+				✕	81.4	April 30-Nov 16
GSP-GW19+				✕	45.7	April 30-Aug 20
GSP-GW20+				✕	70	April 30-Oct 19
GSP-GW21+				✕	81.4	April 30-Nov 16
GSP-GW22+				✕	68.4	April 30-Oct 15
GSP-GW23+				✕	81.4	April 30-Nov 16
GSP-GW24+				✕	81.4	April 30-Nov 16
GSP-GW25+				✕	81.4	April 30-Nov 16

+ Gauge met the success criterion during an average rainfall month (March, June, and August).

Appendix A contains plots of the groundwater depth at each monitoring gauge location during 2003. In addition to documenting the water table level relative to the ground surface, these monitoring gauge graphs are designed to show the reaction of the groundwater level to specific rainfall events. The maximum number of consecutive days that the gauge indicates successful hydrology is noted on each graph. Precipitation events recorded by the onsite rain gauge are also included on each graph. Plots of the data recorded at each of the two surface water gauges are included in Appendix A.



Phase II

Figure 3. 2003 Hydrologic Monitoring Results

Hydrology Results

- < 5%
- 5 - 8%
- 8 - 12%
- >12.5%

- Rain Gauge
- Surface Gauge

N

300 0 300 Feet

2.3.2 Climatic Data

Figure 4 is a graph of monthly rainfall for the period of November 2002 through October 2003 compared to historical precipitation data (collected between 1972 and 2003) for Washington, North Carolina. Rainfall data from the onsite rain gauge was used for the months of (September 03' - November 03'). The NC State Climate Office provided the rainfall data. The comparison of 2003 rainfall versus historical values gives an indication of how 2003 compares to historical climate conditions.

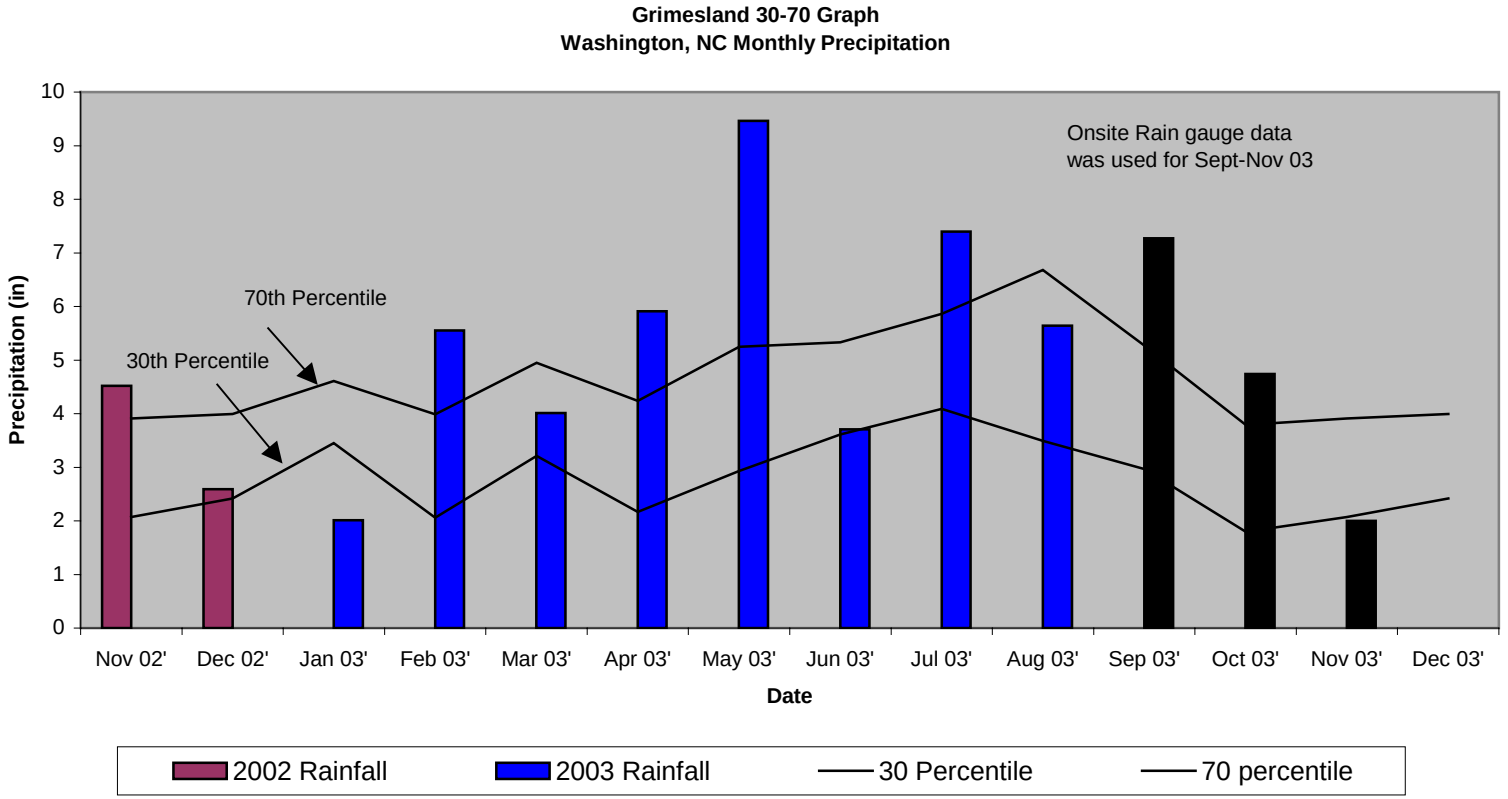
For the 2003-year, November (02'), February, April, May, July, September, and October experienced above average rainfall. The months of January and November recorded below average rainfall for the site. December (02'), March, June, and August experienced average rainfall. Overall, 2003 experienced an average to above average rainfall year.

2.4 Conclusions

The 2003-year concludes the first complete year of hydrology monitoring at the Grimesland Phase II Site. In 2003, the Phase II area experienced prolonged inundation throughout the growing season with 1" - 10" of standing water observed at several gauges. All twenty groundwater-monitoring gauges indicated jurisdictional success of 12.5% for the 2003-monitoring year. A comparison of 2003 rainfall versus historical precipitation shows that 2003 experienced average to above average rainfall conditions.

NCDOT will continue to monitor for hydrology at the Grimesland Phase II area.

Figure 4. Grimesland Phase II 30-70 Percentile Graph, Washington, NC



3.0 VEGETATION: GRIMESLAND SAND PIT MITIGATION SITE - PHASE II (YEAR 1 MONITORING)

3.1 Success Criteria

Success criteria states that there must be a minimum mean density of 320 trees per acre within three years of initial planting and a minimum count of 260 trees per acre must be achieved within five years of initial planting.

3.2 Description of Species

The following species were planted in the Wetland Restoration Area:

Phase II:

Nyssa sylvatica var. *biflora*, Swamp Blackgum

Fraxinus pennsylvanica, Green Ash

Quercus phellos, Willow Oak

Quercus nigra, Water Oak

Taxodium distichum, Baldcypress

Quercus lyrata, Overcup Oak

Platanus occidentalis, Sycamore

3.3 Results of Vegetation Monitoring

TABLE 2: Vegetation Monitoring Statistics

Plot #	Baldcypress	Green Ash	Swamp Blackgum	Water Oak	Willow Oak	Overcup Oak	Sycamore	Total (Year 1)	Total (at planting)	Density (Trees/Acre
1	6	10		6	3	19	1	45	50	612
2	4	5		1		5		15	31	329
3	2	1	5	2		1	4	15	31	329
4	12		9					21	22	649
5	23	4	5			3		35	45	529
6	3	10	1	1				15	26	392
7	1	6	7					14	40	238
	AVERAGE TREE DENSITY									**440**

Site Notes: Other species noted: black willow, *Juncus* sp., woolgrass, cattail, *Cyperus* sp., *Scirpus* sp., smartweed, volunteer sycamore, volunteer swamp blackgum, and various grasses.

3.4 Conclusions

Of the 550 acres on this site, Phase II consisted of approximately 48.8 acres of tree planting. There were 7 vegetation-monitoring plots established throughout the Phase II planting areas. The 2003 vegetation monitoring of the site revealed an average tree density of 440 trees per acre. This average is well above the minimum success criteria of 320 trees per acre.

NCDOT will continue vegetation monitoring at the Grimesland Sand Pit (Phase II) Mitigation Site.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

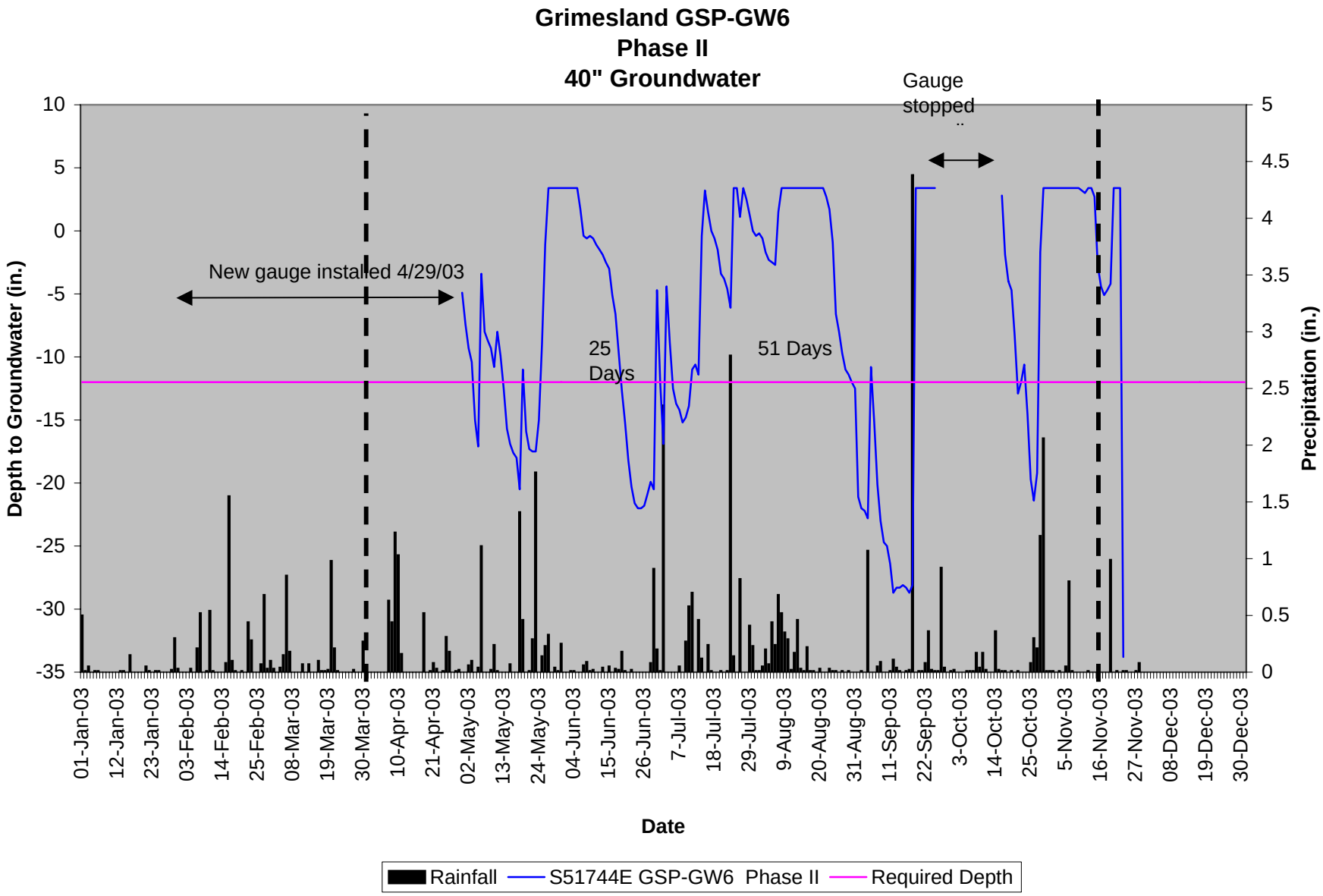
The Grimesland Sand Pit Phase II Mitigation Site was monitored for the first year in 2003. Hydrologically, the Phase II area experienced extended periods of inundation during the growing season with 1" - 10" of standing water observed at several gauges. All twenty groundwater-monitoring gauges indicated jurisdictional success of at least 12.5% for the 2003-monitoring year. An analysis of rainfall in nearby Washington, NC shows that the region experienced average to above average rainfall for the year. Thus, the site met jurisdictional success criteria in average climatic conditions.

Approximately 48.8 acres of the site were planted; seven vegetation plots within this area are used for vegetation monitoring. The established success criteria stated that the minimum survival rate in the first three years following planting was 320 trees per acre. Monitoring results showed an average survival rate of 440 trees per acre in the first year. Therefore, the vegetation exceeds the minimum required success criteria.

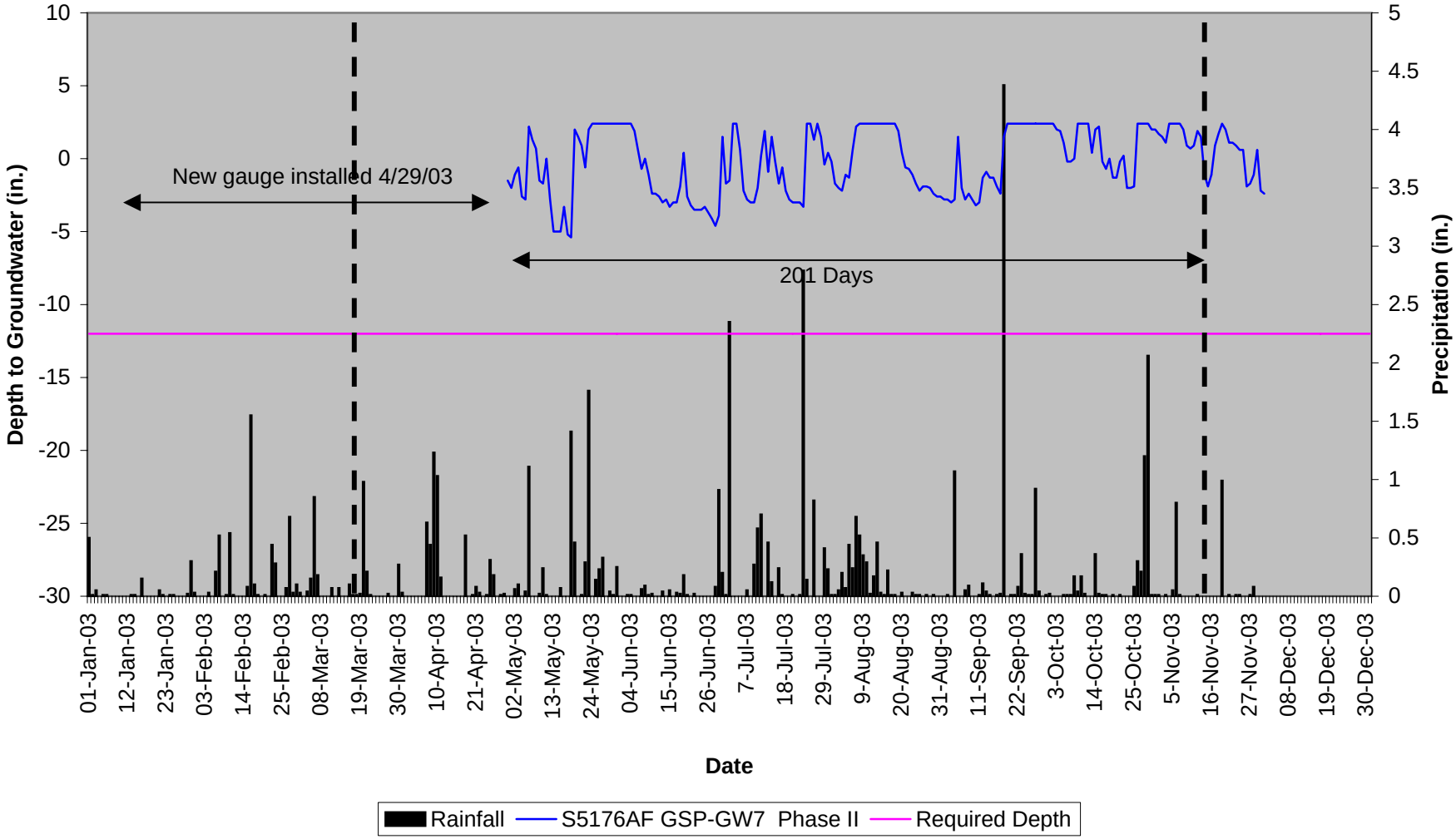
Based on the first year results from the 2003-monitoring season, NCDOT recommends that both hydrologic and vegetation monitoring continue at the Grimesland Phase II Site.

APPENDIX A

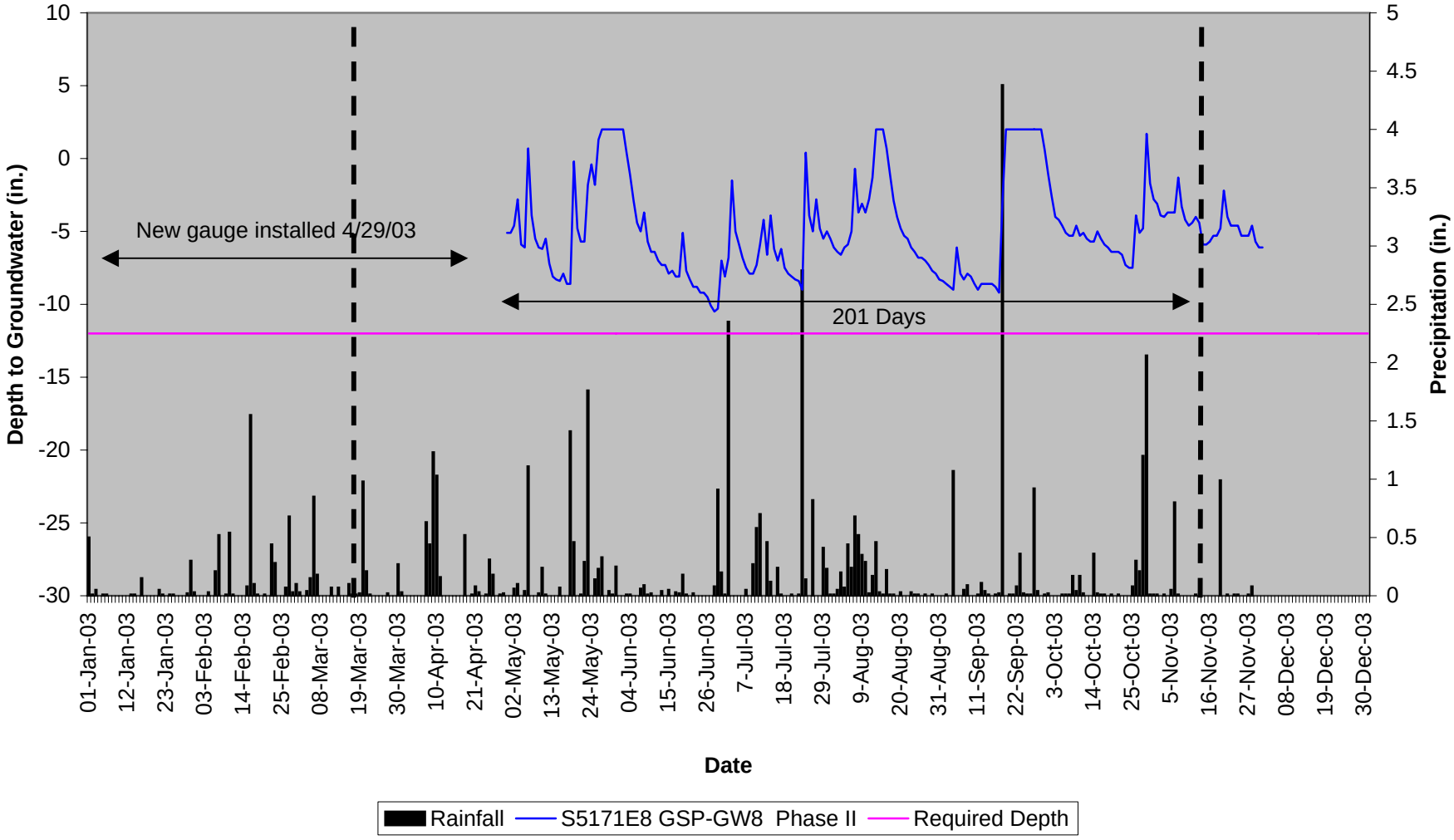
DEPTH TO GROUNDWATER CHARTS


Grimesland GSP-GW6
Phase II
40" Groundwater
Gauge stopped
New gauge installed 4/29/03
25 Days
51 Days
Depth to Groundwater (in.)
Precipitation (in.)
Date
Rainfall
S51744E GSP-GW6 Phase II
Required Depth

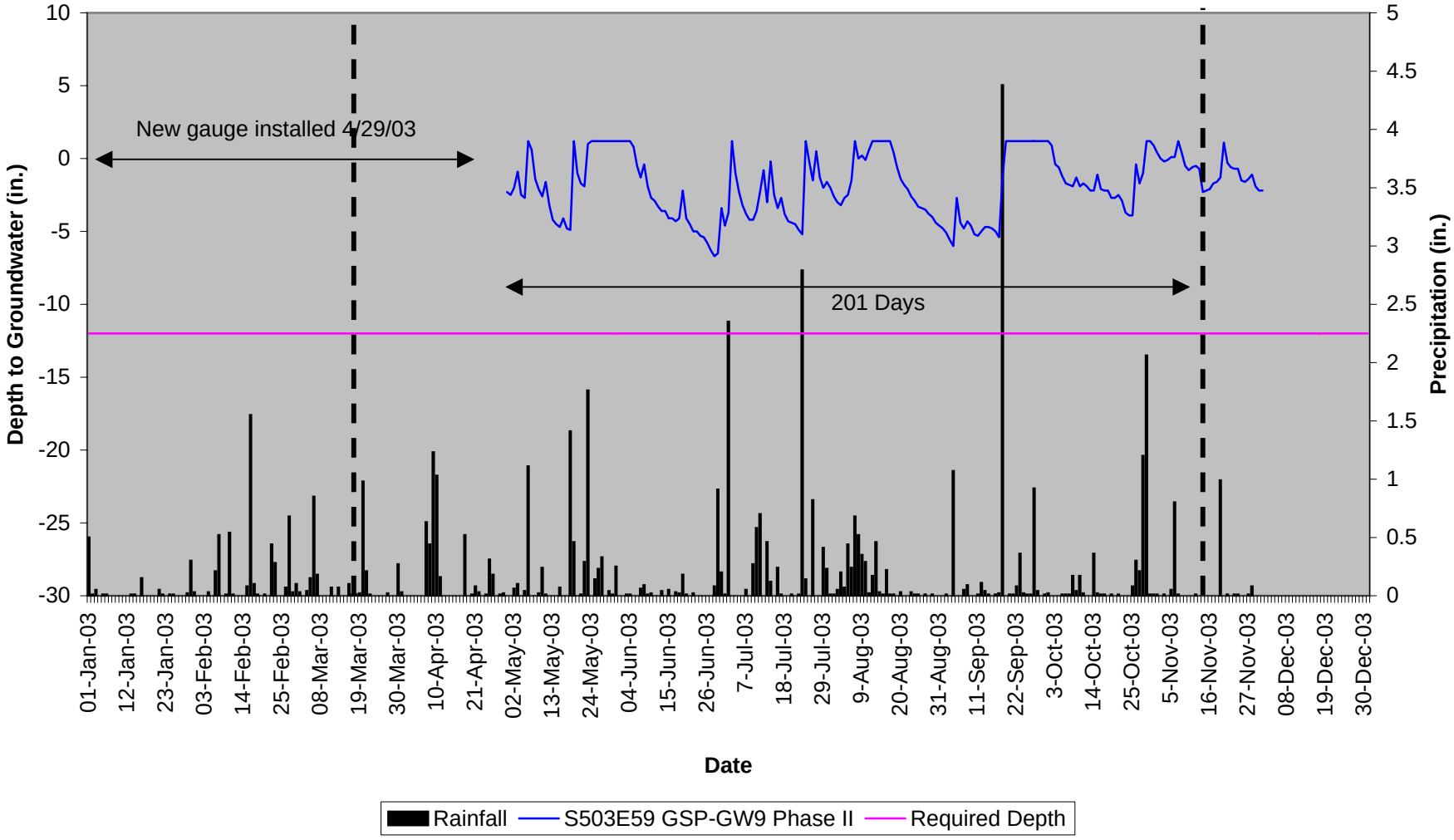
Grimesland GSP-GW7
Phase II
40" Groundwater

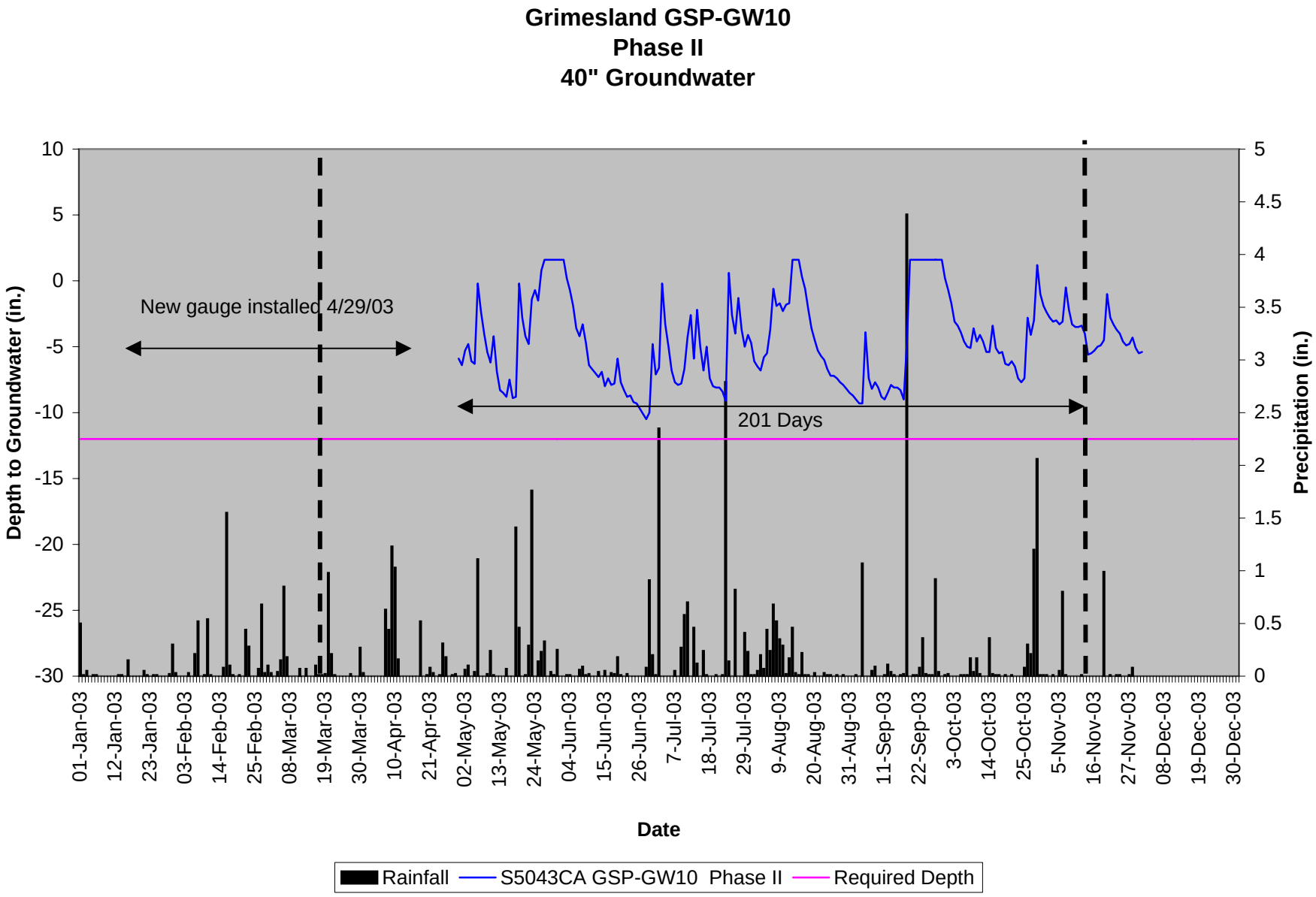


Grimesland GSP-GW8
Phase II
40" Groundwater

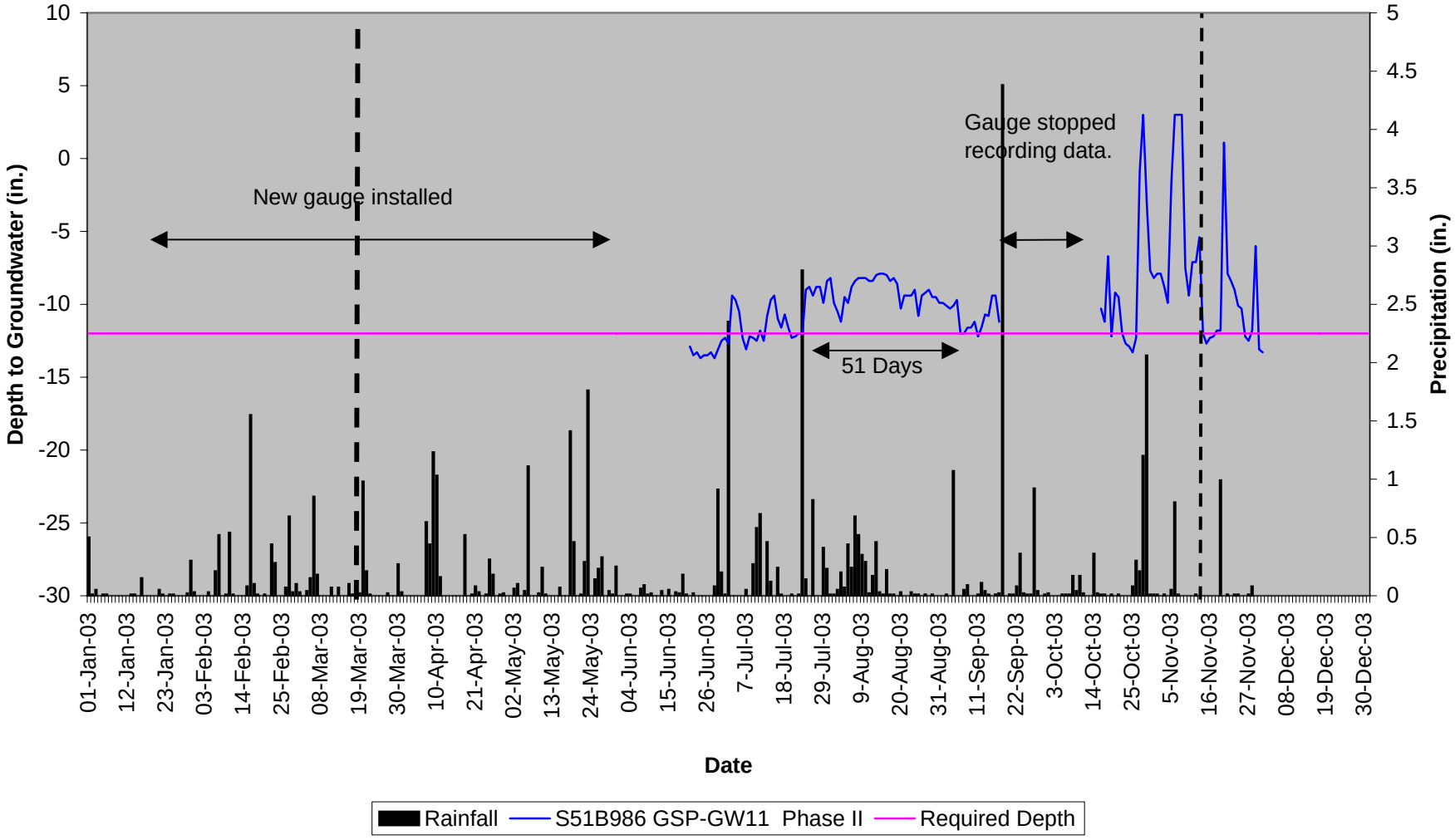


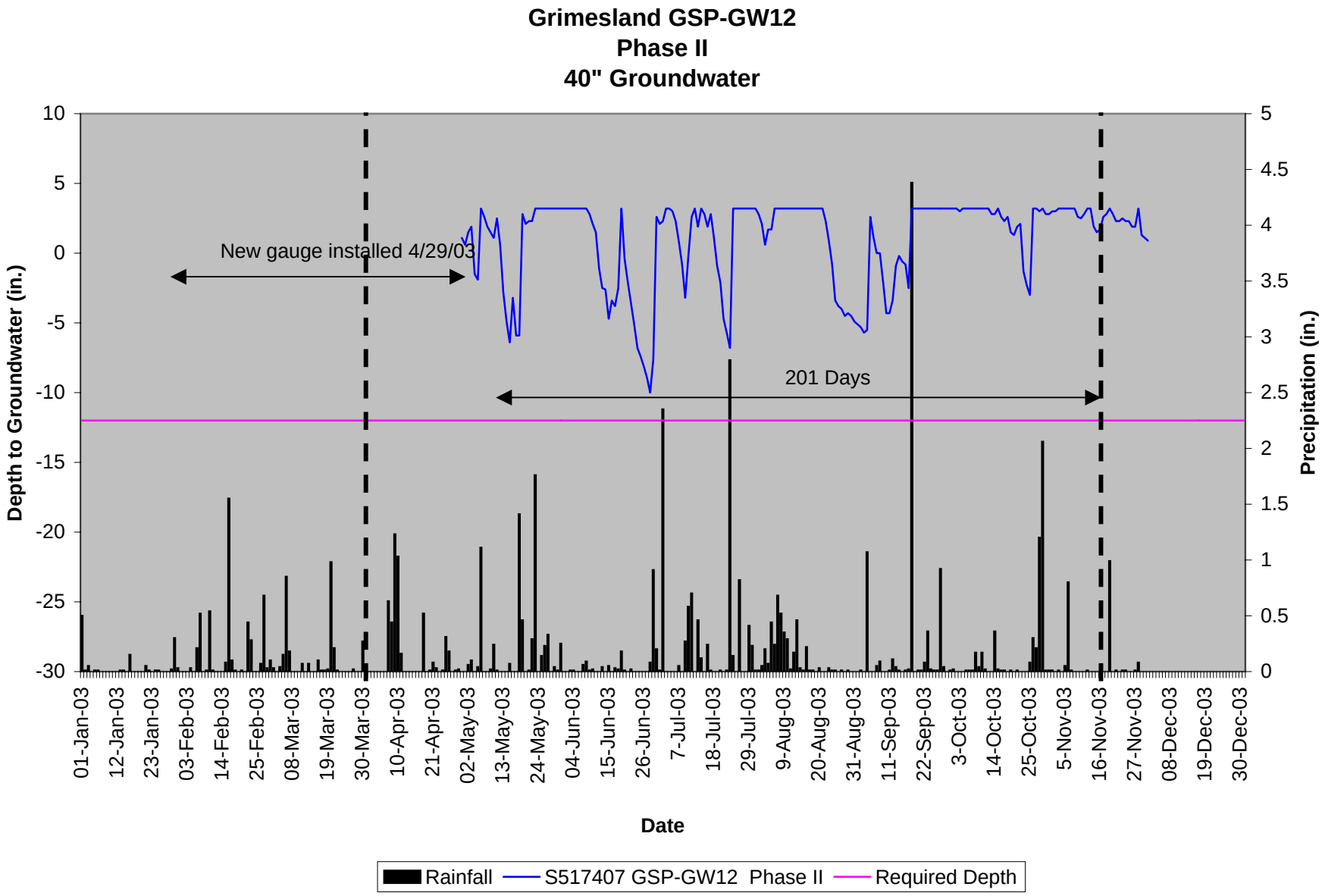
Grimesland GSP-GW9
Phase II
40" Groundwater

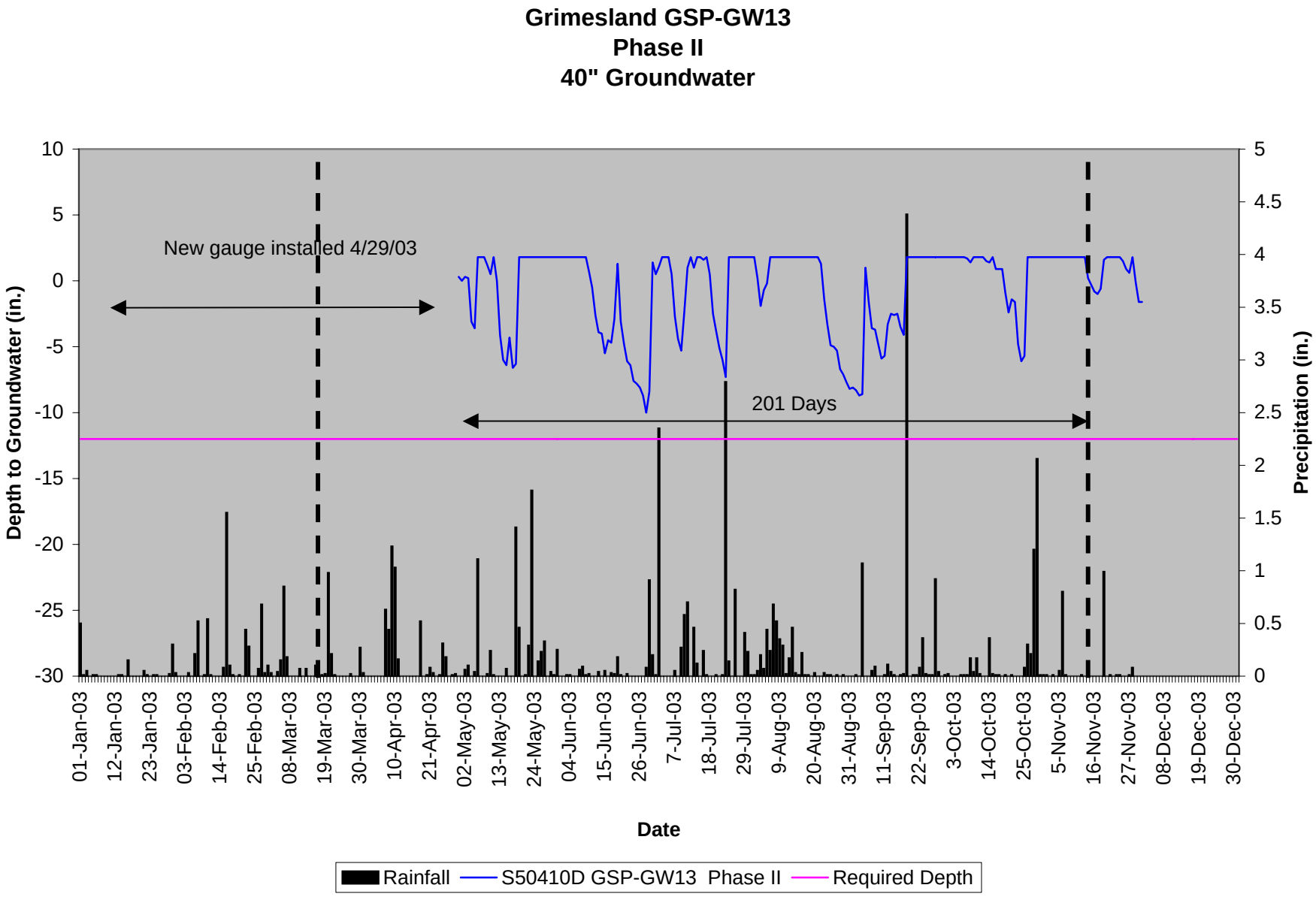



Grimesland GSP-GW10
Phase II
40" Groundwater
Depth to Groundwater (in.)
Precipitation (in.)
New gauge installed 4/29/03
201 Days
Date
Rainfall
S5043CA GSP-GW10 Phase II
Required Depth

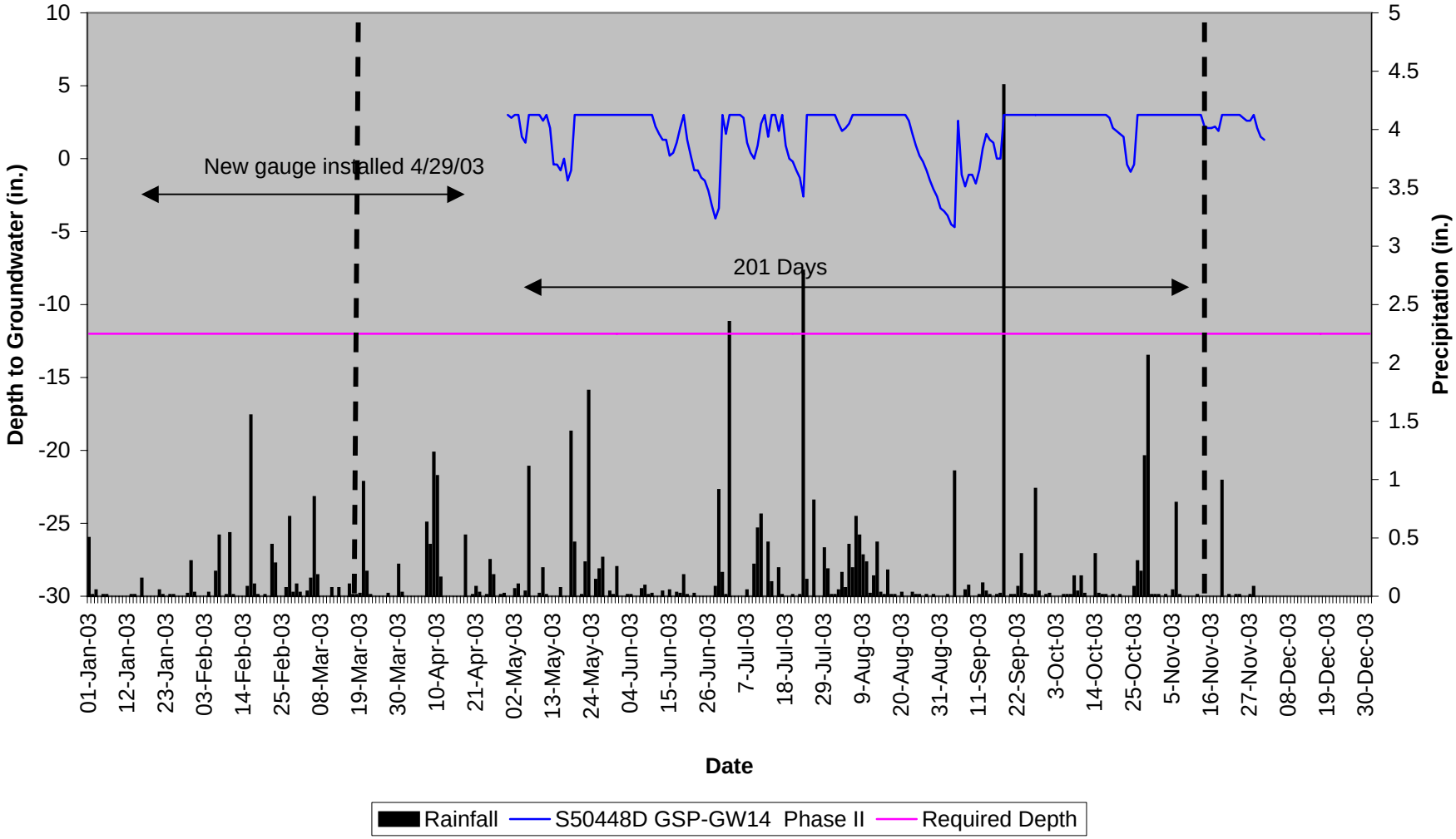
Grimesland GSP-GW11
Phase II
40" Groundwater



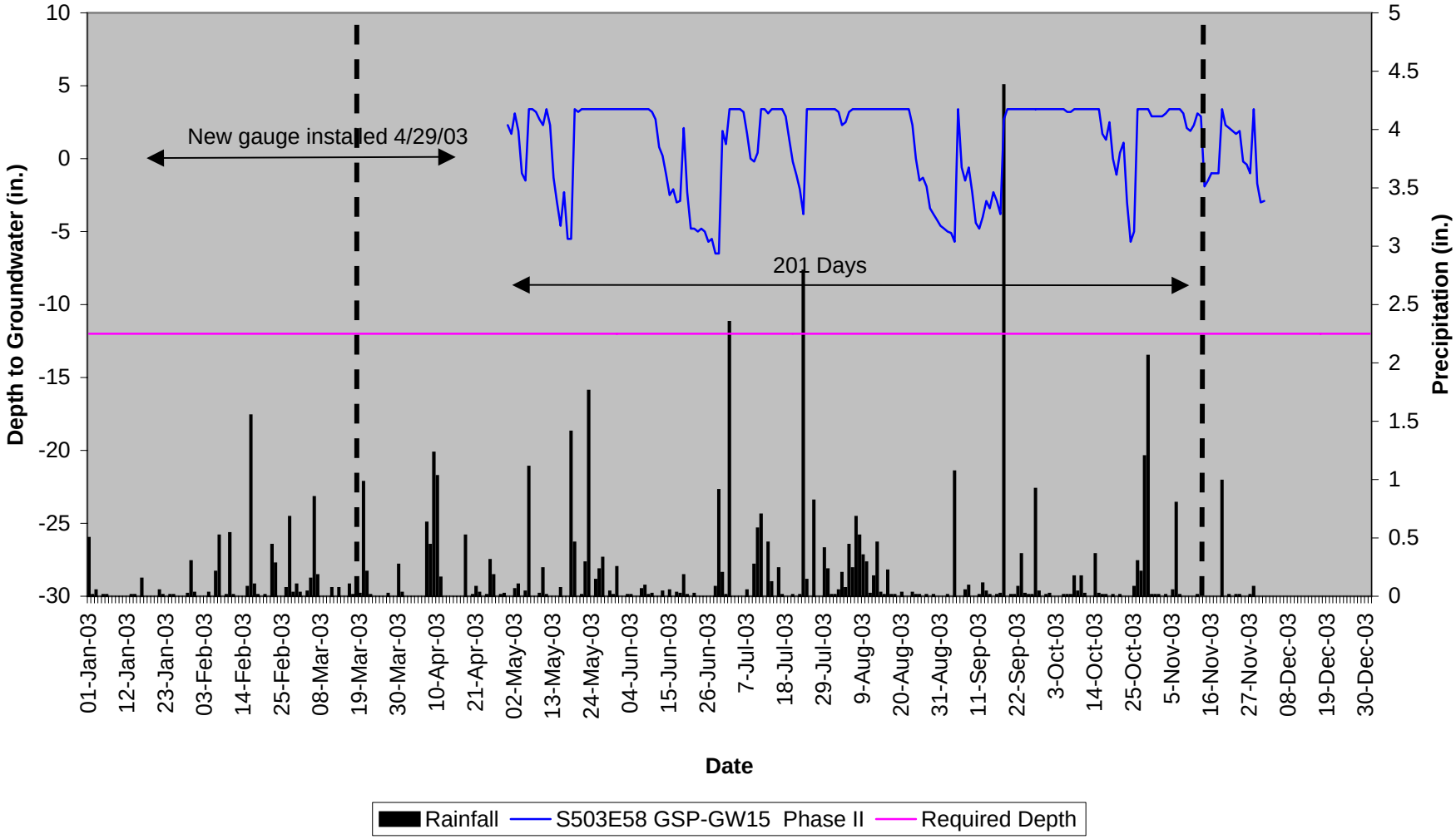

Grimesland GSP-GW12
Phase II
40" Groundwater
New gauge installed 4/29/03
201 Days
Depth to Groundwater (in.)
Precipitation (in.)
Date
10
5
0
-5
-10
-15
-20
-25
-30
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01-Jan-03
12-Jan-03
23-Jan-03
03-Feb-03
14-Feb-03
25-Feb-03
08-Mar-03
19-Mar-03
30-Mar-03
10-Apr-03
21-Apr-03
02-May-03
13-May-03
24-May-03
04-Jun-03
15-Jun-03
26-Jun-03
7-Jul-03
18-Jul-03
29-Jul-03
9-Aug-03
20-Aug-03
31-Aug-03
11-Sep-03
22-Sep-03
3-Oct-03
14-Oct-03
25-Oct-03
5-Nov-03
16-Nov-03
27-Nov-03
08-Dec-03
19-Dec-03
30-Dec-03
Rainfall
S517407 GSP-GW12 Phase II
Required Depth


Grimesland GSP-GW13
Phase II
40" Groundwater
New gauge installed 4/29/03
201 Days
Depth to Groundwater (in.)
Precipitation (in.)
Date
10
5
0
-5
-10
-15
-20
-25
-30
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01-Jan-03
12-Jan-03
23-Jan-03
03-Feb-03
14-Feb-03
25-Feb-03
08-Mar-03
19-Mar-03
30-Mar-03
10-Apr-03
21-Apr-03
02-May-03
13-May-03
24-May-03
04-Jun-03
15-Jun-03
26-Jun-03
7-Jul-03
18-Jul-03
29-Jul-03
9-Aug-03
20-Aug-03
31-Aug-03
11-Sep-03
22-Sep-03
3-Oct-03
14-Oct-03
25-Oct-03
5-Nov-03
16-Nov-03
27-Nov-03
08-Dec-03
19-Dec-03
30-Dec-03
Rainfall
S50410D GSP-GW13 Phase II
Required Depth

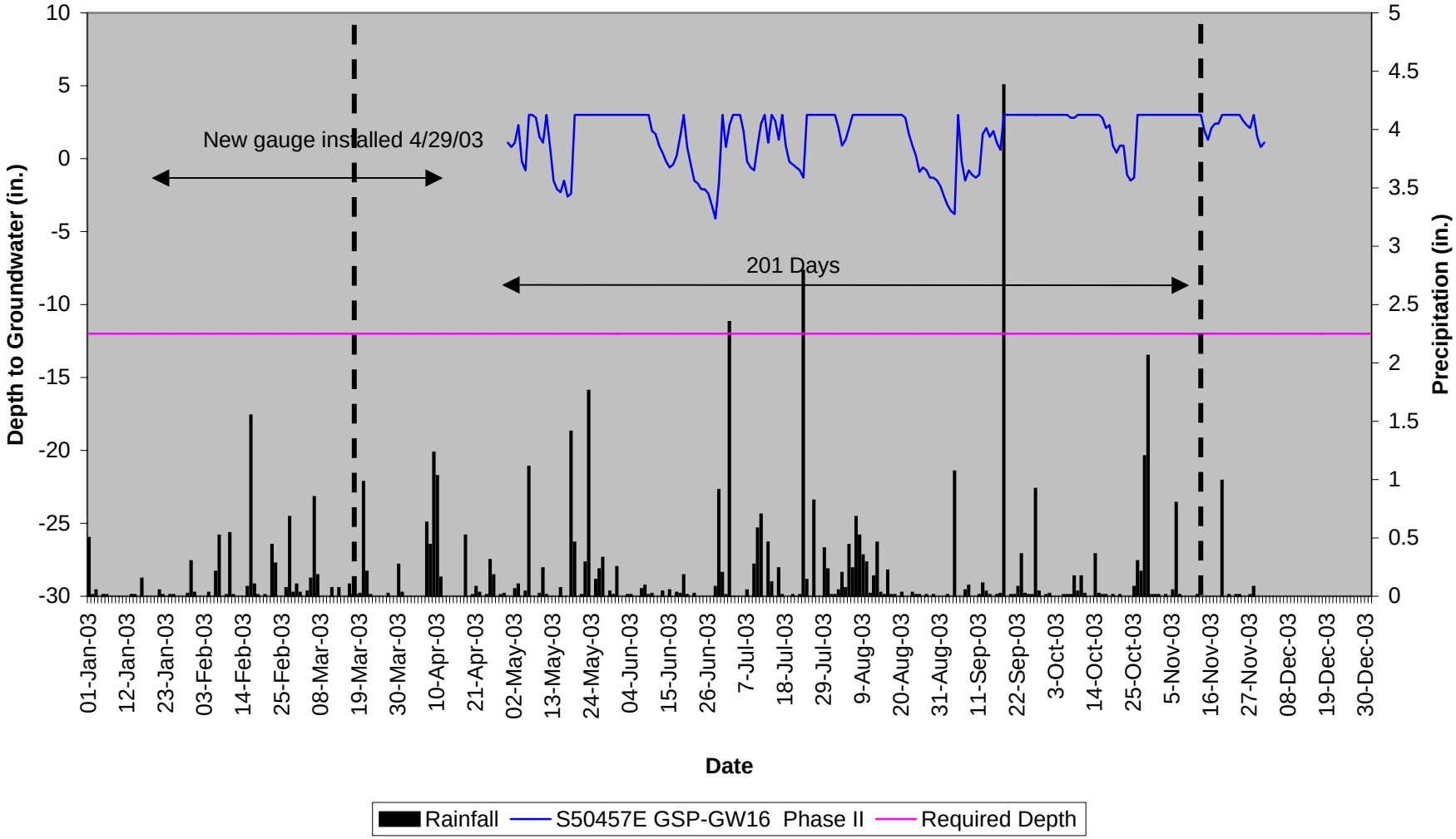
Grimesland GSP-GW14
Phase II
40" Groundwater

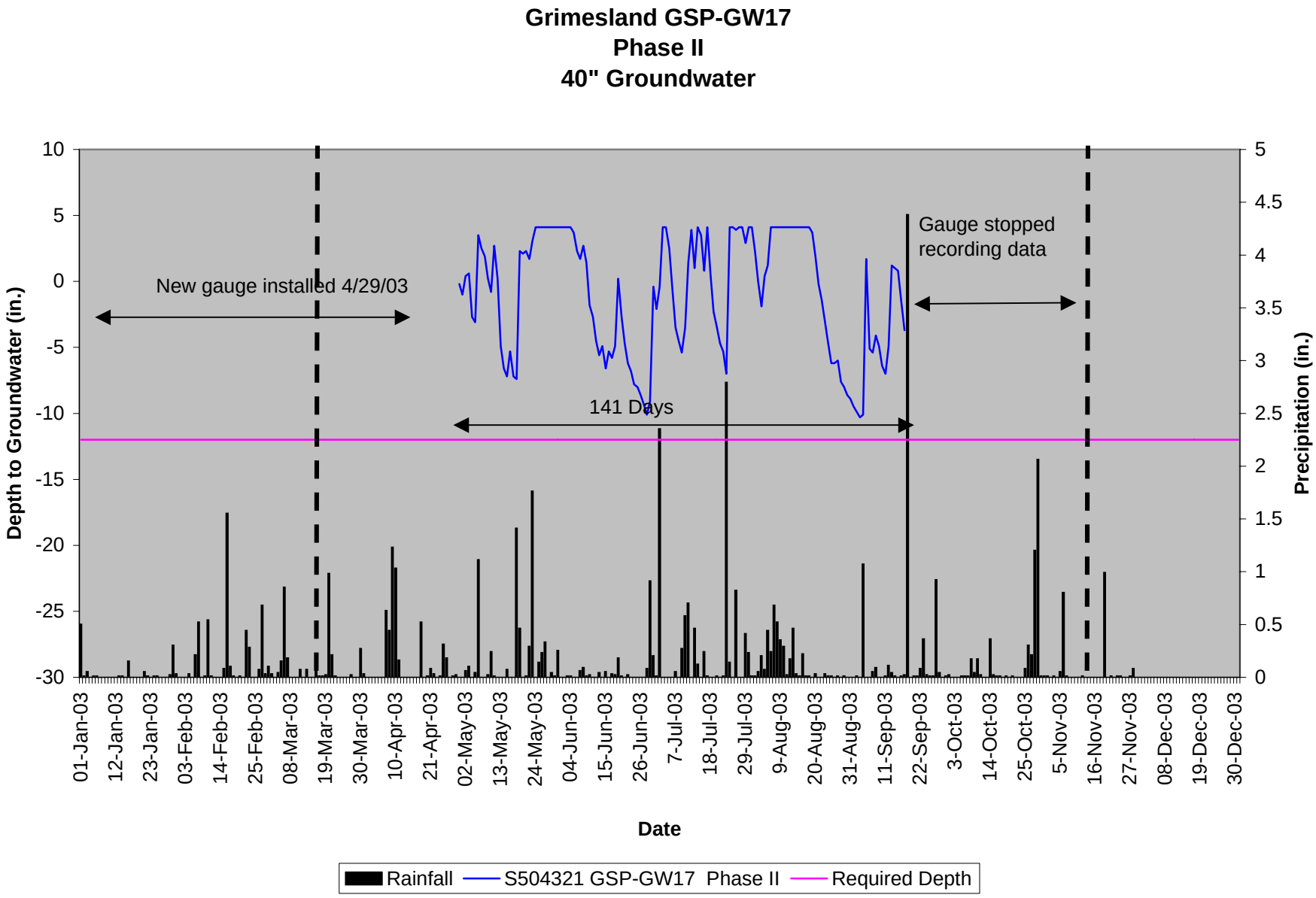


Grimesland GSP-GW15
Phase II
40" Groundwater

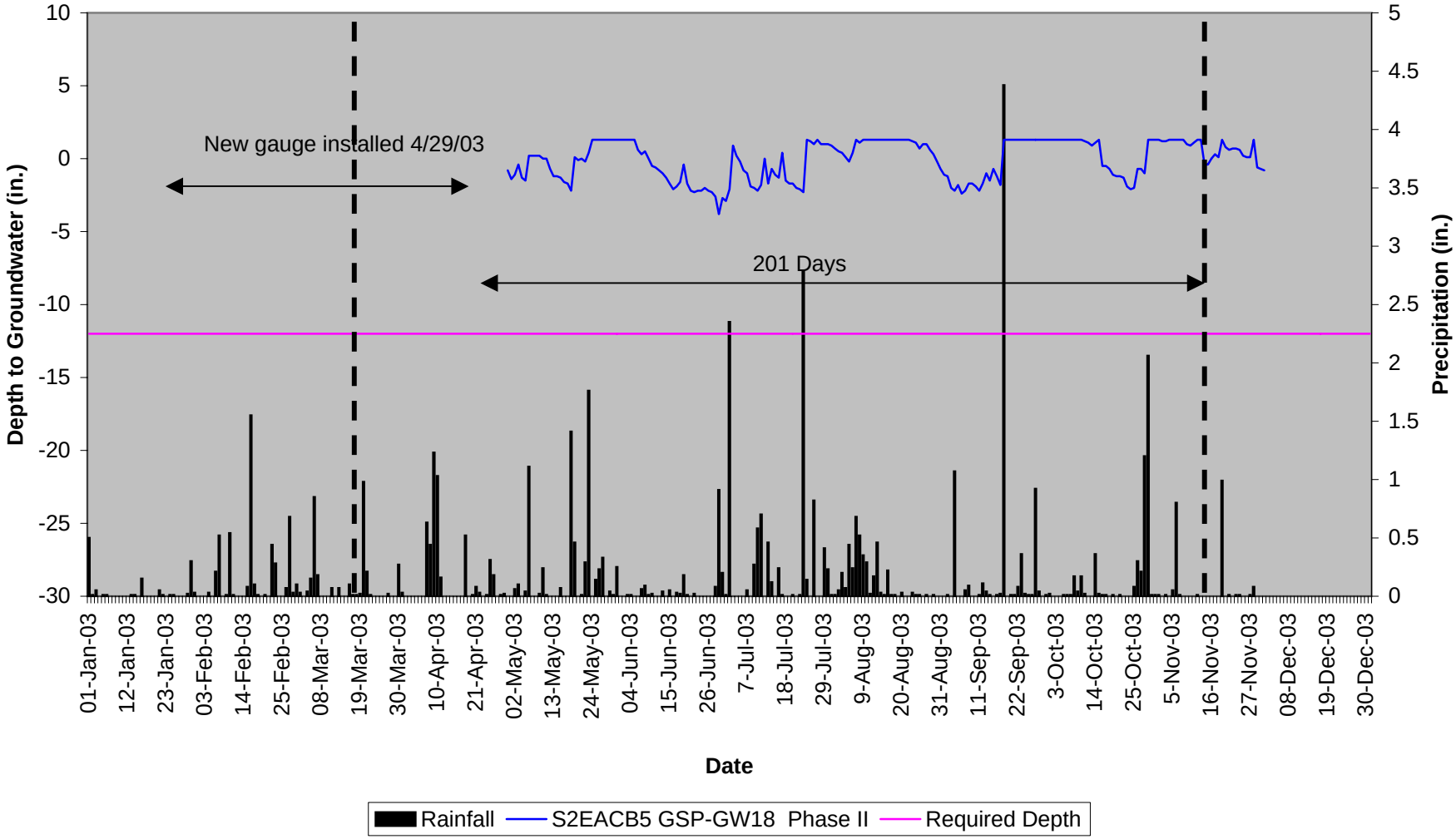


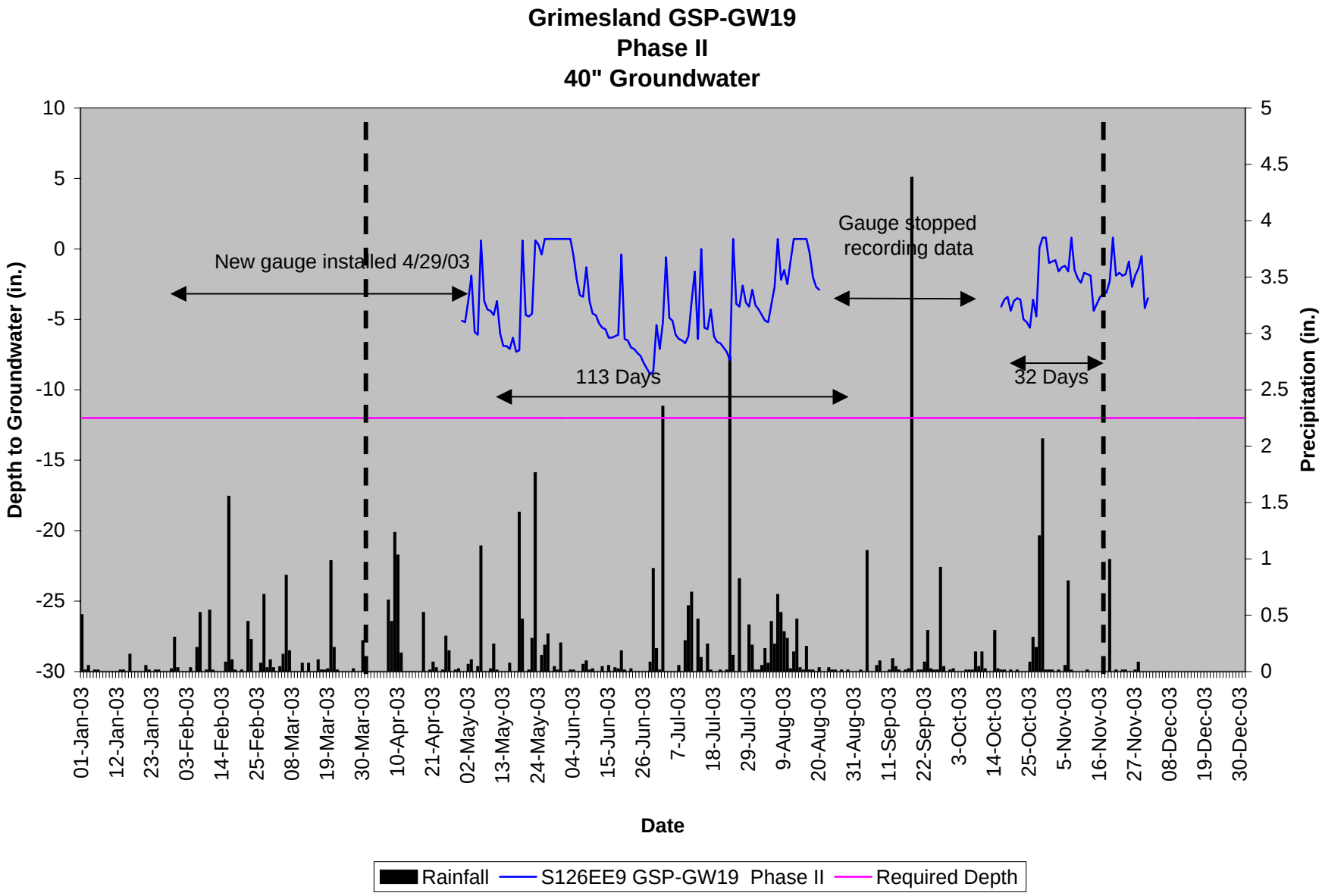
Grimesland GSP-GW16
Phase II
40" Groundwater



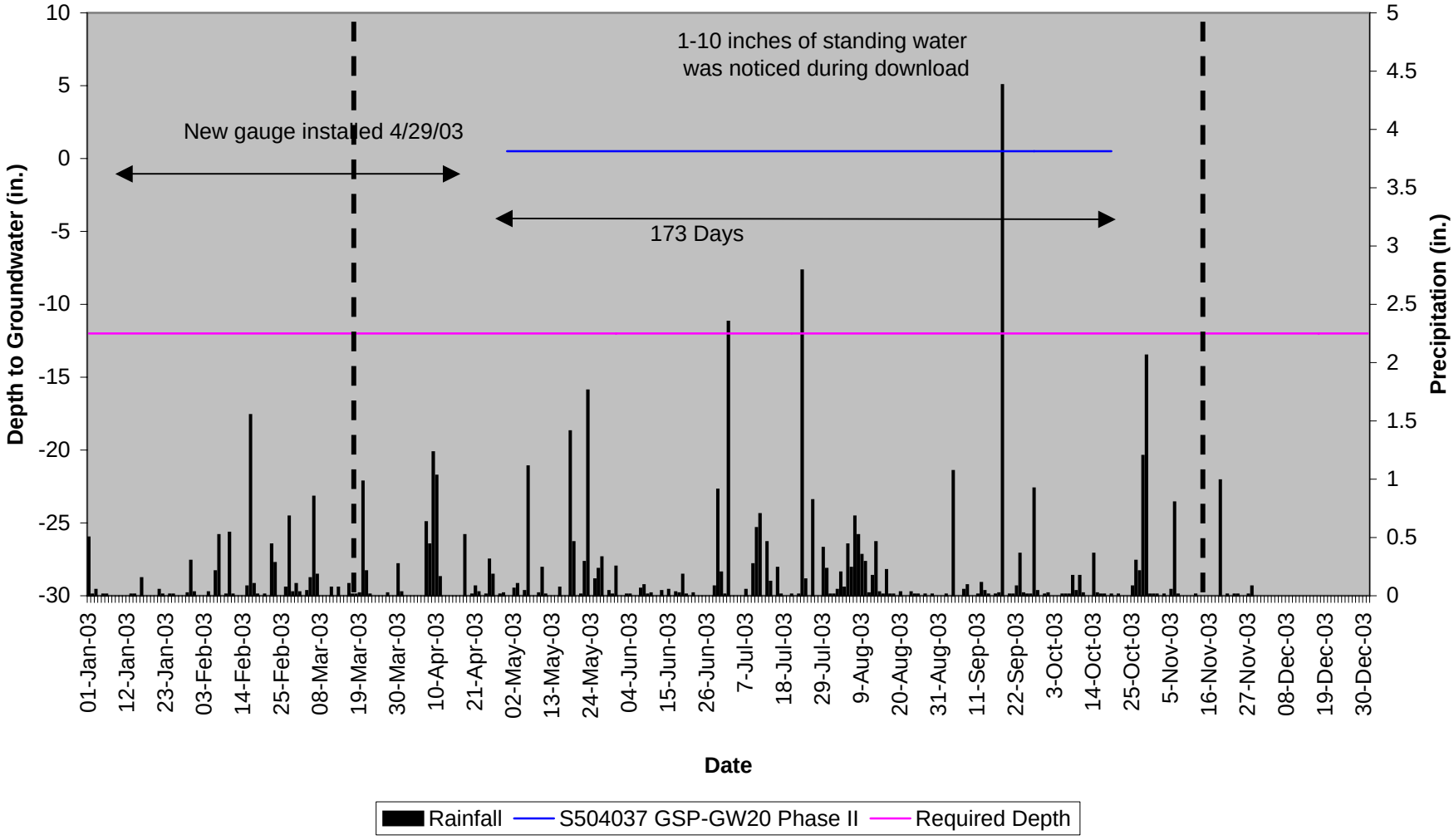

Grimesland GSP-GW17
Phase II
40" Groundwater
New gauge installed 4/29/03
Gauge stopped recording data
141 Days
Depth to Groundwater (in.)
Precipitation (in.)
Date
Rainfall
S504321 GSP-GW17 Phase II
Required Depth

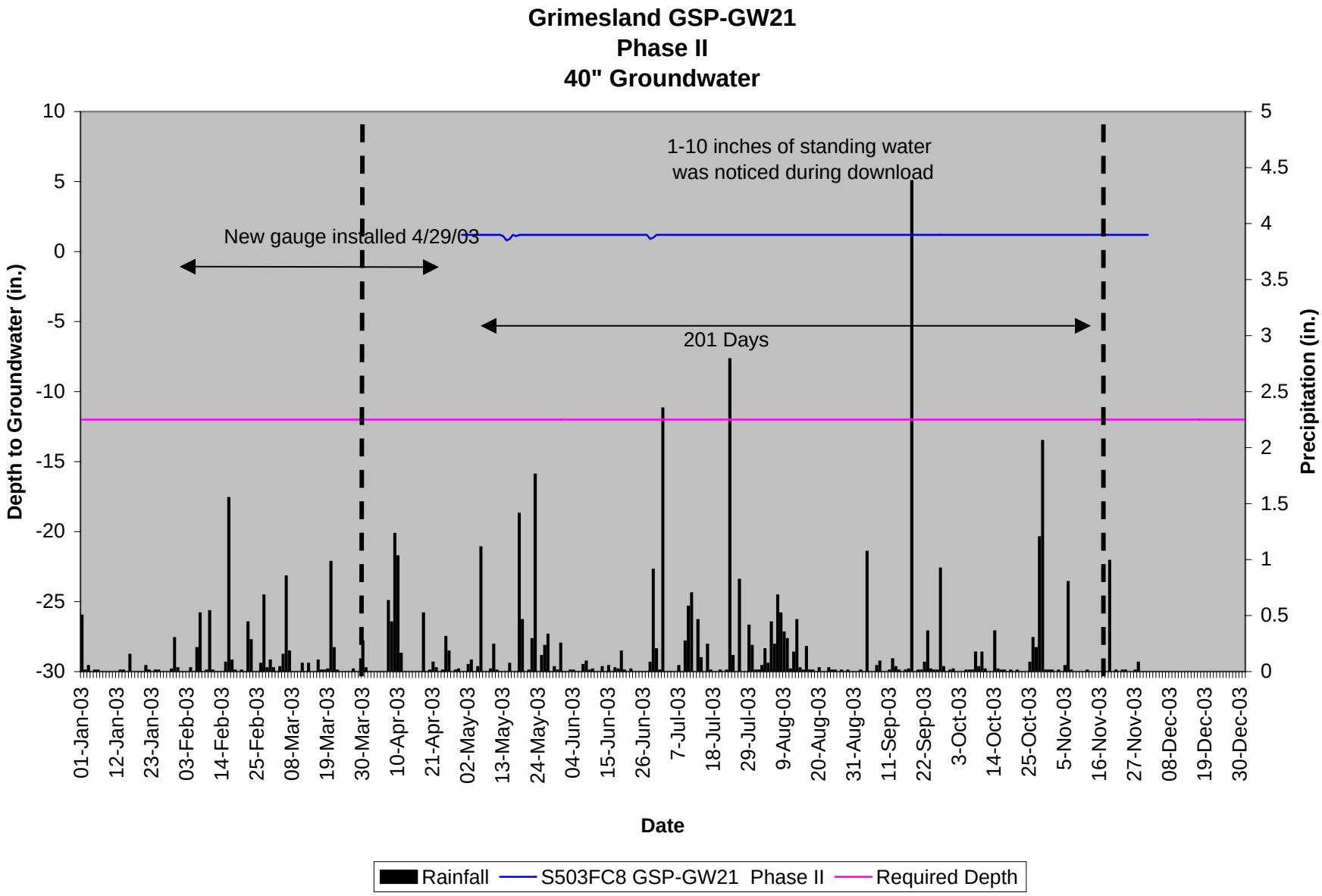
Grimesland GSP-GW18
Phase II
40" Groundwater



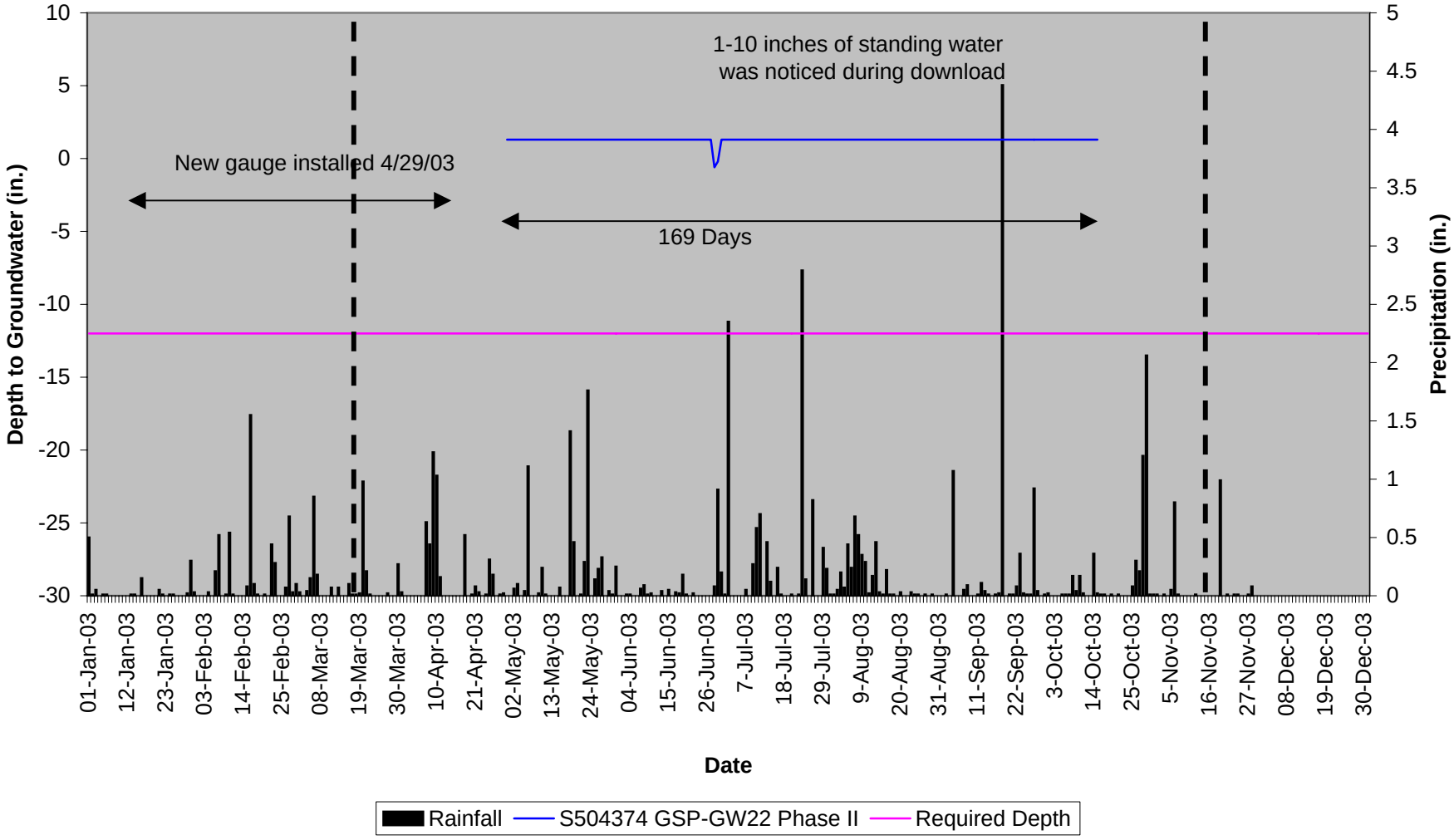

Grimesland GSP-GW19
Phase II
40" Groundwater
Depth to Groundwater (in.)
Precipitation (in.)
New gauge installed 4/29/03
Gauge stopped recording data
113 Days
32 Days
Date
Rainfall
S126EE9 GSP-GW19 Phase II
Required Depth

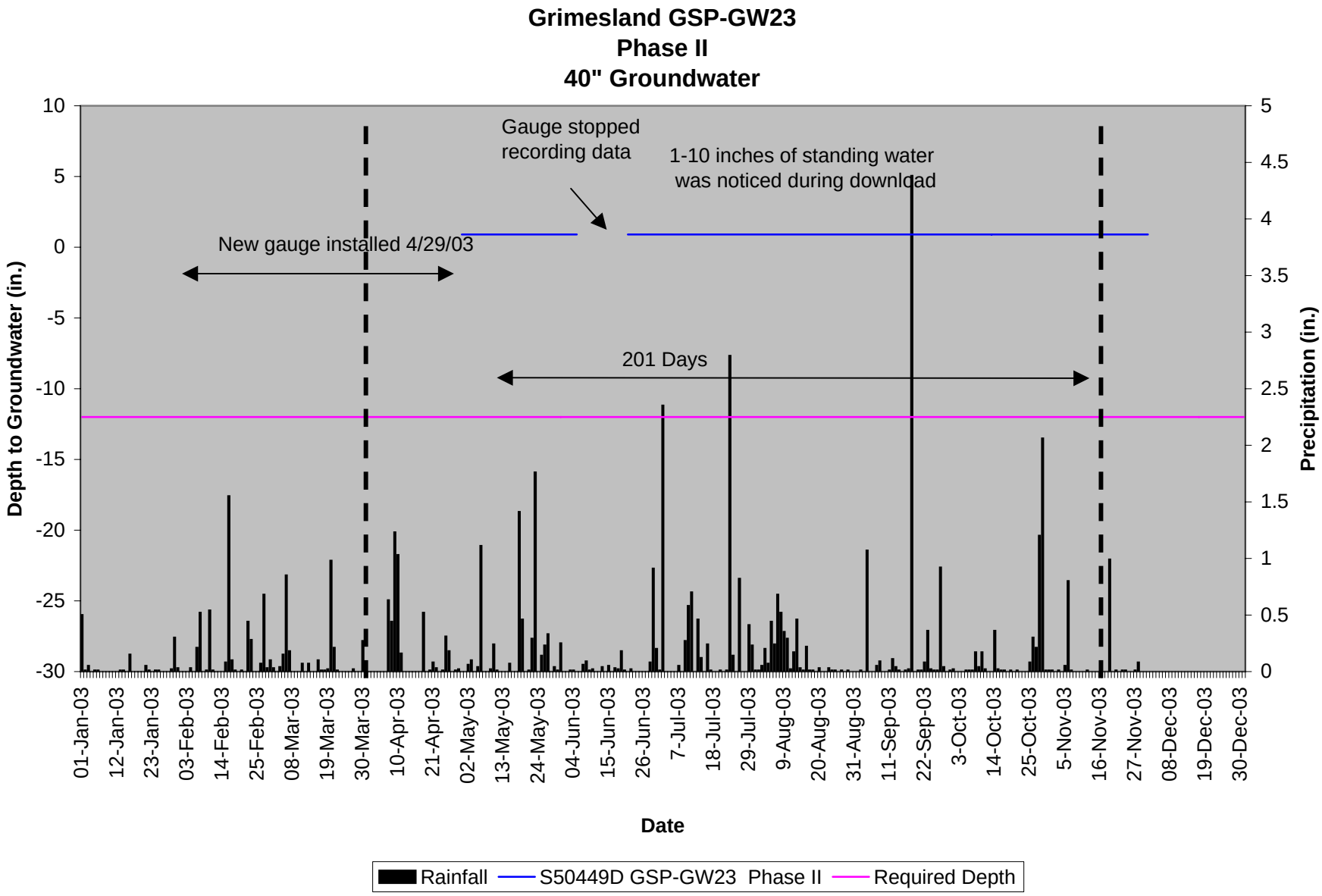
Grimesland GSP-GW20
Phase II
40" Groundwater




Grimesland GSP-GW21
Phase II
40" Groundwater
1-10 inches of standing water
was noticed during download
New gauge installed 4/29/03
201 Days
Depth to Groundwater (in.)
Precipitation (in.)
Date
Rainfall
S503FC8 GSP-GW21 Phase II
Required Depth

Grimesland GSP-GW22
Phase II
40" Groundwater




Grimesland GSP-GW23
Phase II
40" Groundwater
Gauge stopped recording data
1-10 inches of standing water was noticed during download
New gauge installed 4/29/03
201 Days
Depth to Groundwater (in.)
Precipitation (in.)
Date
10
5
0
-5
-10
-15
-20
-25
-30
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01-Jan-03
12-Jan-03
23-Jan-03
03-Feb-03
14-Feb-03
25-Feb-03
08-Mar-03
19-Mar-03
30-Mar-03
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21-Apr-03
02-May-03
13-May-03
24-May-03
04-Jun-03
15-Jun-03
26-Jun-03
7-Jul-03
18-Jul-03
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9-Aug-03
20-Aug-03
31-Aug-03
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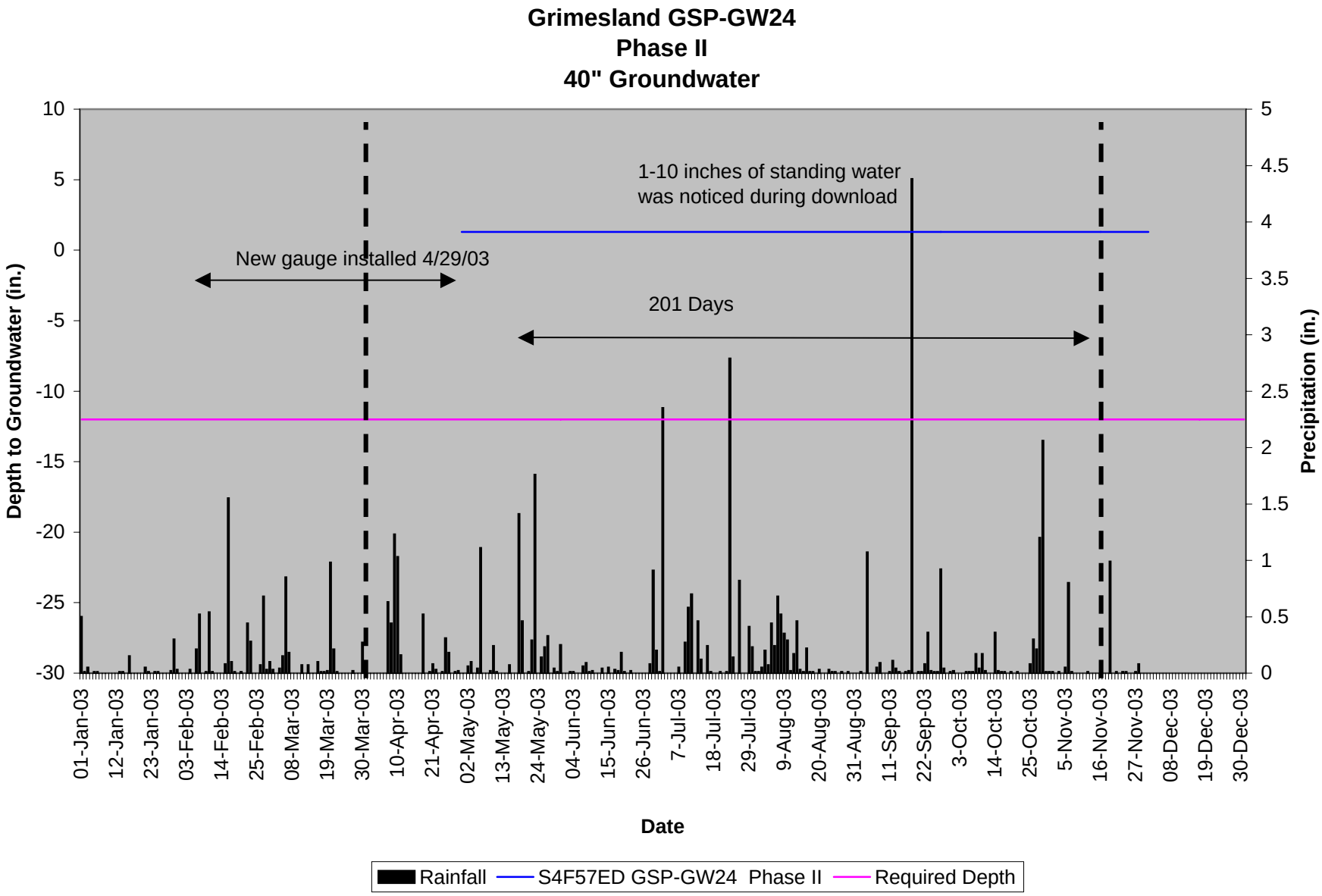
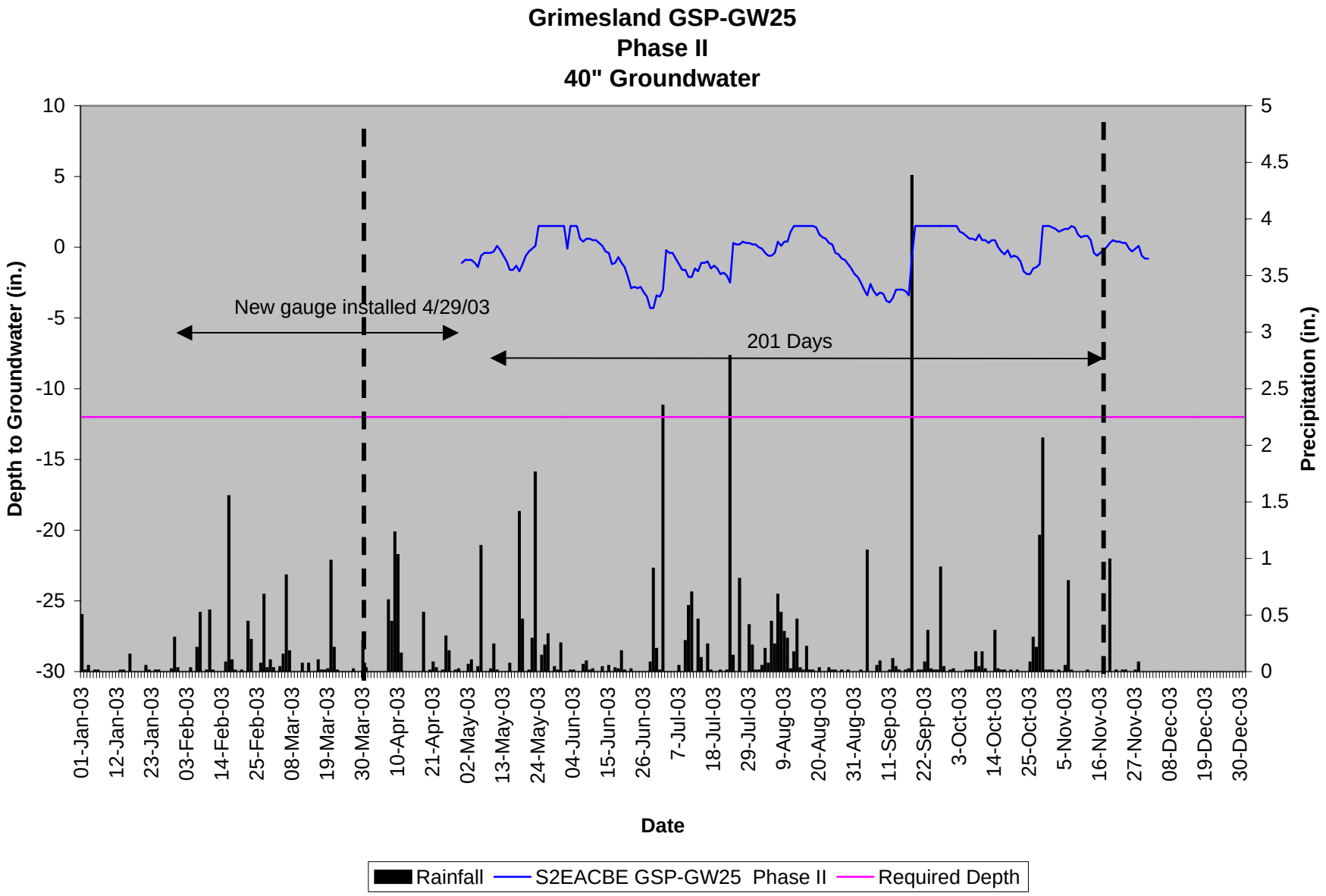
22-Sep-03
3-Oct-03
14-Oct-03
25-Oct-03
5-Nov-03
16-Nov-03
27-Nov-03
08-Dec-03
19-Dec-03
30-Dec-03
Rainfall
S50449D GSP-GW23 Phase II
Required Depth


Grimesland GSP-GW24
Phase II
40" Groundwater
1-10 inches of standing water
was noticed during download
New gauge installed 4/29/03
201 Days
Depth to Groundwater (in.)
Precipitation (in.)
Date
Rainfall
S4F57ED GSP-GW24 Phase II
Required Depth


Grimesland GSP-GW25
Phase II
40" Groundwater
Depth to Groundwater (in.)
Precipitation (in.)
New gauge installed 4/29/03
201 Days
10
5
0
-5
-10
-15
-20
-25
-30
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01-Jan-03
12-Jan-03
23-Jan-03
03-Feb-03
14-Feb-03
25-Feb-03
08-Mar-03
19-Mar-03
30-Mar-03
10-Apr-03
21-Apr-03
02-May-03
13-May-03
24-May-03
04-Jun-03
15-Jun-03
26-Jun-03
7-Jul-03
18-Jul-03
29-Jul-03
9-Aug-03
20-Aug-03
31-Aug-03
11-Sep-03
22-Sep-03
3-Oct-03
14-Oct-03
25-Oct-03
5-Nov-03
16-Nov-03
27-Nov-03
08-Dec-03
19-Dec-03
30-Dec-03
Date
Rainfall
S2EACBE GSP-GW25 Phase II
Required Depth

APPENDIX B

SITE PHOTOS AND PHOTO AND PLOT LOCATIONS MAP

Grimesland Pit – Phase II

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

2003

GRIMESLAND PHASE II PHOTO AND PLOT LOCATIONS