

ANNUAL REPORT FOR 2001



***Mud Creek Mitigation Site
Henderson County
Project No. 8.T842404
TIP No. A-10 WM***



Prepared By:
Natural Systems Unit & Roadside Environmental Unit
North Carolina Department of Transportation
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SUMMARY

The following report summarizes the monitoring activities that occurred in the past year at the Mud Creek mitigation site. Monitoring activities in 2001 represent the fourth year of monitoring after construction in late 1997.

The Mud Creek mitigation site contains ten groundwater-monitoring gauges, one surface water gauge and an Infinity rain gauge. Gauge 4 is located in a wetland area that was enhanced by project implementation. Gauges 5 and 6 are located in the on-site wetland. For the 2001 monitoring period no gauges met the success criteria for wetland hydrology.

The vegetation success criterion was met with an average density of 613 trees per acre. This average is well above the minimum success criteria of 320 trees per acre. The Wetland Enhancement Area was monitored utilizing a 30-foot by 100-foot transect to determine the vegetative success of the target species planted in 1998. This is the fourth year of monitoring vegetation. The Mud Creek Mitigation Plan (March 12, 1997) called for the monitoring period to be three years.

Based on the continued lack of success within the creation portion of the site, NCDOT recommends discontinuing the hydrologic monitoring activities. Based on the success of the vegetation planted in the Wetland Enhancement Area in the fourth year of monitoring (three-year required per the Plan), NCDOT recommends discontinuing monitoring activities. The 4.1 acres of proposed wetland creation failed and will be deducted from the wetland totals of the site and noted in the Debit Ledger through coordination with permitting agencies. NCDOT is in the process of identifying other potential mitigation sites to offset the 3.1-acre deficit.

1.0 INTRODUCTION

1.1 Project Description

The Mud Creek Mitigation Site, in Henderson County, encompasses 39.1 acres. The site is located north of Hendersonville, along SR 1528 (Figure 1). It is designed to mitigate for various projects in the French Broad River Basin. Ideally, the Mud Creek site was to provide the following:

- 4.1 acres of creation,
- 26.9 acres of enhancement, and
- 3.1 acres of preservation

However, due to the continual yearly hydrologic failure of the Mud Creek site, NCDOT has recommended to discontinue monitoring activities. Consequently, NCDOT recommends that the mitigation Mud Creek provide the following mitigation:

- 4.1 acres of upland, and
- 26.9 acres of enhancement, and
- 3.1 acres of preservation

This recommendation is proposed based on the Mud Creek Mitigation Plan dated March 12, 1997. As noted on page 27 of that document,

“Enhancement of the existing wetlands will occur through planting hardwood species as well as removing the invasive shrub, Chinese Privet. Chinese Privet is an introduced species which can out-compete native species. The removal of privet will allow the colonization of native plant species on the site, which would improve wildlife habitat. The planting of hardwood species would also improve wildlife habitat in this area.”

The success criterion for the enhancement portion of the site was based on grading, clearing an invasive plant, and planting hardwood species. This was done and the planted area was monitored as noted in Section 3.0 of this report.

1.2 Purpose

The Mud Creek Mitigation Site is monitored for both hydrology and vegetation. The 2001 growing season marks the fourth year of monitoring for the site. The following report describes the results of both hydrologic and vegetative monitoring for 2001.

1.3 Project History

November 1997	Grading Construction
February-March 1998	Tree Planting
March 1998	Monitoring Gages Installed
April- October 1998	Hydrologic Monitoring (1 yr)
September 1998	Vegetation Monitoring (1 yr)
April- October 1999	Hydrologic Monitoring (2 yr)
August 1999	Vegetation Monitoring (2 yr)
April – October 2000	Hydrologic Monitoring (3 yr)
September 2000	Vegetation Monitoring (3 yr.)
April – October 2001	Hydrologic Monitoring (4 yr.)
July 2001	Vegetation Monitoring (4 yr.)

1.4 Debit Ledger

Mud Creek	Mit. Plan	Ratios	TIP DEBIT
Henderson Co. Habitat	Acres at Start:	Acres Remaining	R-2116B
BLH Creation	4.1	3.1	75.61
BLH Enhancement	26.9	16.5	61.34
Wet Meadow Preservation	3.1	3.1	100.00
TOTAL	34.1	22.7	66.57

Note: US Army Corps of Engineers Action ID Numbers: 199505135, 199505735, 199301755
 Division of Water Quality Certification Numbers: 3078, 2671. The debit ledger will be adjusted through coordination with permitting agencies.

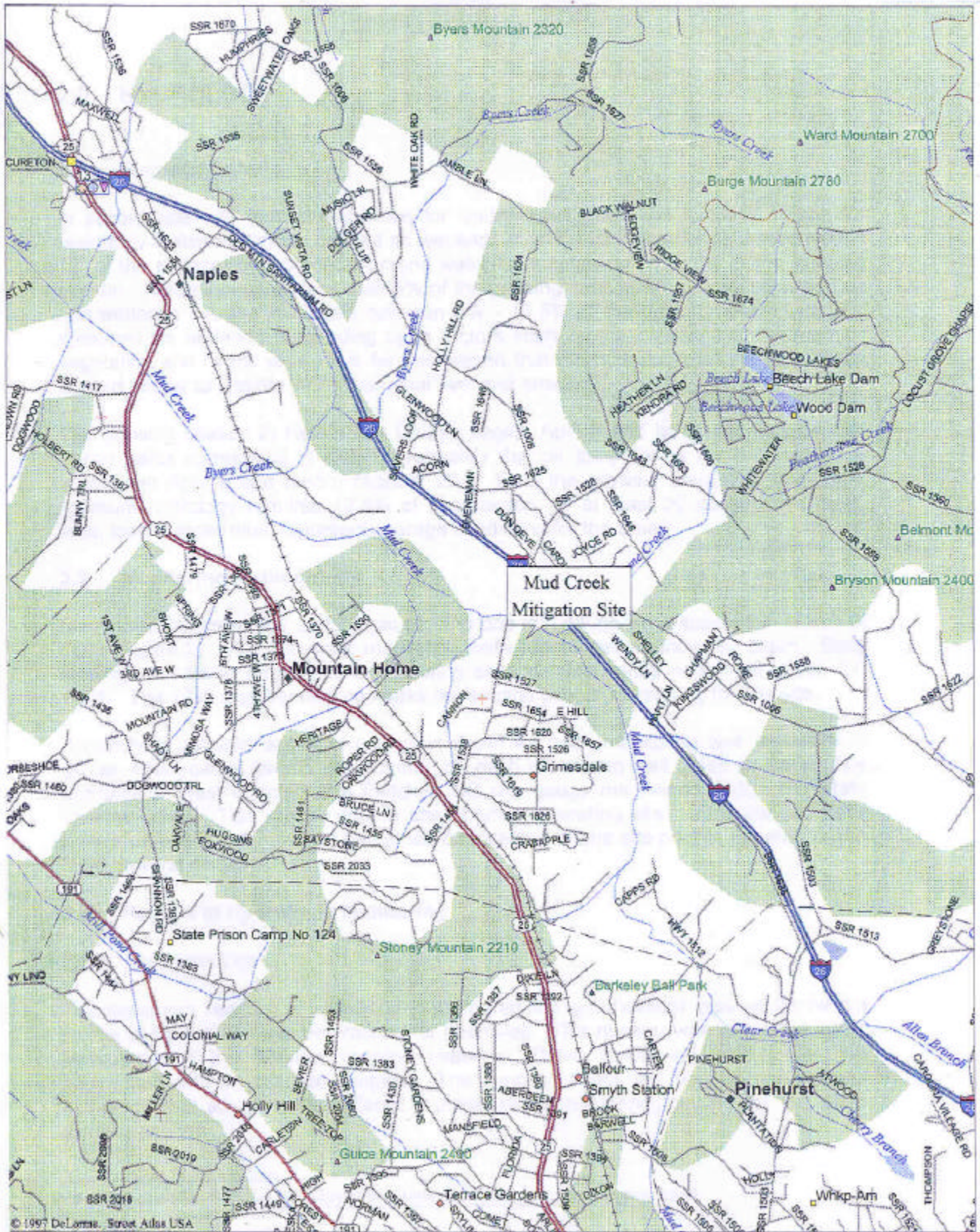


Figure 1 - Site Location Map

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that areas defined as wetlands must be inundated or saturated (within 12" of the surface) by surface or ground water for 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% and 12.5% of the growing season can be classified as wetlands, depending upon factors such as the presence of hydrophytic vegetation and hydric soils. It is for this reason that the hydrologic results have been divided further to identify these "marginal" wetland areas.

The growing season in Henderson County begins April 9 and lasts until October 29. These dates correspond to a 50% probability that air temperature will drop to 28° F or lower after April 9 and before October 29.¹ Thus the growing season is 204 days; optimum hydrology requires 12.5% of this season, or at least 26 consecutive days. Eight percent of the growing season corresponds to at least 16 consecutive days and 5% corresponds to at least 10 consecutive days. Also, local climate must represent average conditions for the area.

2.2 Monitoring Methodology

Six monitoring gauges, one surface gauge, and one rain gauge were installed in March of 1998 and an additional four monitoring gauges and an Infinity rain gauge were installed in April 2000 (Figure 2). The automatic monitoring gauges and rain gauge record depth to groundwater and rainfall, respectively. Daily readings are taken throughout the growing season. Monitoring began on March 27, 1998. The 2001 growing season marks the fourth year of monitoring for this site.

Appendix A contains a plot of the water depth for each monitoring gauge and surface gauge. Precipitation events are included on each monitoring gauge graph as bars.

2.3 Results of Hydrologic Monitoring

2.3.1 Site Hydrology

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each well. This number was converted into a percentage of the 204-day growing season. These monitoring gauge results are segmented into percentage ranges. The ranges reflect the

¹ Soil Conservation Service, Soil Survey of Henderson County, North Carolina, 1980.

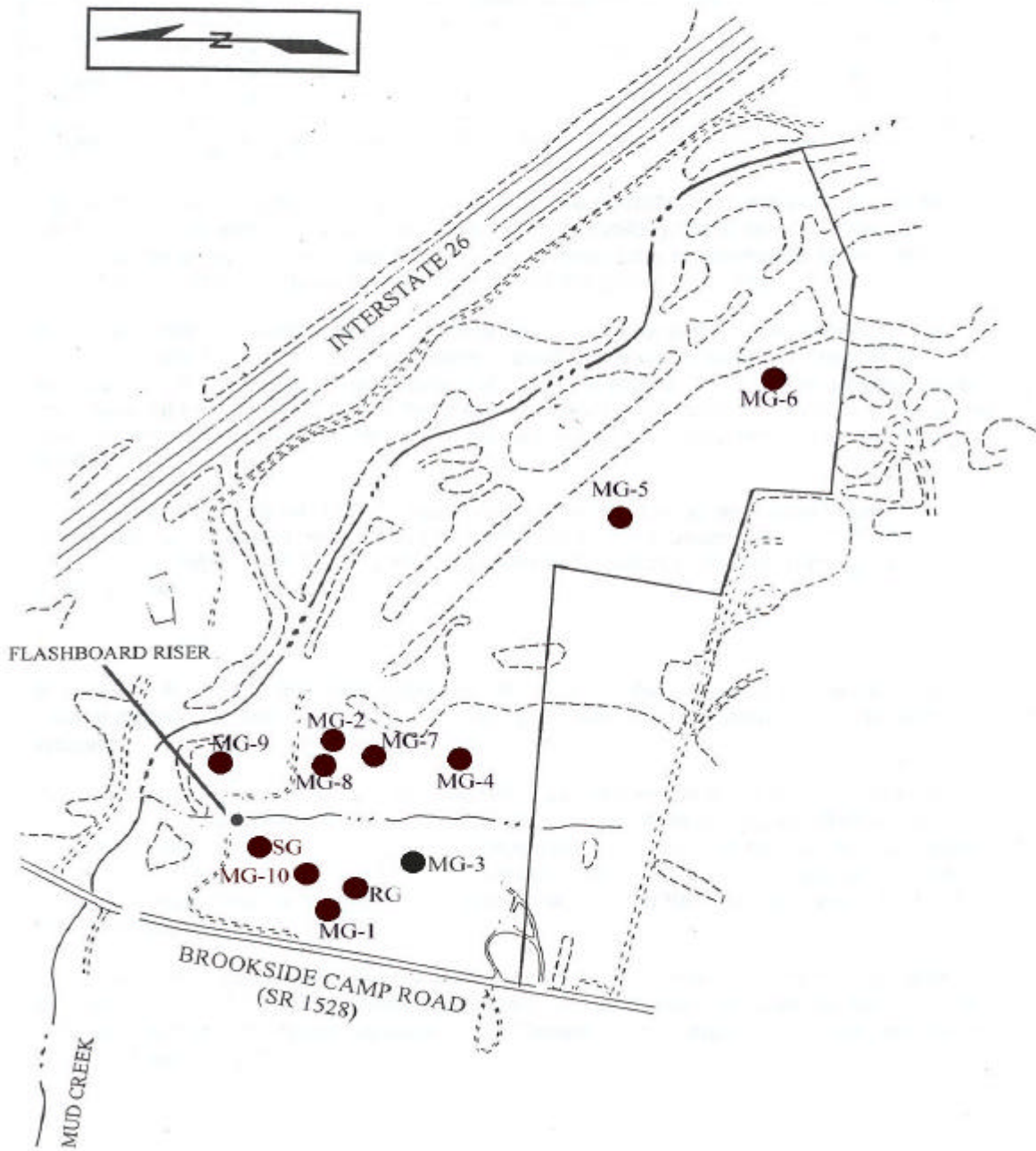


Figure 2
Monitoring Gauge
Location Map

degrees of wetland hydrology that are possible. Table 1 presents the monitoring results for the 2001-growing season.

Table 1
HYDROLOGIC MONITORING RESULTS

Monitoring Well	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %
MG-1	✓				0
MG-2	✓				0
MG-3	✓				0.98
MG-4	✓				1.4
MG-5 (RG)	✓				3.9
MG-6 (RG)	✓				0
MG-7	✓				0.98
MG-8	✓				0
MG-9	✓				0.49
MG-10	✓				4.9

(RG) indicates a reference gauge.

Figure 3 provides a graphical representation of the hydrologic monitoring results for 2001. Gauges labeled in blue represent optimum hydrology for at least a consecutive 12.5% of the season. Gauges labeled in green recorded the groundwater level within twelve inches of the surface between 5 and 8% of the growing season. Gauges labeled in black recorded the groundwater level within twelve inches of the surface for less than 5% of the growing season. Based on the performance of the 2001 monitoring period, all gauges have been coded black.

During the 2001 growing season, groundwater was never within twelve inches of the surface at MG-1, MG-2, MG-6, and MG-8. For the remaining gauges, groundwater levels were within twelve inches of the surface less than 5% of the growing season, a decline in performance over the monitoring period for 2000: MG-3 (two days), MG-4 (three days), MG-5 (six days) MG-7 (two days), MG-9 (one day), and MG-10 (ten days) for monitoring year 2001.

Also of note is that MG-4, MG-5, and MG-6 is located in an area, which was delineated as a wetland and confirmed by the USACE on December 6, 1995. In addition, data for MG-9 was not available from the beginning of September to the end of the growing season.

2.3.2 Climatic Data

In order for the hydrologic data to be considered valid, the area must have experienced normal climatic conditions during the growing season. Precipitation is one climatic indicator.

Figure 4 is a comparison of the 2001 monthly rainfall with the historical rainfall for the area. The lines represent the 30th and 70th percentiles of monthly precipitation for Hendersonville, North Carolina. These percentiles are based on rainfall data collected

between 1966 and 1996 from a National Climatic Data Center official gauge and serve as the historical data for the area. The percentiles create the “normal range” for rainfall for the vicinity.

The bars on the graph represent the total monthly rainfall from January through November of 2001. The 2001 rain data was provided by the on-site Infinity rain gauge. The historic rainfall data was obtained from the North Carolina State Climatic Office (NCSCO) in Hendersonville, North Carolina.

Data for Henderson County shows that the area experienced normal rainfall during the months of March, May, June, August, and September. Henderson County was drier than average during January, February, April, and October. July was moderately above average. November and December data was not included since the end of the growing season is October 29th.

Mud Creek 30 - 70 Percentile Graph Hendersonville, NC

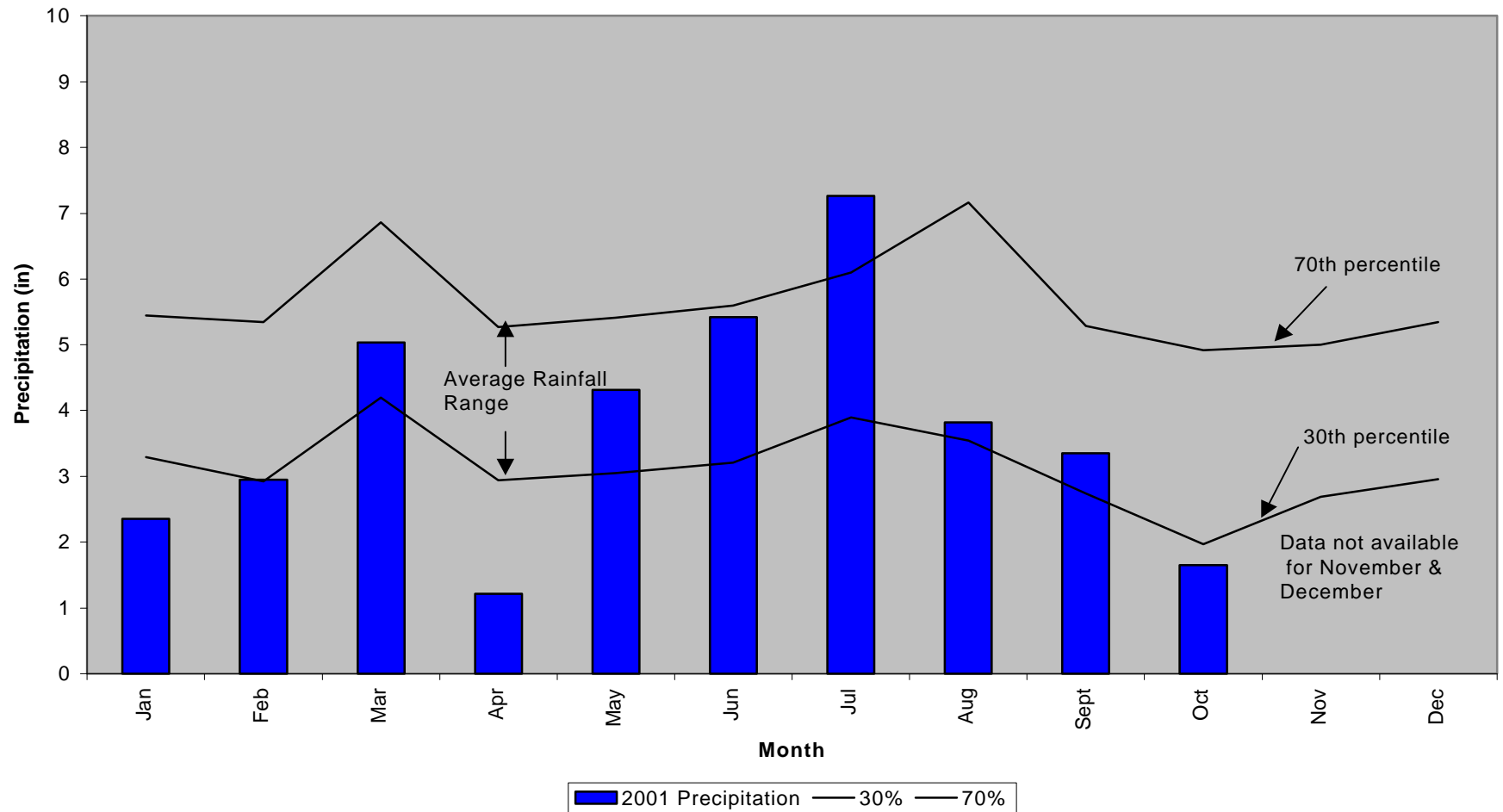


FIGURE 3

2.4 Conclusions

For the 2001 monitoring period no gauges indicated wetland hydrology. MG-10 displayed the overall highest reading of ten days, yet was still below 5%. Of the remaining nine gauges MG-1, MG-2, MG-3, MG-7 and MG-8 are located in areas of constructed wetland. MG-4 is located in an existing wetland that has been impacted. MG-5 and MG-6 are located in an existing wetland that has not been impacted. MG-9 is located in one of the lower portions of the site.

The Mud Creek site has consistently failed to meet the hydrological success criteria. Over the most recent four monitoring periods, there has been the opportunity for 32 gauges to meet success criteria for hydrology. There were five gauges that met the success criteria during this time; MG-6 in 1998, 1999, and 2000 and MG-5 in 1998 and 2000. Climatic rainfall data during these times have been in the dry to normal range. The rainfall that falls into the drainage area for the site is held back from entering into the site by an upstream impoundment located off-site. Then NCDOT recommends halting further hydrologic monitoring activities. The creation portion of the site (4.1 acres of bottomland hardwood) has never met the hydrological success criteria. The Debit Ledger will be changed to note the 4.1 as upland.

3.0 VEGETATION: MUD 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 after three years.

3.2 Description of Species

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

Betula nigra, River Birch

Fraxinus pennsylvanica, Green Ash

Nyssa sylvatica, Blackgum

Quercus phellos, Willow Oak

Diospyros virginiana, Persimmon

Juglans nigra, Black Walnut

Prunus serotina, Black Cherry

3.3 Results of Vegetation Monitoring (4 year)

TABLE 2 – VEGETATIVE MONITORING RESULTS

Plot # (Type)	Green Ash	Blackgum	River Birch	Willow Oak	Persimmon	Black Walnut	Total (4 year)	Total (at planting)	Density (Tree/Acre)
1(BLH)	11	4	8	14	7	6	50	50	680
2(BLH)	12		12		5	3	32	35	622
3(BLH)	13		5	4	6		28	28	680
4(BLH)	10	2	6	6	5		29	30	657
5(BLH)	11	4	10	4			29	29	680
6(BLH)	16			10	2		28	37	515
7(BLH)	3		10	8	16		37	41	614
8(BLH)	7	3	4	3	4	1	22	33	453
AVERAGE DENSITY									613

Site Notes: Other species noted: goldenrod, Queen-Anne's-lace, clover, black willow, *Juncus* sp., sycamore, silver maple, dogwood, and multiflora rose.

Transect: A 100' x 30' (0.07 acre) transect was installed within the Wetland Enhancement Area during the July 2001 monitoring visit. GPS coordinates for this transect could not be obtained due to the dense tree canopy cover. The approximate location of the transect is shown on the attached map. The following species were located and identified within this transect: 25 Green Ash, 5 Tulip Poplar, 5 Blackgum, 10 River Birch, and 5 Willow Oak.

3.4 Conclusions

Of the 39.1 acres on this site, approximately 9.4 acres involved tree planting. There were 8 vegetation-monitoring plots established throughout the planting areas and one transect established within the enhancement area. The 2001 vegetation monitoring of the site revealed an average tree density of 613 trees per acre. This average is well above the minimum success criteria of 320 trees per acre. All plots met the success criteria. NCDOT recommends no further monitoring of the vegetation. The vegetation on the site including the Wetland Enhancement Area has met the success criteria. The enhancement portion of the wetland is supporting hydrophytic vegetation.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

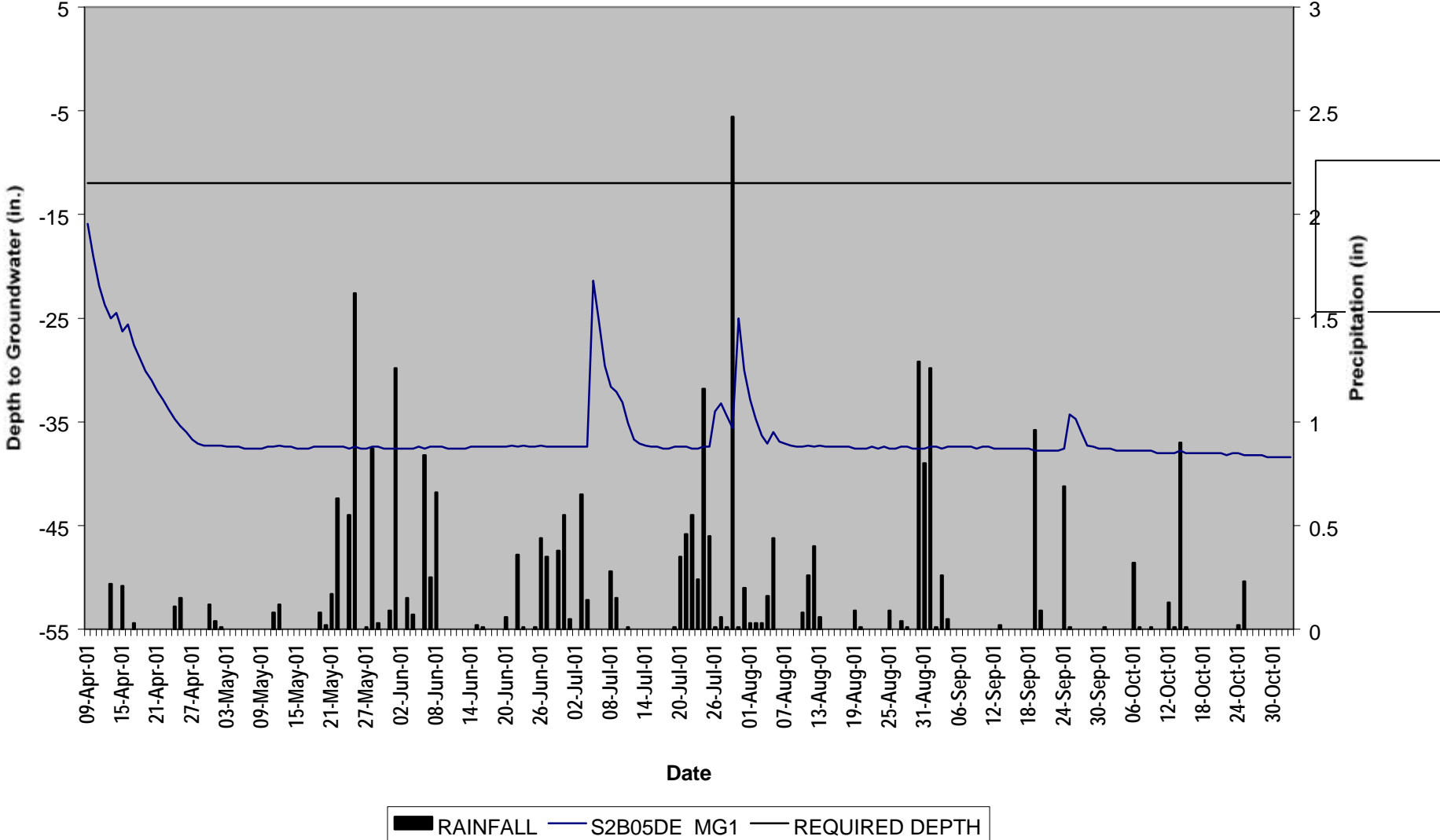
From a vegetative standpoint, Mud Creek appears to be very successful. From a hydrological standpoint, Mud Creek will never meet the success criteria other than during a higher than average rainfall year. However, yearly rainfall must remain in the “normal” range to meet hydrologic success. The upstream impoundment limits the amount of surface water runoff into the site. Over the last four years, the two gauges in the reference wetland met the success criteria five times.

The created wetland portion of the site will never meet the hydrologic success criteria as proposed in the Mud Creek Monitoring Plan. The Wetland Enhancement Area of the site has met the success criteria for enhancement as proposed in the Mud Creek Mitigation plan.

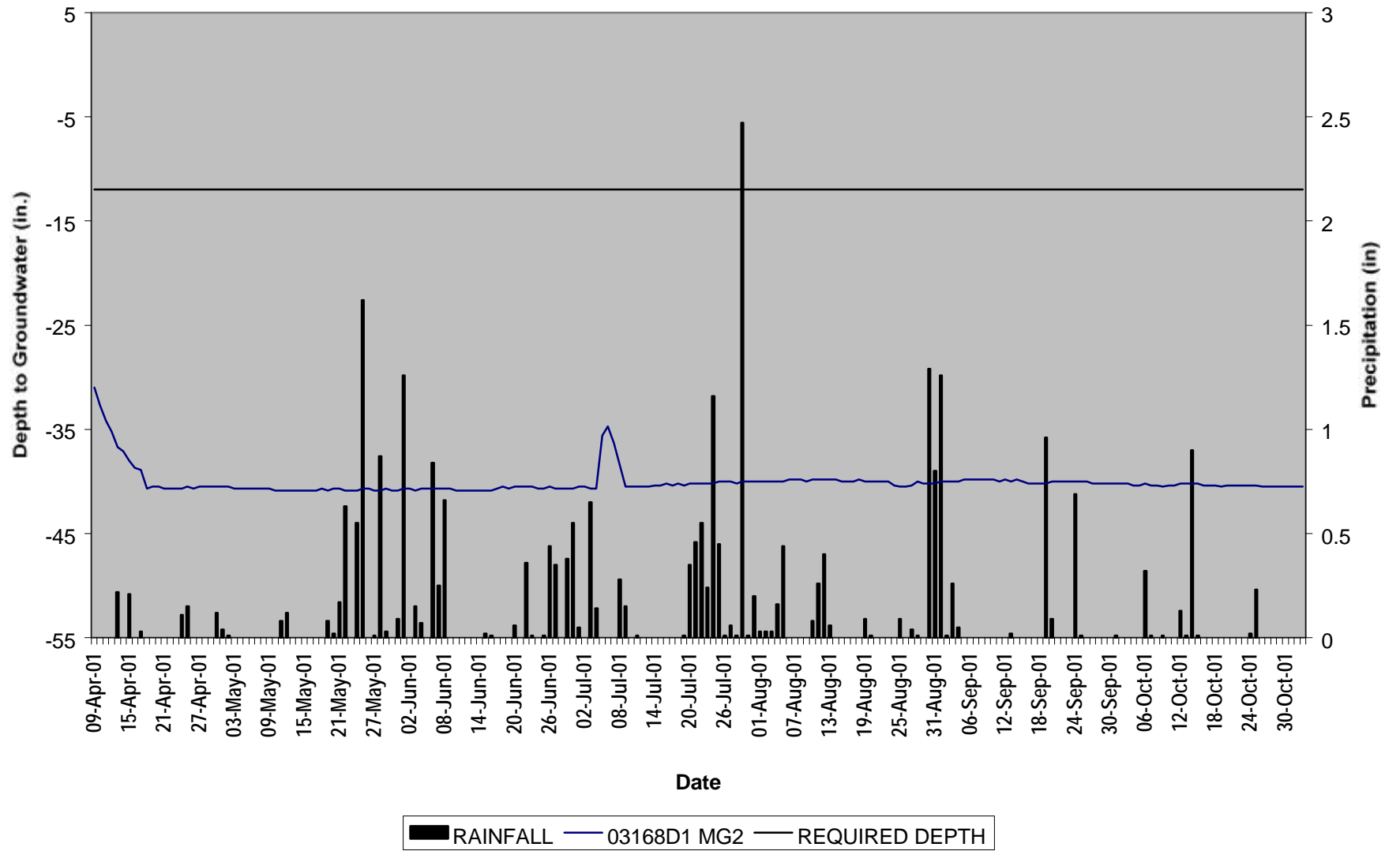
The Debit Ledger will be adjusted through coordination with the permitting agencies. One acre of wetland creation has been deducted from the ledger for project R-2116B. NCDOT has an ongoing search for mitigation in the French Broad basin for upcoming projects. NCDOT recommends closing the site since the created wetland portion of the site will not meet the hydrologic success criteria and the enhanced wetland portion of the site has exceeded the success criteria for four years. There are no viable remediation options available. NCDOT will discuss this recommendation with the regulatory agencies at the annual monitoring review meeting.

APPENDIX A
DEPTH TO GROUNDWATER PLOTS

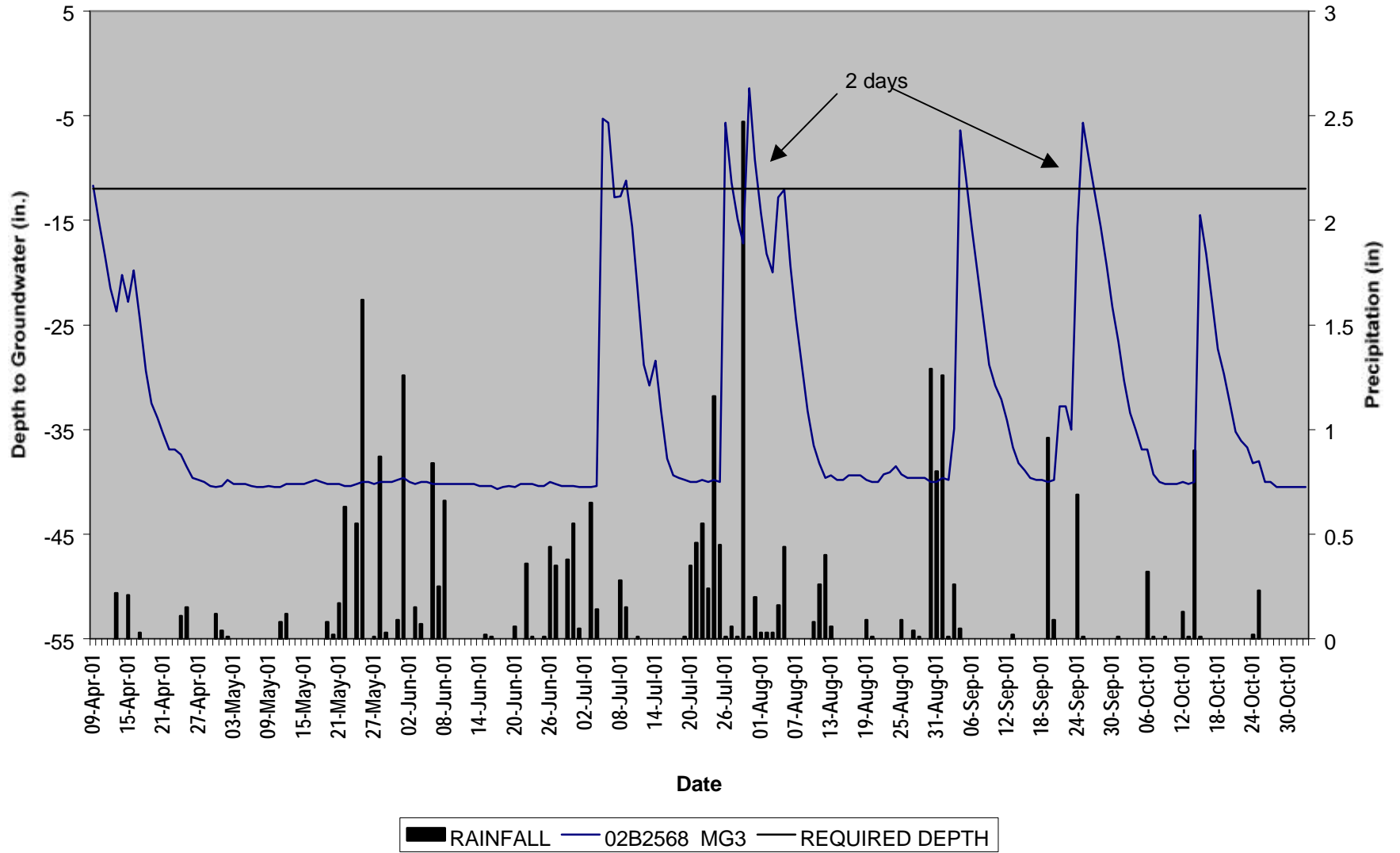
2001 Mud Creek MG1



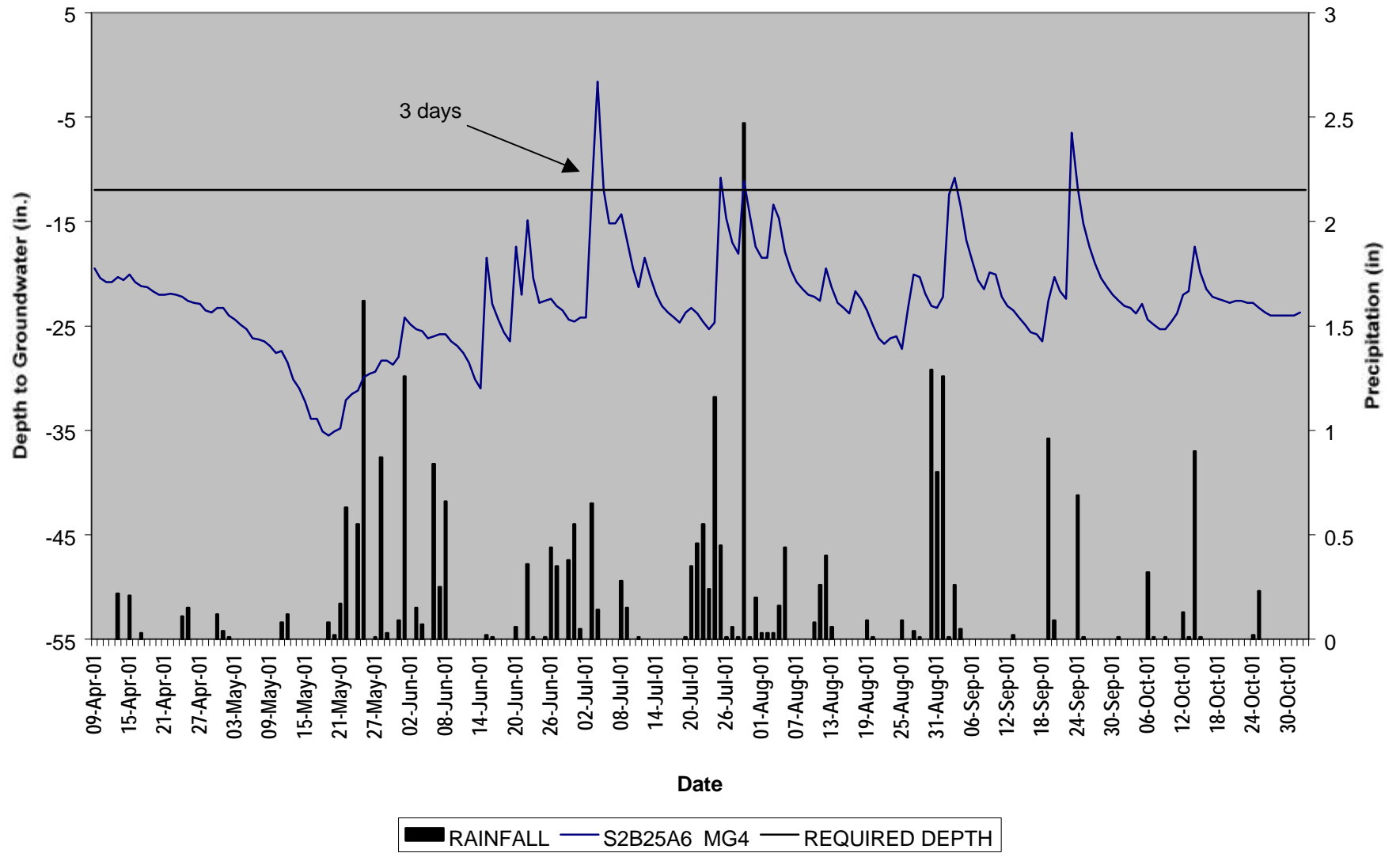
2001 Mud Creek MG-2



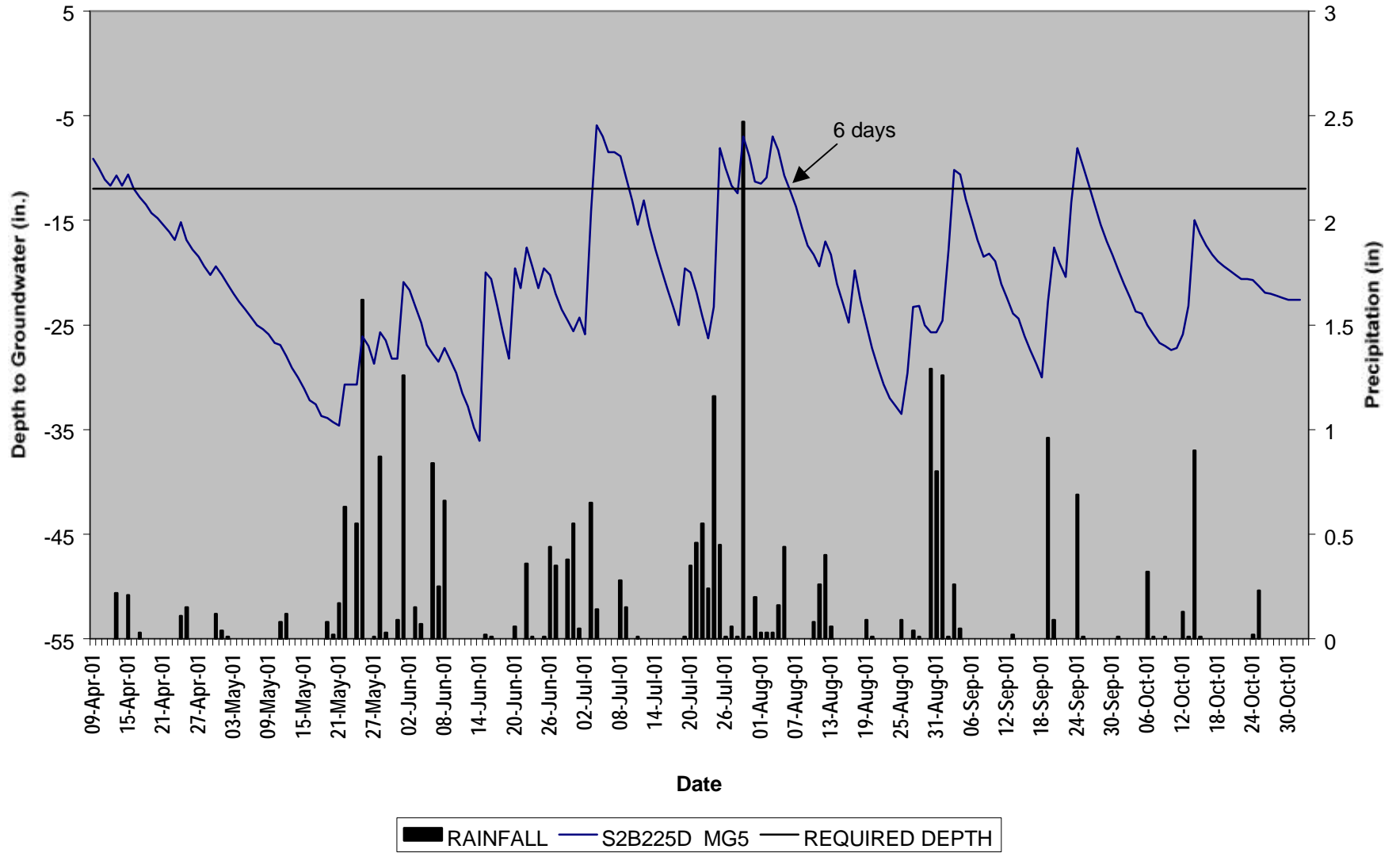
2001 Mud Creek MG-3



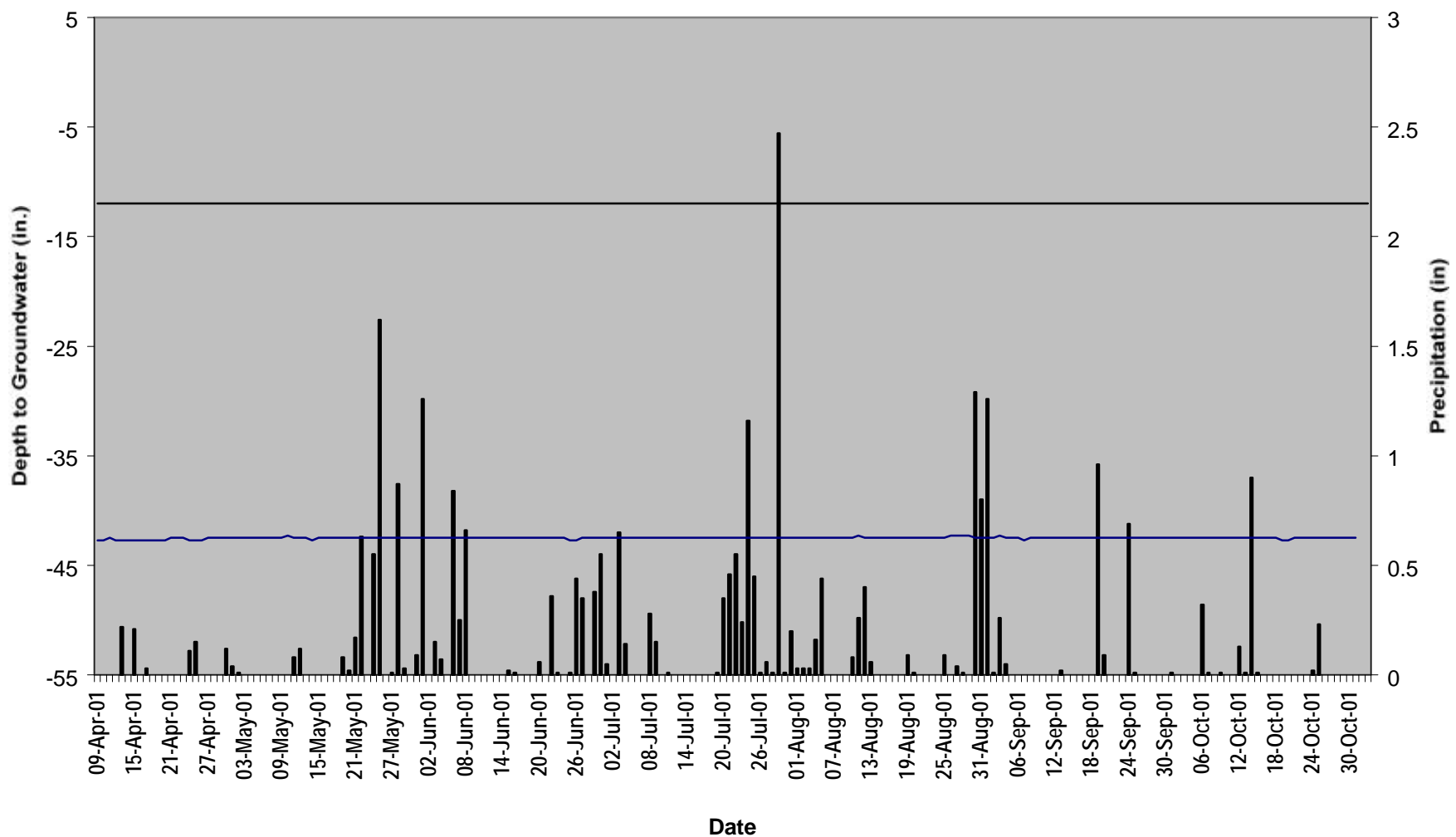
2001 Mud Creek MG-4



2001 Mud Creek MG-5

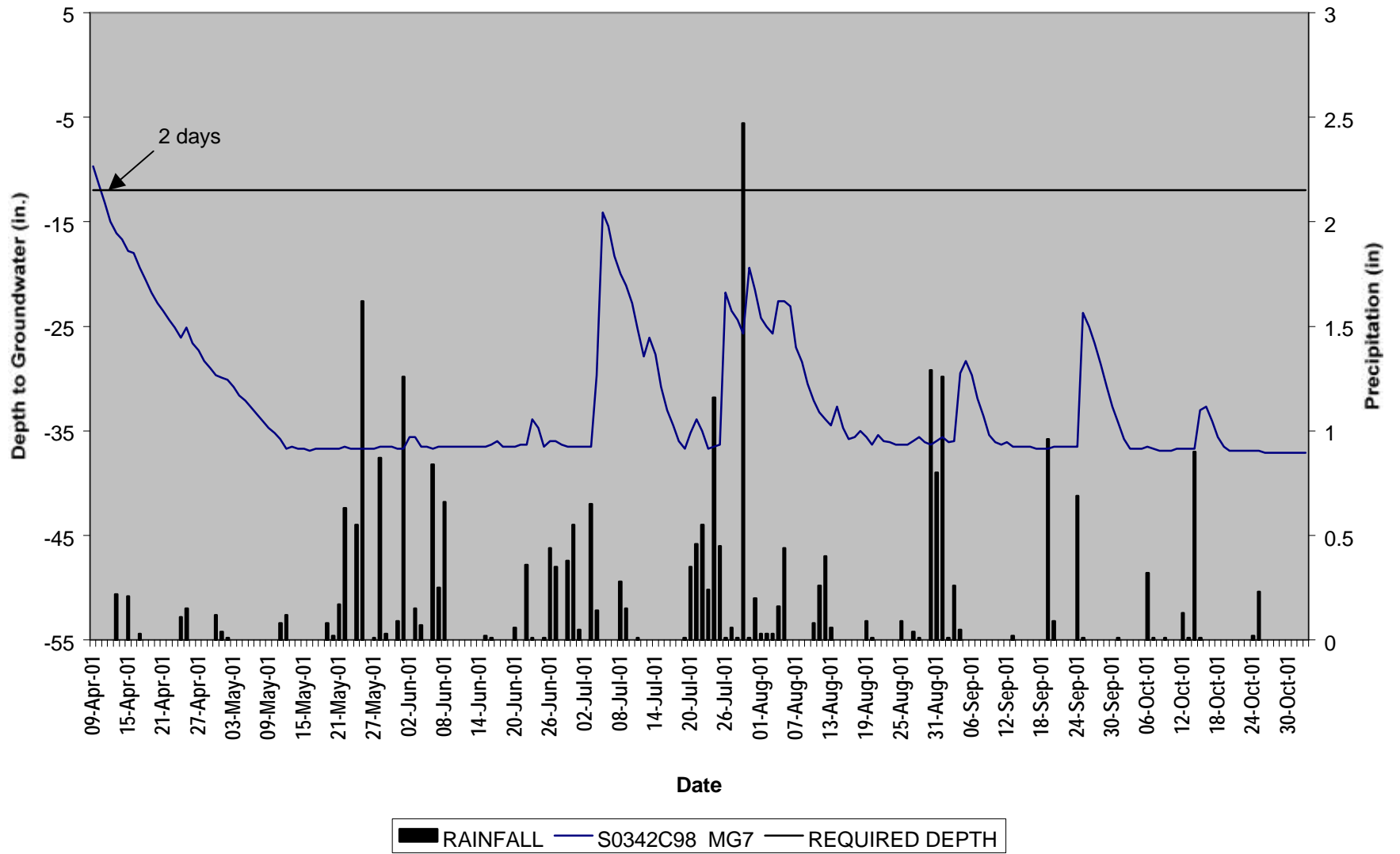


2001 Mud Creek MG-6

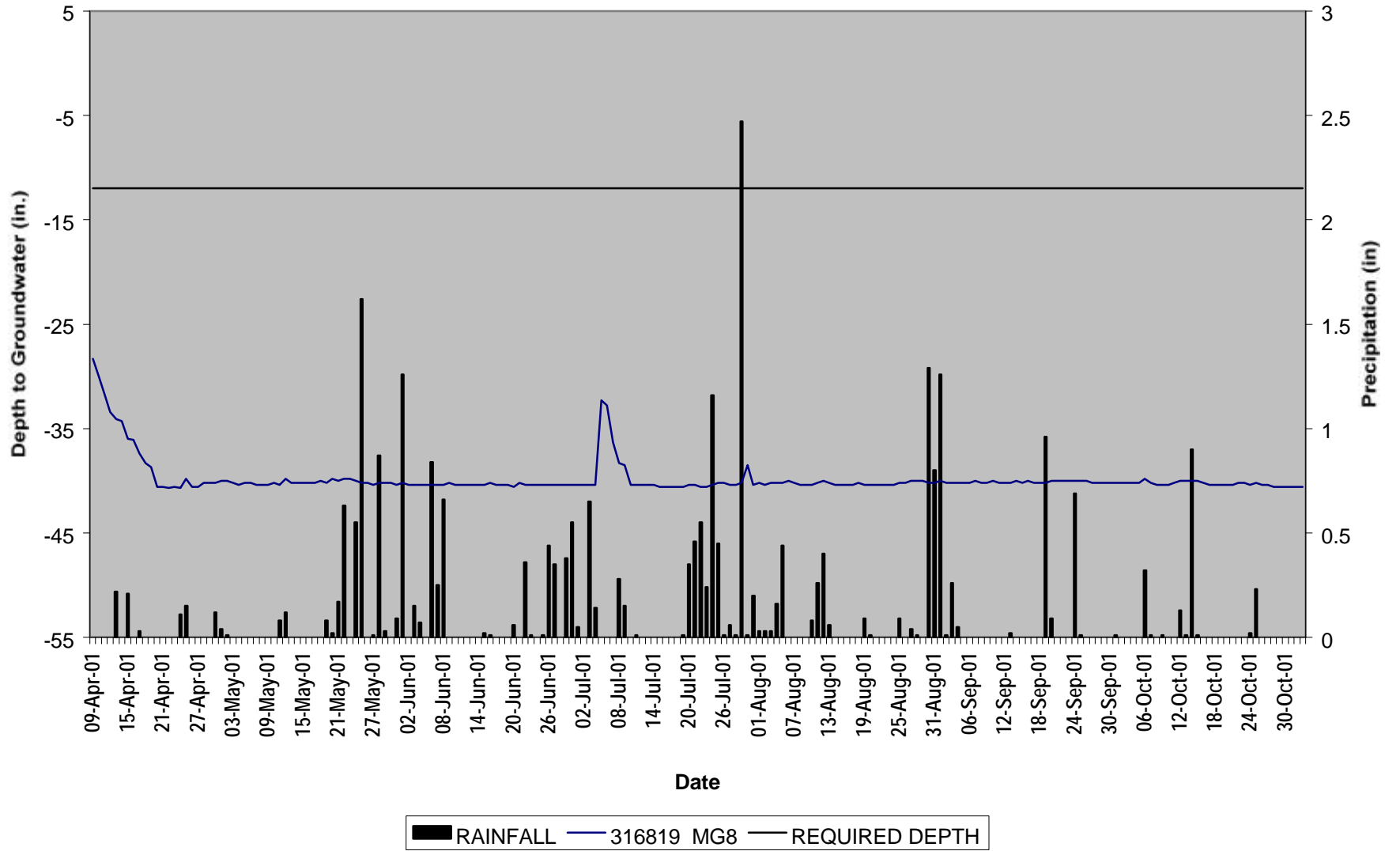


RAINFALL
 S213EAD MG6
 REQUIRED DEPTH

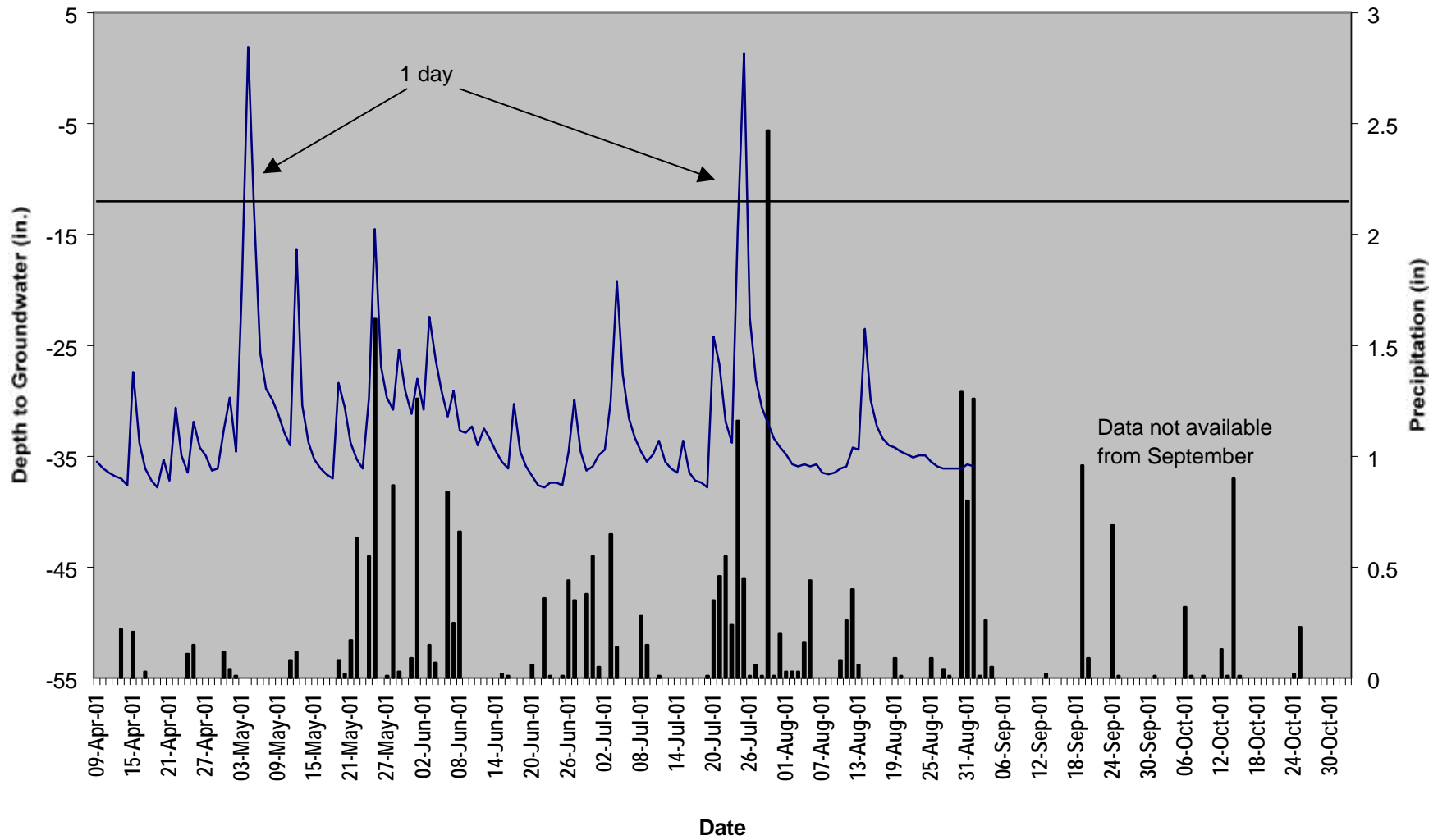
2001 Mud Creek MG-7



2001 Mud Creek MG-8

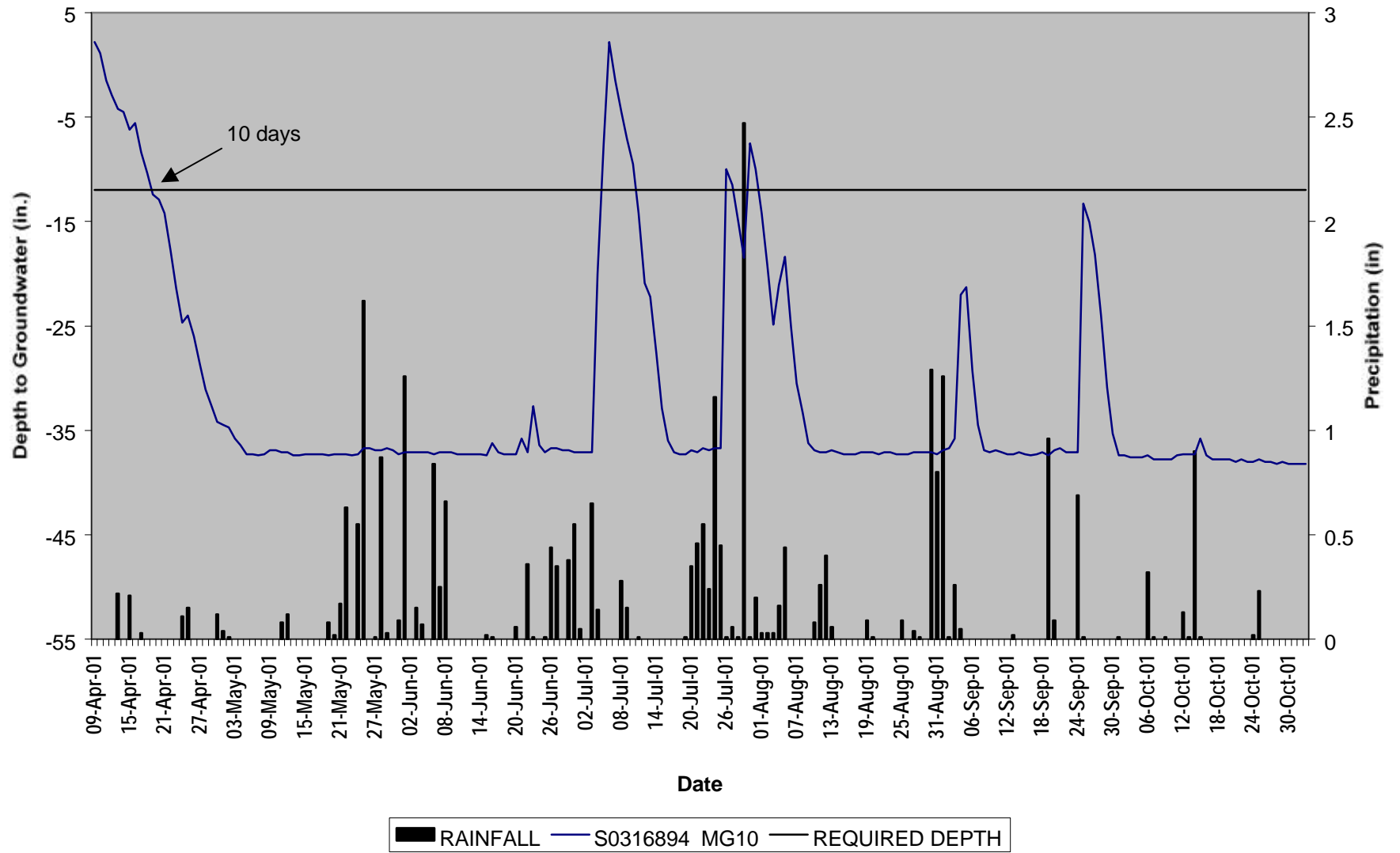


2001 Mud Creek MG-9

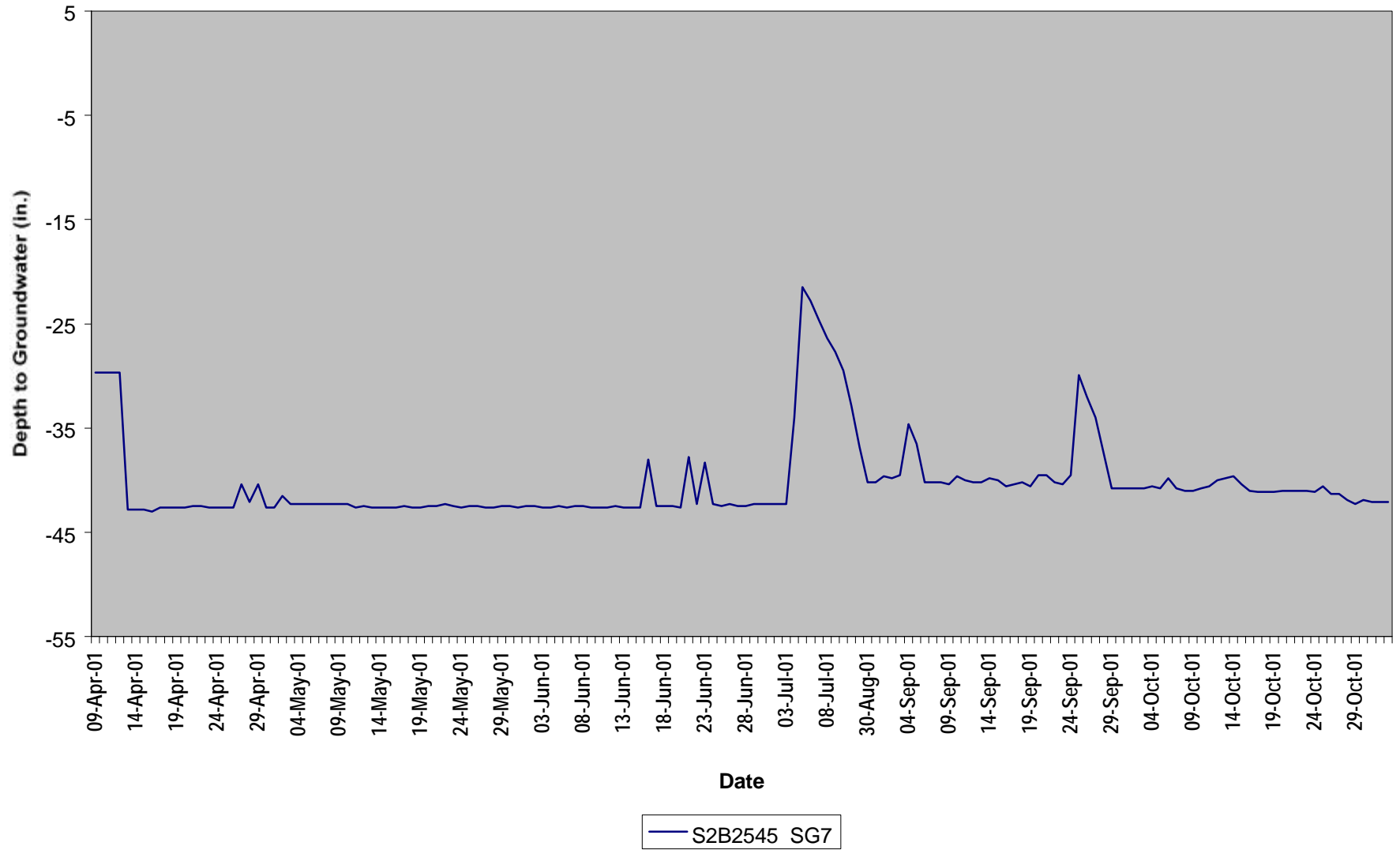


■ RAINFALL — S0342C96 MG9 — REQUIRED DEPTH

2001 Mud Creek MG-10



2001 Mud Creek Surface Gauge SG-7



APPENDIX B

SITE PHOTOS & VEGETATION PLOT LOCATION MAP



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6 (Transect)

