ANNUAL REPORT FOR 2001

Haws Run Mitigation Site

Pender and Onslow County

Project No. 6.259002T

TIP No. R-2405WM

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North Carolina Department of Transportation
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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at Haws Run Mitigation Site. This site was constructed in 1998 and planted in early 1999. This is the third year of monitoring after site construction. The site must demonstrate both hydrologic and vegetation success for a minimum of three years.

Restoration activities at Haws Run included swamp forest and pine savanna restoration, enhancement, and preservation components. The site is equipped with 25 groundwater-monitoring gauges, 2 surface gauges, and one rain gauge. The on-site rain gauge was installed in July 2001; therefore local climate office data is used along with the on-site data to provide complete data for the entire growing season.

Hydrologic monitoring results are presented by three methods: jurisdictional wetland criteria, average depth to groundwater, and duration of soil saturation.

Based on jurisdictional wetland criteria, the Haws Run mitigation site met hydrologic success for the year 2001. In the swamp forest area, all gauges met or exceeded the 12.5% jurisdictional wetland criteria. In the pine savanna area, all gauges recorded hydroperiods 8% or greater of the growing season, which is an improvement over the 2000 results.

Hydrologic patterns of flooding in the restoration areas across Haws Run Mitigation site followed patterns in the reference areas. The duration of saturation between the restoration gauges and the reference gauges were also very comparable for the swamp and savanna areas. Results at the haul road area were variable between the reference and restoration areas and within each area.

Vegetation monitoring consists of three 500 feet X 500 feet sample plots in the savanna areas, and seven 50 feet X 50 feet sample plots within the bottomland hardwood area. Vegetation success criteria were met for 2001, with 31 trees per acre in the savanna area and 459 trees per acre in the swamp forest area. Pond cypress was planted in the savanna area Spring 2000.

The eroded areas on the northern slope were repaired as described in the attached plan. The revised debit map and debit ledger are included.

The adjacent land owned by The Nature Conservancy is being pursued for wetland mitigation, potentially providing both hydrologic and habitat benefits.

NCDOT will continue to monitor the hydrology and vegetation on the Haws Run Mitigation site to demonstrate successful achievement of the mitigation plan.

1.0 INTRODUCTION

1.1 Project Description

The Haws Run Mitigation Site was purchased in 1995 by the North Carolina Department of Transportation (NCDOT) to provide compensatory mitigation for unavoidable impacts to wetlands resulting from highway construction in the region. The site is located approximately 28 miles northeast of Wilmington, North Carolina, straddling the Pender-Onslow County line. The site consists of riverine swamp forests at the northern and southern ends and a cutover interior of former wet flats and savannas with an extensive ditch and canal system. The central canal and lateral ditches north of the electrical transmission line were plugged in December 1997 for a short –term study to determine effects of ditch-plugging and filling.

Full site construction began in Summer 1998 with excavation of the northern end of the site to the reference swamp elevation and plugging/filling of the central canal and lateral field ditches to the north of the powerline crossing. Construction was completed in February 1999 and the site was planted in the early spring 1999.

Final planting of pond cypress in the savanna area occurred in the Spring of 2000. This planting was delayed due to difficulty in obtaining needed quantities of this particular specie.

After the hurricane season in 1999, the northern slope between the swamp forest and savanna was eroded in several locations. Roadside Environmental Unit in cooperation with the Natural Systems Unit, Division Construction personnel, and the United States Army Corps of Engineers developed a slope remediation plan, dated June 8 2000. Eleven eroded areas were backfilled and stabilized with stone lined swales. Two areas were stabilized with seeding and matting. A low berm was constructed to direct overland flow into the stabilized swales. This slope constitutes the transition zone between the swamp restoration area and the savanna restoration area. This location of the flumes and the slope area are depicted in the Slope Repair Plan in Appendix D. No wetland mitigation credit is expected from this zone. A revised debit map and ledger is included with this report.

The adjacent land owned by The Nature Conservancy is being evaluated for potential wetland mitigation. The site consists of approximately 720 acres, including clear cuts, natural forests, and pine plantations. Several ditches, including the canal along the eastern boundary of Haws Run drain the site. Currently the site is being monitored with RDS gauges to determine existing hydrologic and ditch effects.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Development of the success criteria is discussed in the Haws Run Mitigation Plan. The following report documents the results of the hydrologic and vegetative monitoring activities in the year 2001 at the Haws Run mitigation site.

1.3 Project History

Winter 1997	Pilot Study
Sum 1998 – Winter 1999	Site Construction
Spring 1999	Site Planted (entire site, except pond cypress)
October 1999	Vegetation Monitoring (1 yr.)
March – November 1999	Hydrologic Monitoring
March 2000	Pond Cypress Planting Completed
August - October 2000	Slope Repair
October 2000	Vegetation Monitoring (Restart - 1 yr.)
March – November 2000	Hydrologic Monitoring
October 2001	Vegetation Monitoring (2 yr.)
March – November 2001	Hydrologic Monitoring

Figure 1: Vicinity Map

2.0 HYDROLOGY

2.1 Success Criteria

The Haws Run Mitigation Plan, and the Final Responses to Agency Comments, describe the success criteria for hydrology for the site. The success criteria for the swamp restoration area are based on the hydrologic regime of Sandy Run Swamp reference area. Specifically, the mean depth to groundwater for wells in the swamp restoration area should be at, above, or no more than 25% deeper than the mean depth to groundwater for wells in the reference area.

The success criteria for the pine savanna restoration area were initially tied to the Lanier Quarry Savanna reference site. Subsequent to review by NCDOT and USACE, Lanier Quarry savanna was deemed unsuitable as a reference site. Therefore, the success criteria for Haws Run savanna restoration area reverted to federal guidelines for wetlands as described in the 1987 USACE Wetlands Delineation Manual. These guidelines state that the area 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% - 12.5% of the growing season can be classified as wetlands depending upon factors such as the presence of hydrophytic vegetation and hydric soils.

Success criteria for the area isolated by the forestry haul road was based on reestablishing the hydrologic connection of the area to the southern swamp. The flooding regime and groundwater depths should be similar in each area or show recover of these processes after removal of the haul road.

This document uses three methods to report the hydrologic monitoring results for Haws Run mitigation site: jurisdictional wetland criteria, average depth to groundwater, and duration of soil saturation.

The growing season for Haws Run site was calculated as an average of data from Pender County, Onslow County, and the U.S. Weather Bureau publication, *Low Temperature Probabilities in North Carolina.* Using all three data sets, the average growing season for the Haws Run site was estimated to be 237 days in length, lasting from March 23 to November 15. Therefore, for Haws Run to meet the 12.5% jurisdictional wetland hydrology, the water table must not fall below the 12-inch line for at least 30 consecutive days during the growing season under normal precipitation. This hydroperiod is expected in the swamp forest restoration area. The pine savanna restoration area is expected to support jurisdictional wetland hydrology for 8% to 12.5% of the growing season. This translates into a hydroperiod of 19 to 30 consecutive days during the growing season along with the presence of hydrophytic vegetation and hydric soils.

2.2 Hydrologic Description

After site construction, nineteen groundwater monitoring gauges (RDS WL-40) were installed on the site (Figure 2). Two additional gauges, HR-20 and HR-21, were installed in early Spring 2000. HR-15 was reported in the 1999 Monitoring report as located in the delineated wetland in the pine savanna reference area. Using GPS, the location of HR-15 fell in the pine savanna restoration area. This revised location is reported below along with all the gauges located at Haws Run.

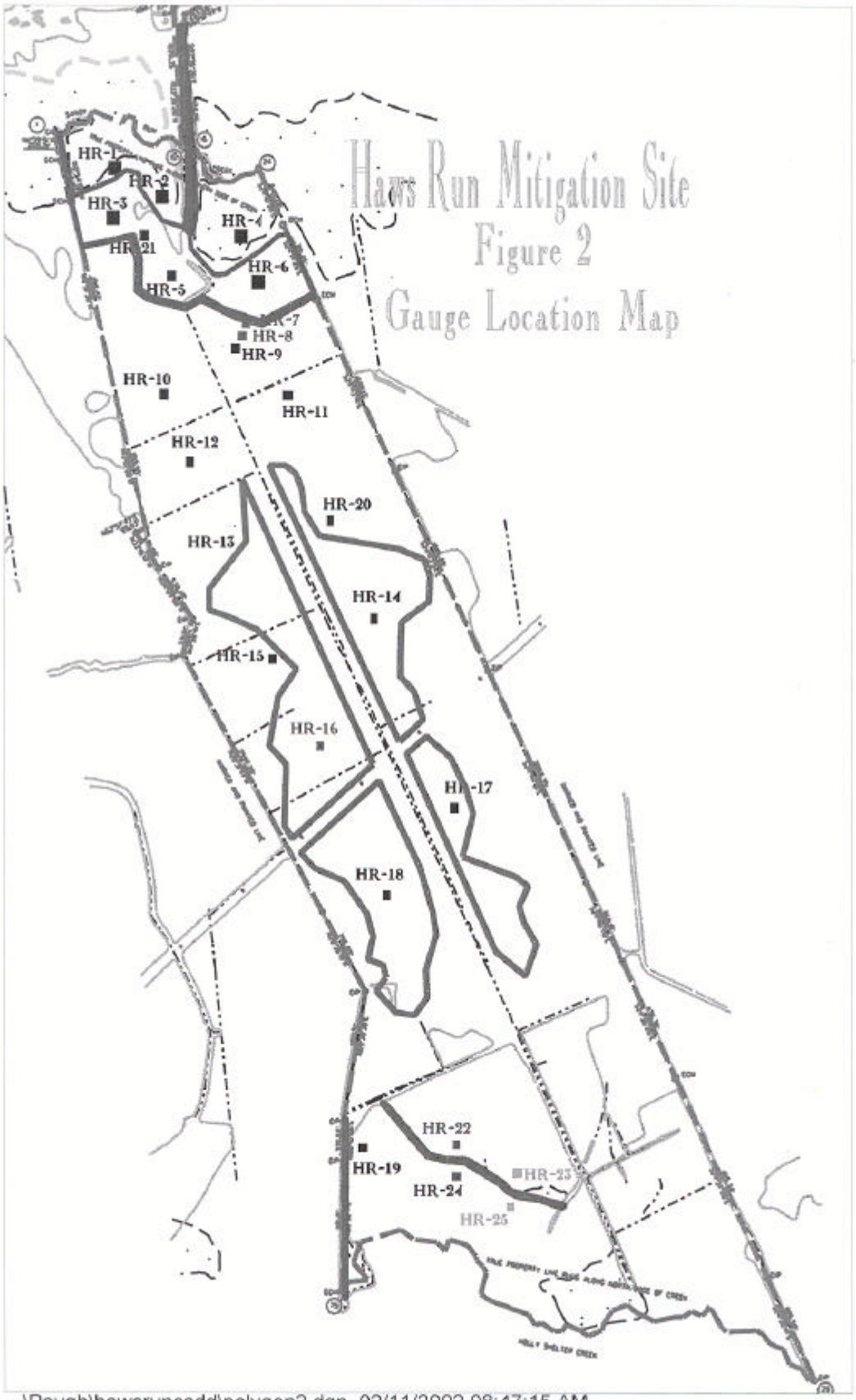
- three in the swamp reference area (HR –1, HR-2, HR-4)
- five in the swamp restoration area (HR-3, HR-5, HR-6, HR-21) (HR-19 in the southern swamp restoration area)
- two on the slope transition area (HR-7, HR-8)
- six in the pine savanna restoration area (HR-9 through 12, HR-15, HR-20)
- five in the pine savanna jurisdictional wetlands (HR-13, HR-14, HR-16, HR-17, HR-18)

After field inspection in April 1999, monitoring gauges HR-1 through HR-6 were relocated (as shown on Figure 2) to better represent site conditions. Ground surface elevation was surveyed at each well and used to correlate well data for restoration area and reference area comparisons. Based on similar elevations, the following wells were paired for hydrologic monitoring:

- HR-1 and HR-3 at a relative elevation of 6.2 ft
- HR-2 and HR-5 at a relative elevation of 5.8 ft
- HR-4 and HR-6 at a relative elevation of 4.9 ft

There are also four groundwater gauges, HR-22 through 25, and two surface gauges, SG-1and SG-2, located along the forestry haul road which were installed during the pre-construction monitoring phase. The surface gauges failed to record data properly during this monitoring period and therefore they are not included in this monitoring report. They will be replaced with new gauges.

All of the monitoring gauges automatically recorded daily depth to groundwater or surface water on the site. Appendix A contains the graphs for each gauge along with daily rainfall data.



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2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The hydrologic monitoring results from the restoration areas are presented in this report by three methods:

1) Comparison to jurisdictional wetland criteria,
2) Comparison to reference area mean depth to groundwater,
3) Comparison to reference area duration of saturation.

Comparison to Jurisdictional Wetland Criteria

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined at each gauge. This number was converted into a percentage of the 237-day growing season. Because of the variability between wetland systems and within wetland types, the monitoring gauge results are segmented into percentage ranges (Figure 3). Table 1 presents the monitoring results for the 2001 growing season as a range of percentages, actual percentages, and success dates of the longest hydroperiod for each gauge on the site. Shaded rows indicate gauges in restoration areas.

Results presented in Table 1 include data from the months of July and August for this monitoring period, in contrast to year 2000 which excluded data from these two months. The months of July and August 2000 experienced extended periods of rainfall, although monthly totals did not exceed the normal range.

All gauges in swamp forest restoration area achieved the optimum hydrology for jurisdictional wetland criteria of 12.5% of the growing season. Gauges HR-2 and HR-4 exhibited the highest hydrology percentage at 84.8%, while HR-19 was the lowest, with soil saturation occurring for a consecutive 17.2% of the growing season.

In the pine savanna restoration area, all gauges met the 12.5% jurisdictional hydrology criteria with the exception of gauge HR-16, which exhibited soil saturation occurring for a consecutive 8.0% of the growing season.

The gauges along the haul road again had mixed results, but showed a decline compared to the year 2000. The hydroperiod at HR-22 showed the highest reading at 8.8% criteria but was far below last year's reading. Gauges HR-23 and HR-25 recorded identical hydroperiods of 7.5%, and HR-24 produced the lowest reading with a hydroperiod of only 4.6% of the growing season. These gauges and associated areas will be investigated to determine any problems or conditions related to the mixed results.

Results from gauges located in the reference areas at Haws Run also supported jurisdictional hydrology for the swamp forest and pine savanna. Gauges in the

haul road reference area had mixed results, as did the haul road restoration area.

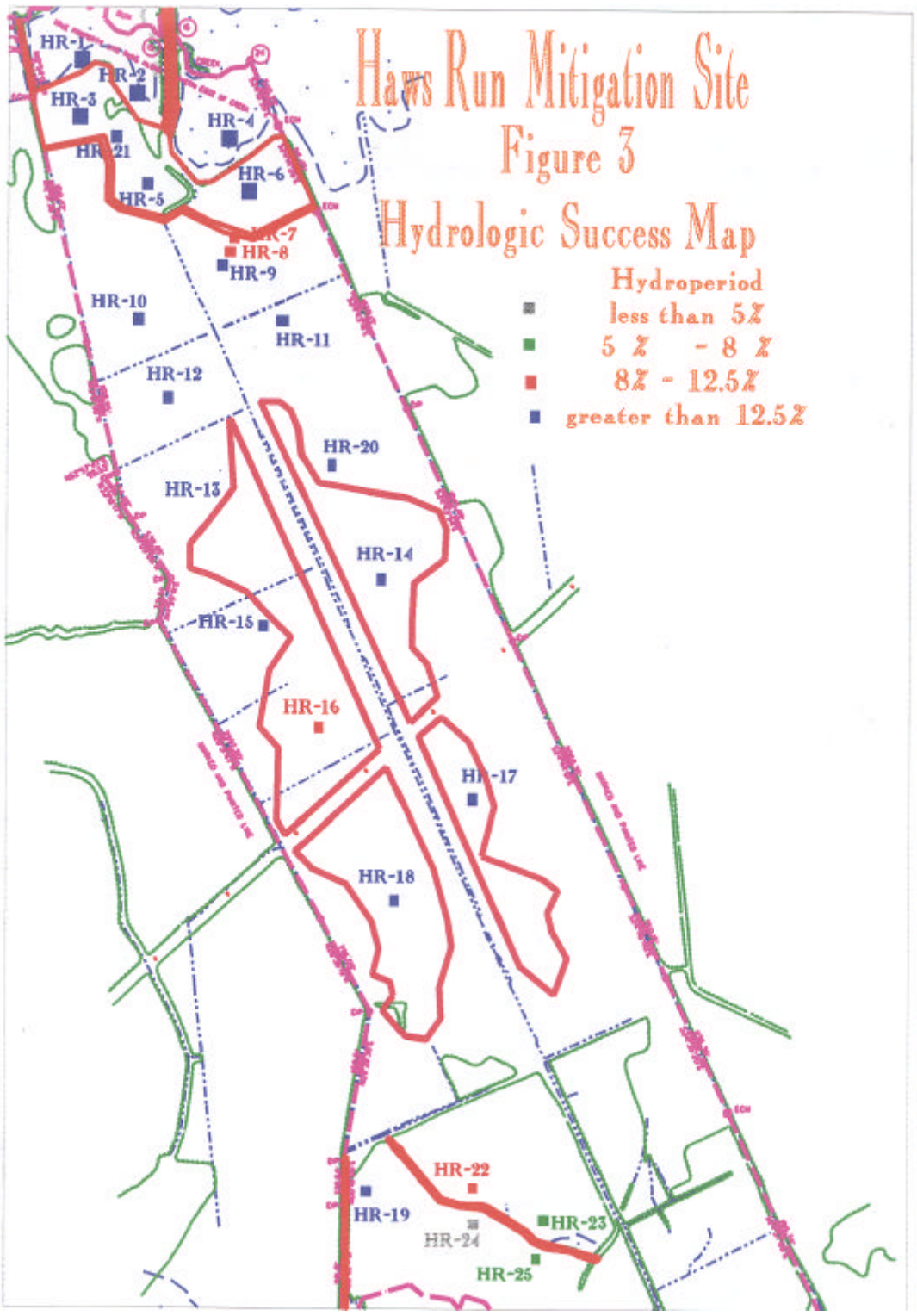

Haws Run Mitigation Site
Figure 3
Hydrologic Success Map
Hydroperiod
less than 5%
5 % - 8 %
8% - 12.5%
greater than 12.5%
HR-1
HR-2
HR-3
HR-4
HR-21
HR-5
HR-6
HR-7
HR-8
HR-9
HR-10
HR-11
HR-12
HR-13
HR-20
HR-14
HR-15
HR-16
HR-17
HR-18
HR-19
HR-22
HR-23
HR-24
HR-25

Table 1 HYDROLOGIC MONITORING RESULTS 2001

Monitoring Gauge		< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Success Dates
Swamp forest	HR-1				✓	63.2	May 13 – Oct. 9
	HR-2				✓	106	March 23 – Nov 29
	HR-3				✓	27.8	May 13 – July 17
	HR-4				✓	106	March 23 – Nov 29
	HR-5				✓	29.1	May 29 - Aug. 5
	HR-6				✓	97.0	March 23 – Nov 9
	HR-19				✓	17.2	March 23 – May 2
	HR-21				✓	30.8	May 29 - Aug. 9
Trans Zone	HR-7			✓		11.3	April 15 – May 6
	HR-8			✓		8.8	March 23 –April 12
Pine Savannah	HR-9				✓	21.5	May 13 - July 2
	HR-10				✓	15.6	Aug. 12 - Sept. 17
	HR-11				✓	16.8	Aug. 12 - Sept. 20
	HR-12				✓	34.5	July 20 - Oct. 9
	HR- 20				✓	37.0	July 20 - Oct. 9
	HR-13				✓	16.8	July 24 - Sept. 20
	HR-14				✓	32.4	July 20 - Oct. 4
	HR-15				✓	70.0	May 13 – Oct. 25
	HR-16			✓		8.0	March 23 –April 10
	HR-17				✓	37.0	July 20 - Oct. 9
	HR-18				✓	36.2	July 20 - Oct. 9
Haul Road	HR-22			✓		8.8	Mar 23 – April 12
	HR-23		✓			7.5	Mar 23 – April 9
	HR-24	✓				4.6	Mar 23 – April 2
	HR-25		✓			7.5	Mar 23 – April 9

Comparison of Average Depth to Groundwater

The average depth to groundwater for both the reference and restoration area gauges was calculated and plotted for the growing season (Appendix B). Appendix B also contains the comparisons of depth to groundwater for paired gauges. The results are presented as a percentage of the days when the depth to groundwater in the restoration area was at, above, or no deeper than 25% of the depth to groundwater in the reference area. The results are as follows.

- Average Swamp restoration area was comparable for 56% of days in the Average Swamp reference area.
- MW-3: 60% of days at MW-1.
- MW-5: 20% of days at MW-2.

- MW-6: 91% of days at MW-4.

- Average Pine Savanna restoration area was comparable for 47% of days in the Average Pine Savanna reference area.

- Average Haul road restoration area was comparable for 76% of days in the Average Haul road reference area.

Comparison of Duration of Saturation

For each well, the longest hydroperiod i.e., the number of consecutive days of soil saturation (free water table) within 12 inches of the surface, was calculated and averaged for the restoration areas and the reference areas. The average hydroperiod for the restoration area is reported as a percentage of the average hydroperiod for the reference area. The comparison is also made for the paired wells. The results are as follows.

- Average Swamp restoration area hydroperiod was 50% of Average Swamp reference area hydroperiod.
- MW-3: 44% of MW-1.
- MW-5: 27% of MW-2.
- MW-6: 92% of MW-4.

- Average Pine Savanna restoration area hydroperiod was 125% of Average Pine Savanna reference area hydroperiod.

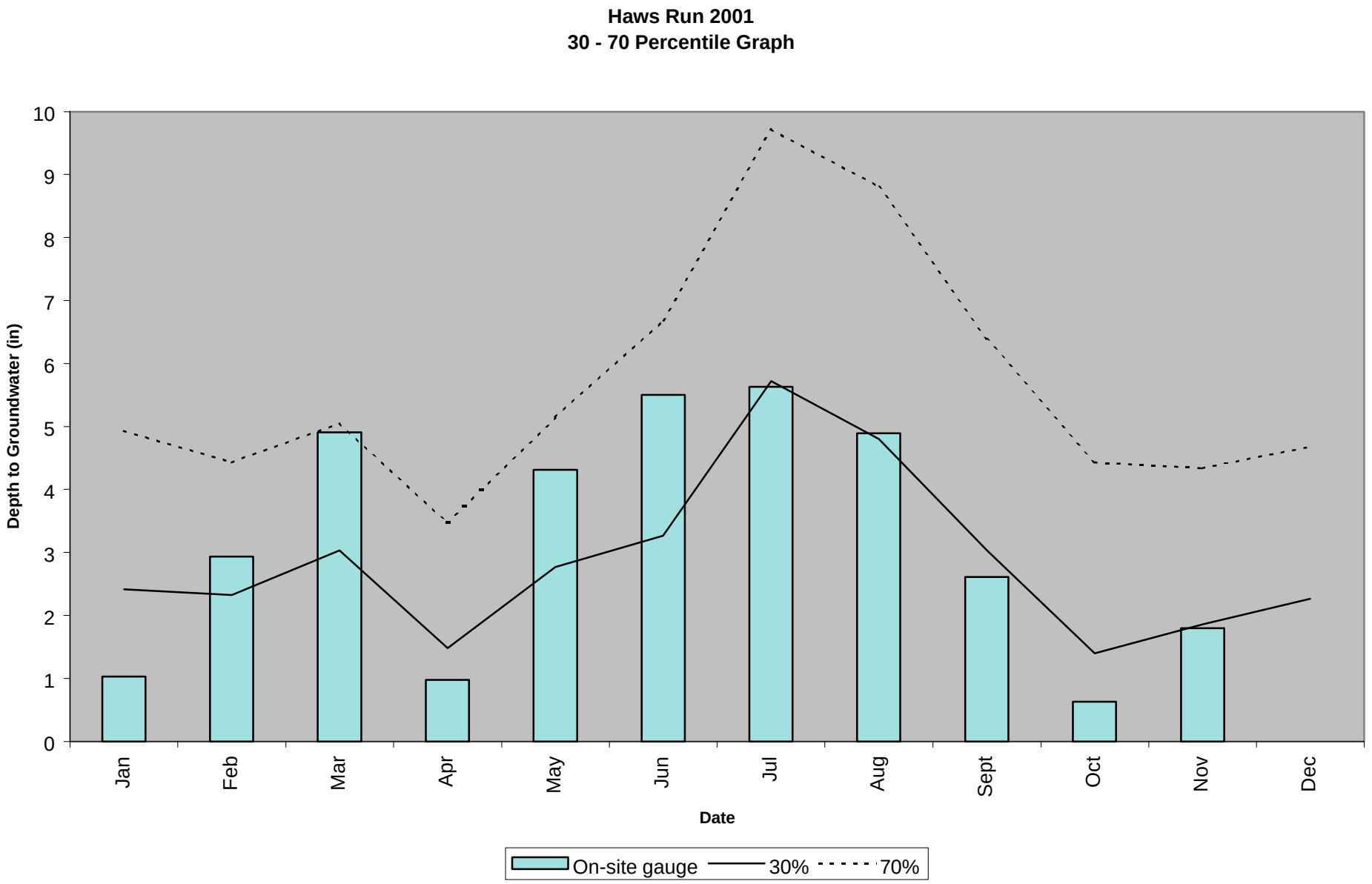
- Average Haul road restoration area hydroperiod was 134% of Average Haul road reference area hydroperiod.

2.3.2 Climatic Data

Figure 4 represents an examination of the local climate in comparison with historical data to determine if 2001 rainfall is within the normal rainfall range of the area. The historical data was provided by the National Climatic Data Center from the Trenton station; the 2001 rainfall data was recorded with an on-site Infinities rain gauge. The Trenton station was used in place of the Marine Corp Air Station at New River station because of incomplete data records.

Rainfall during January, April, August, September, and November were below the normal range for the area. Rainfall for the rest of the months fell within the normal range. Data after November was not available.

Figure 4: Monthly Rainfall Totals



2.4 Conclusions

Based on jurisdictional wetland criteria, the Haws Run mitigation site met hydrologic success for the year 2001. In the swamp forest area, all gauges met or exceeded the 12.5% jurisdictional wetland criteria. HR-6 recorded a substantially longer hydroperiod than rest of the swamp area. It is located in a low area of the swamp restoration that receives and holds runoff from the adjacent land. The swamp reference area gauges showed similar results. In the pine savanna area, all gauges recorded hydroperiods 8% or greater than the growing season, which is an improvement over the 2000 results. The pine savanna reference area at Haws Run also showed results similar to the restoration area. Results at the haul road area were variable between the reference and restoration areas and within each area. The hydroperiods for two gauges were just below 8% of the growing season. The other two gauges represented the highest at 8% and the lowest at 4.6% of the growing season.

Hydrologic patterns in the restoration areas across Haws Run Mitigation site did follow patterns in the reference areas. HR-22 was missing data for the month of November and most of October, however. Flooding frequency and depth in the swamp restoration area coincided with flooding in the swamp reference area. The comparison plots in Appendix B clearly illustrate the restoration hydrologic regime coinciding with the reference area hydrologic regime. The water table did decline quicker in the swamp restoration area than in the swamp reference area, resulting in less storage time. This can be partially attributed to differences in soil organic matter content and surface roughness between the two areas.

Water table fluctuations in the pine savanna area were more variable between gauges. However, average restoration and reference area values were very similar. The plots in Appendix B show the similarities in hydrologic regime between the savanna reference and restoration areas. The daily average depth to groundwater in the pine savanna restoration area matched the reference area 47% of the growing season.

The average hydrologic regime for the haul road restoration area was very similar to the reference area. Although the actual values varied substantially, the flooding patterns coincided very well. The data illustrated the effects of removal of the haul road, reestablishing the hydrologic connection of the isolated area to the southern swamp area.

The duration of saturation between the restoration gauges and the reference gauges were also very comparable for the swamp and savanna areas. The lengths of the hydroperiods for both restoration areas were approximately 75% of the reference area hydroperiods. The restoration gauges in the haul road area exhibited a much longer hydroperiod than the reference area, attributable mainly to HR-22.

3.0 VEGETATION: HAWS RUN MITIGATION SITE (YEAR 2 MONITORING)

3.1 Success Criteria

A. Savanna Areas

Success Criteria states that there must be a minimum of 20 trees per acre living for at least five consecutive years.

B. Swamp Forest Area

NCDOT will monitor the site for five years. A 320 stems per acre survival criterion for planted seedlings will be used to determine success for the first three years. The required survival criterion will decrease by 10% per year after the third year of vegetation monitoring (i.e., for an expected 290 stems per acre for year 4, and 260 stems per acre for year 5). The number of plants of one species will not exceed 20% of the total number of plants of all species planted.

C. Grass Area

No success criterion was established for the planted grass areas.

3.2 Description of Species

A. Savanna Areas

The following tree species were planted in the Savanna Restoration and Enhancement Areas:

Zone 1: Wet Savanna Restoration and Enhancement Area (202 acres)

Pinus palustris, Longleaf Pine

Pinus serotina, Pond Pine

Taxodium ascendens, Pond Cypress

Zone 2: Dry Savanna Enhancement Area (113 acres)

Pinus palustris, Longleaf Pine

B. Swamp Forest Area

The following tree species were planted in the Swamp Forest Area:

Zone 3: Swamp Forest Restoration Area (33 acres)

Nyssa sylvatica var. *biflora*, Swamp Tupelo
Taxodium distichum, Baldcypress
Quercus laurifolia, Laurel Oak
Quercus lyrata, Overcup Oak
Quercus michauxii, Swamp Chestnut Oak
Liriodendron tulipifera, Tulip Poplar
Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Fraxinus pennsylvanica, Green Ash
Platanus occidentalis, American Sycamore

C. Grass Area

The following grass species were planted in ten 100’ x 100’ grass plots:

Wiregrass
Carolina Dropseed
Toothache grass
Savanna muhly

3.3 Results of Vegetation Monitoring

A. Savanna Areas

ZONE	Plot #	Longleaf Pine	Pond Pine	Pond Cypress	Total	Density (Tree/Acre)
1	S1	19	117	18	154	27
	S3	73	180	1	254	45
	ZONE 1 AVG.					**36**
2	S2	128			128	22
	ZONE 2 AVG.					**22**
	TOTAL AVG.					**31**

To determine tree density, 500’ x 500’ plots (5.7 acre) were installed immediately following planting. The actual numbers of planted trees, which occur within the plot, are counted. Since the actual plot size is 5.7 acres, actual trees per acre can be estimated.

Notes from Report: Pines in savanna areas growing well. Broomsedge present throughout plots. Trees difficult to find in large plots, especially the small cypresses.

B. Swamp Forest Area

Plot #	Swamp Tupelo	Baldcypress	Pond Cypress	Laurel Oak	Overcup Oak	Swamp Chestnut Oak	Tulip Poplar	Cherrybark Oak	Green Ash	American Sycamore	Total (2 year)	Total (at planting)	Density (Tree/Acre)
1		1			2						3	32	64
2		9			7	3		4	20		43	53	552
3	1	3			3	7			8		22	34	440
4	2	3			6	9		2	6		28	35	544
5					20	5		7			32	39	558
6	4			7	2			5	3		21	36	397
7	3	2		3	4			2	7	12	33	43	522
TOTAL AVG.													**439**

Site Notes: Other species noted: Fennel, *Juncus* sp., cattail, *Bidens* sp., *Baccharis halimifolia*, various grasses and sedges, broomsedge, woolgrass, giant cane, *Panicum* sp., fern, bay, *Carex* sp., elder, *Distichlis spicata*, *Eleocharis* sp., sweet bay, and volunteer sweet gum, red maple, black gum, and pine.

C. Grass Area

Only visual inspection was done within the grass plots. Grasses appear to be establishing well.

3.4 Conclusions

A. Savanna Areas

Of the 595 acres of this site, approximately 315 acres involved savanna tree planting. There were 3 test plots established throughout the planting. The vegetation monitoring of the planted areas revealed an average density of 31 trees per acre, which is well above the minimum requirement of 20 trees per acre.

B. Swamp Forest Area

Of the 595 acres of this site, approximately 33 acres involved tree planting. There were 7 test plots established throughout the planting. The vegetation monitoring of the planted areas revealed an average density of 439 trees per acre, which is well above the minimum requirement of 320 trees per acre.

The transect areas at the southern end of the site were supplementally planted Spring 2000.

The area around plot one has been inundated with water at every site visit (See photos 1 and 2). The planted tree seedlings have not been able to survive in this area. NCDOT will supplementally plant this area in 2002 with baldcypress, water tupelo, and green ash. It is hoped that these more wet tolerant trees will stand a better chance of survival in this wet area.

The washouts along the northern side of the site adjacent to the swamp forest area were repaired and are stabilizing. Those washes stabilized with stone are doing well. One of the washes stabilized only with matting and vegetation has minor erosion problems (see photo 13). DOT will continue to monitor these washes throughout the year to determine if further repair is necessary.

C. Grass Area

Of the 595 acres of this site, approximately 2.3 acres involved grass planting. The grasses were planted in ten 100’ x 100’ test plots. The vegetation monitoring of the planted areas revealed that the planted grasses were establishing well.

4.0 OVERALL CONCLUSIONS / RECOMMENDATIONS

Hydrologic monitoring in 2001 revealed trends in the restoration areas similar to those in the reference areas. The majority of gauges on site did meet jurisdictional wetland criteria, as well as exhibit comparable depths to groundwater and duration of the hydroperiods.

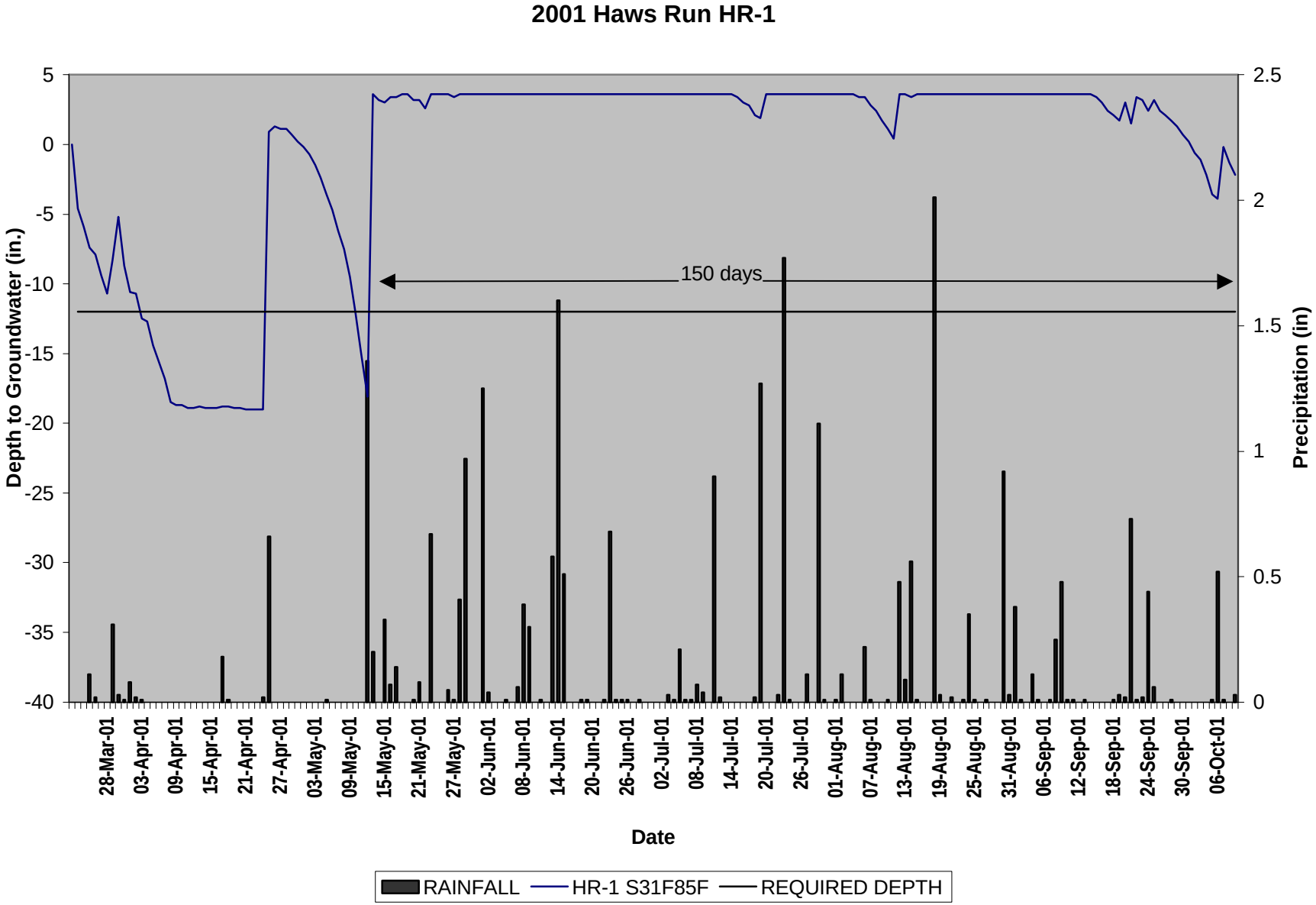
Vegetation on Haws Run is doing well in both the swamp and savanna areas, with exceptions as noted. Final planting was completed Spring 2000.
The erosion areas on the northern slope were repaired as described in the attached plan. The revised debit map and debit ledger are included in this report.

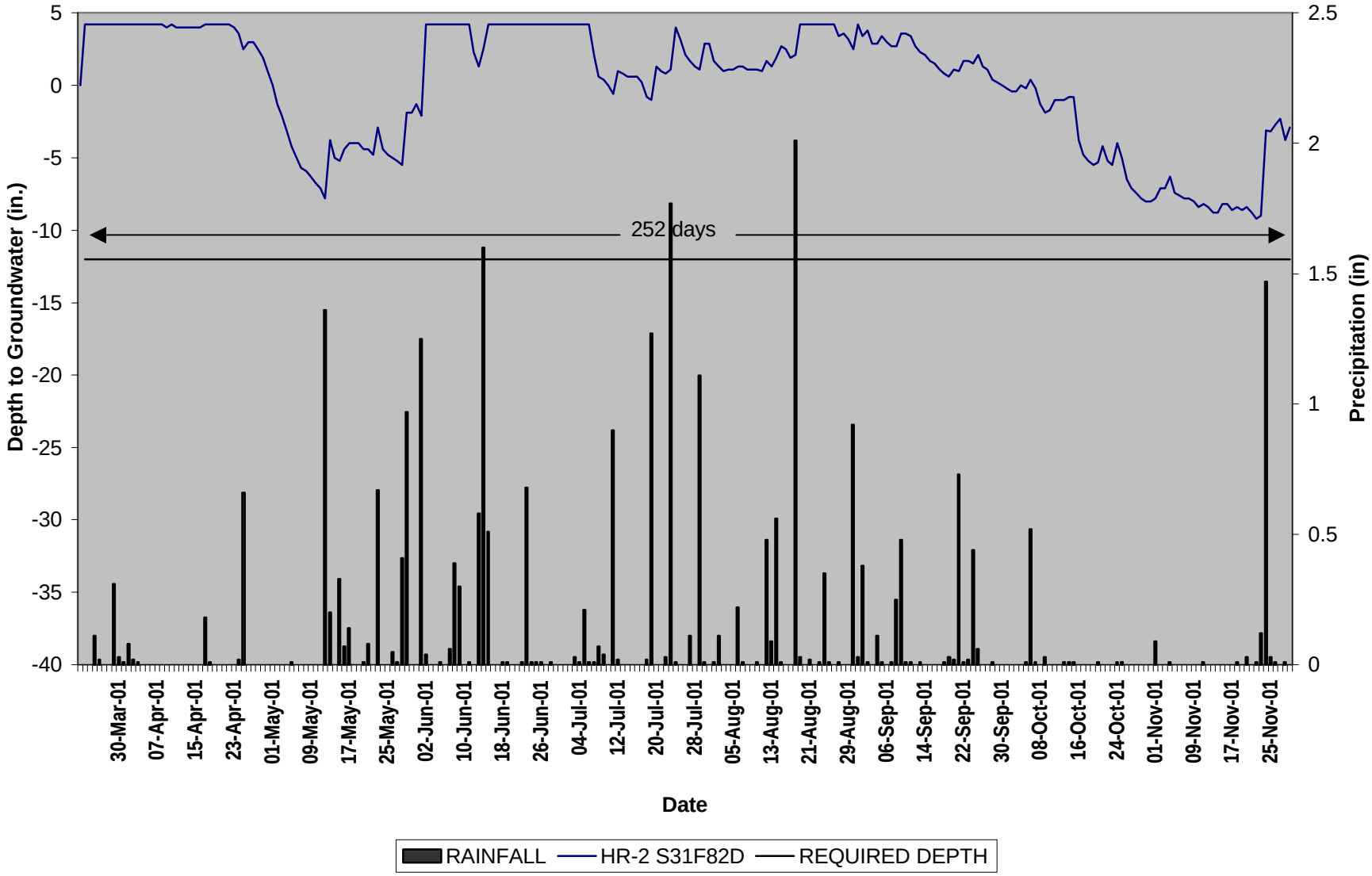
Overall, the Haws Run Mitigation site performed well in 2001. Jurisdictional wetland hydrology was established and supported a prevalence of hydrophytic vegetation.

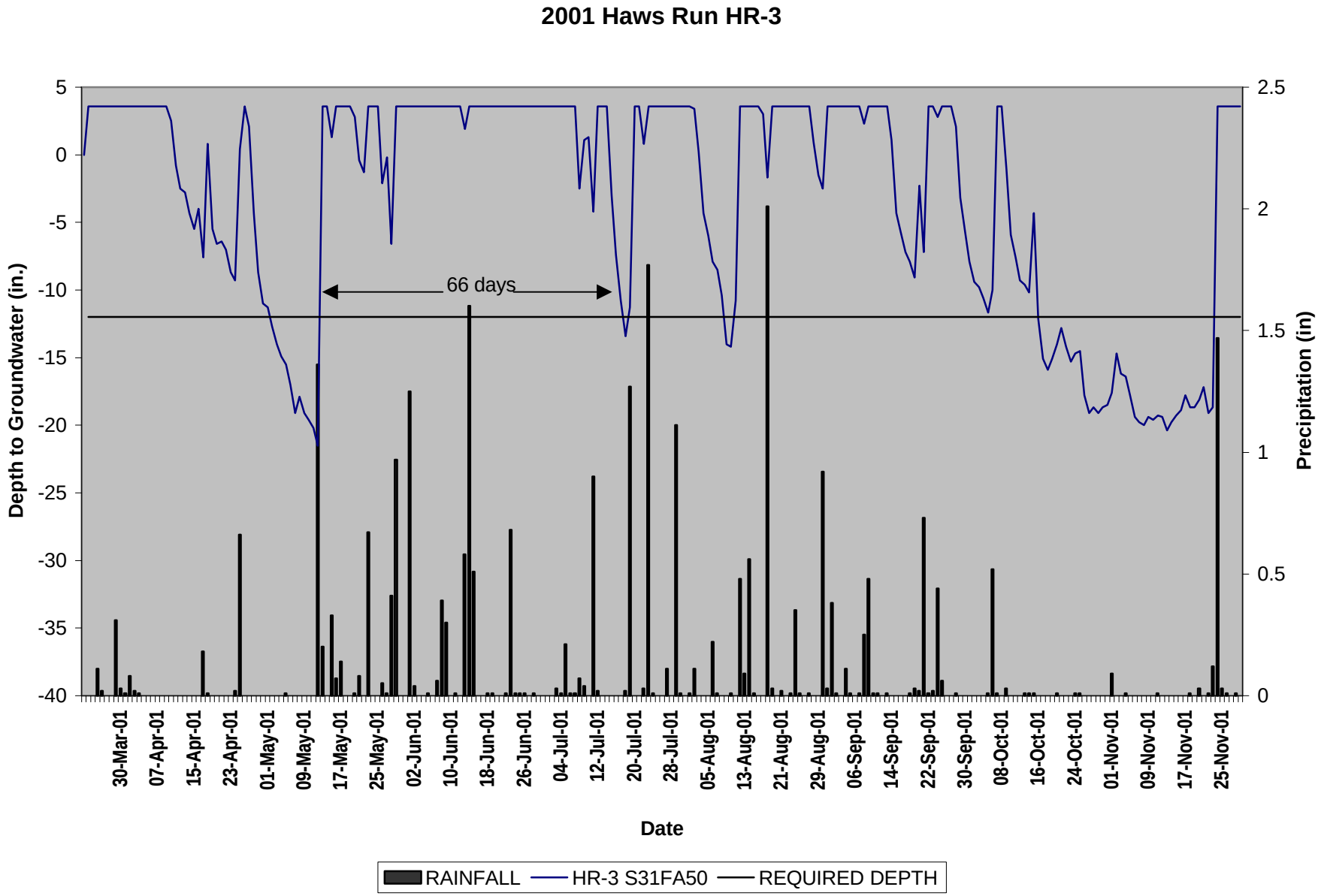
The potential addition of the adjacent Nature Conservancy land to the Haws Run Mitigation site will provide both hydrologic and habitat benefits.

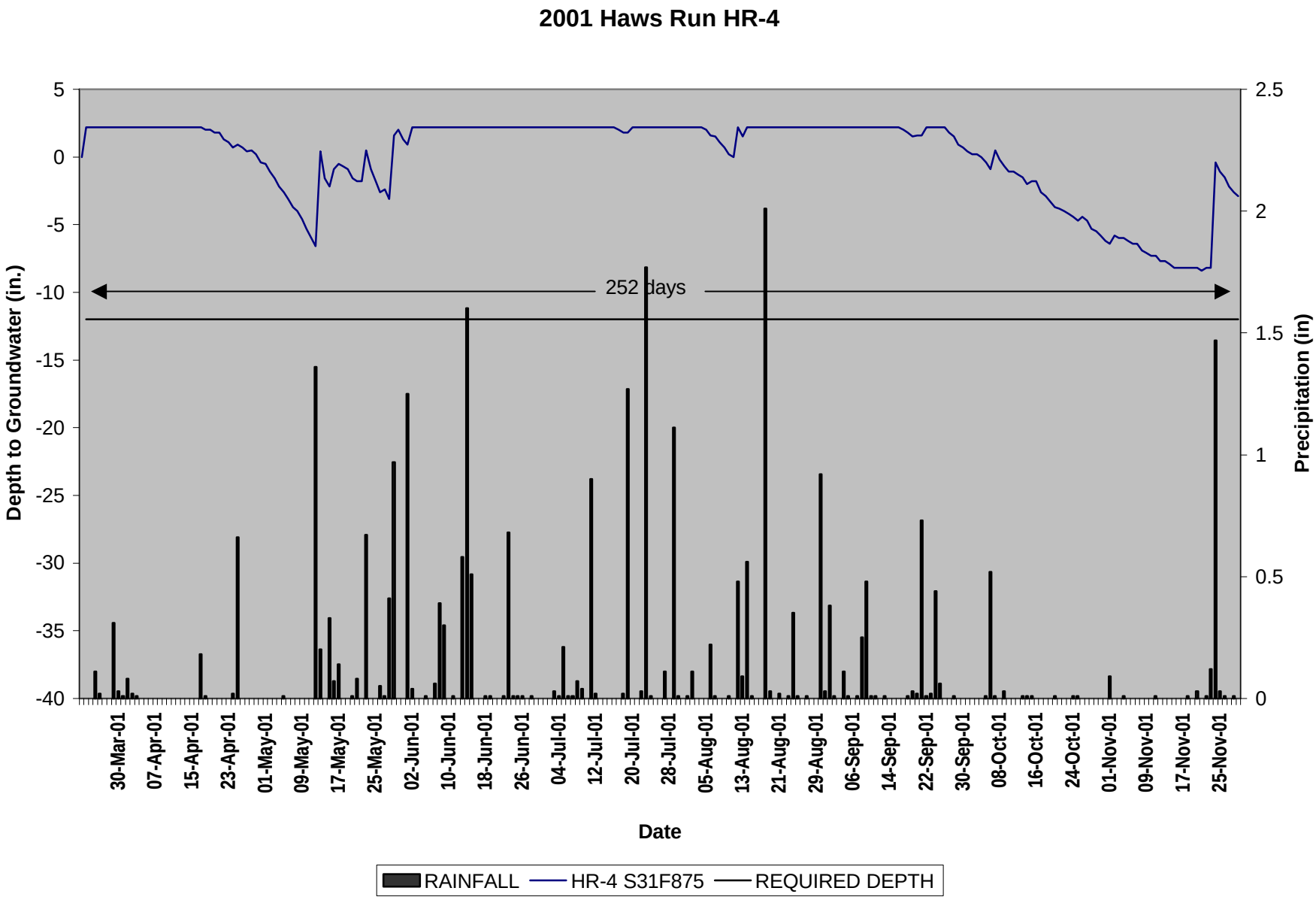
NCDOT will continue to monitor the site for both vegetation and hydrologic success.

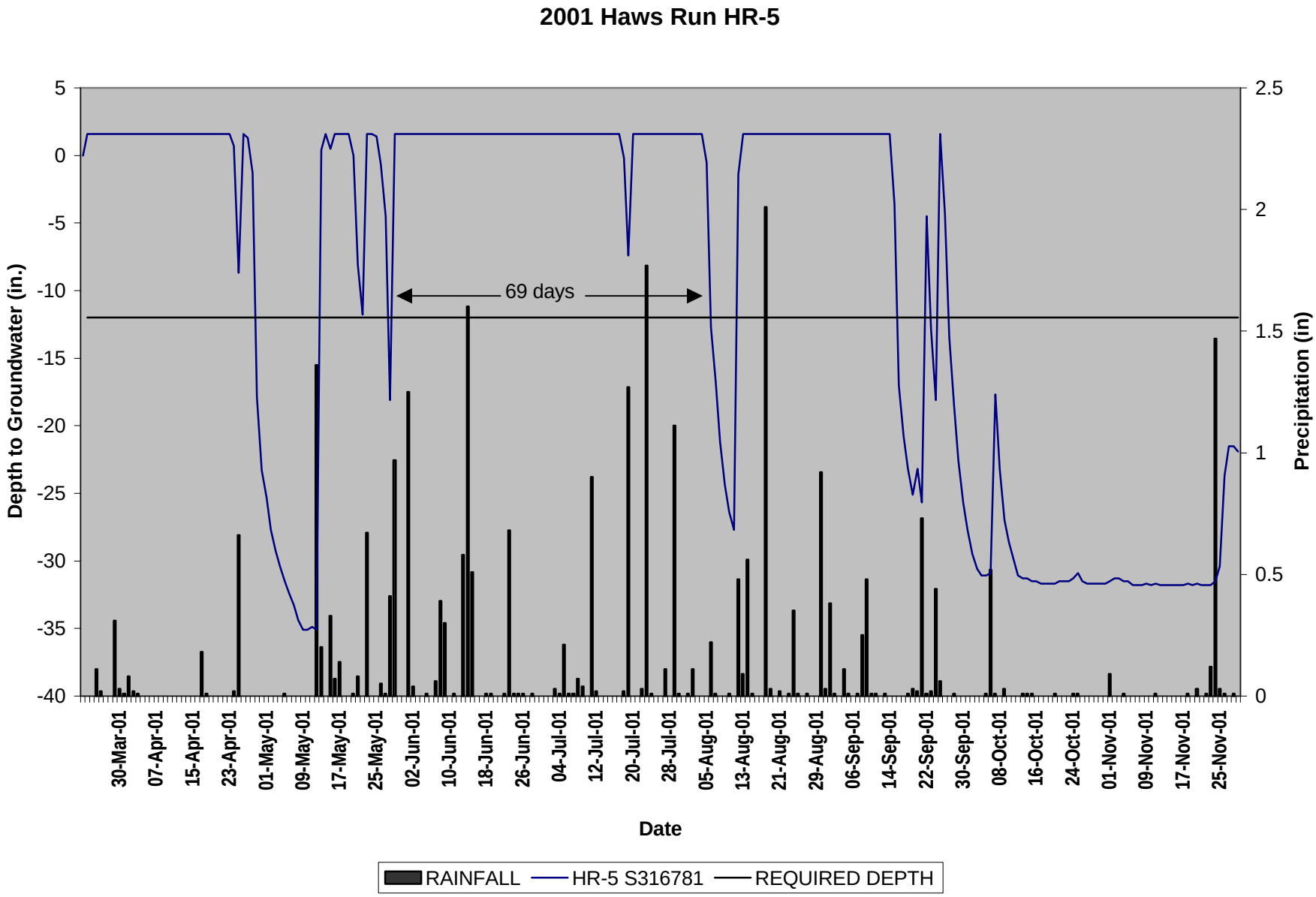
Appendix A
Depth to Groundwater Graphs

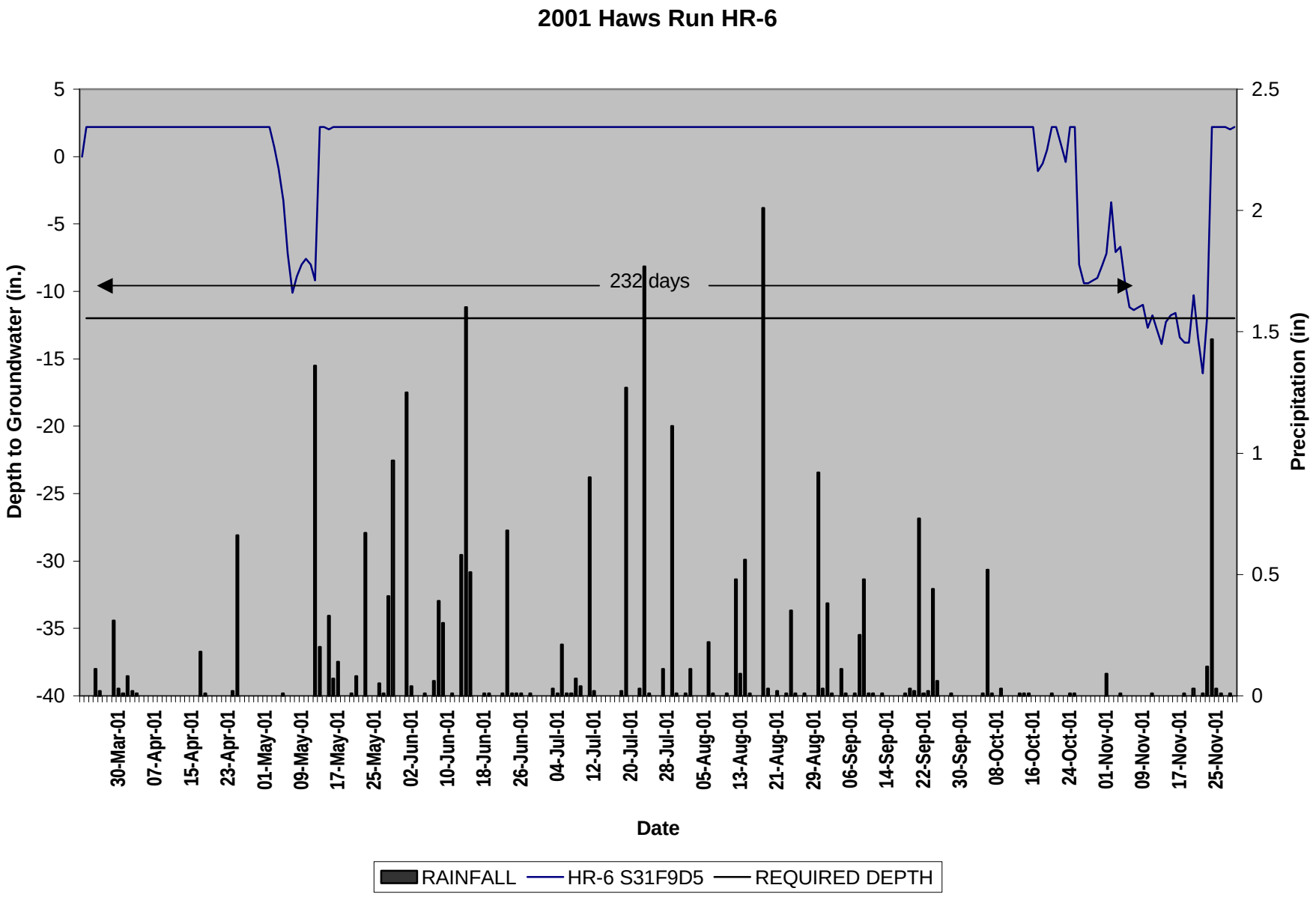

2001 Haws Run HR-1
Depth to Groundwater (in.)
Precipitation (in)
150 days
Date
RAINFALL
HR-1 S31F85F
REQUIRED DEPTH

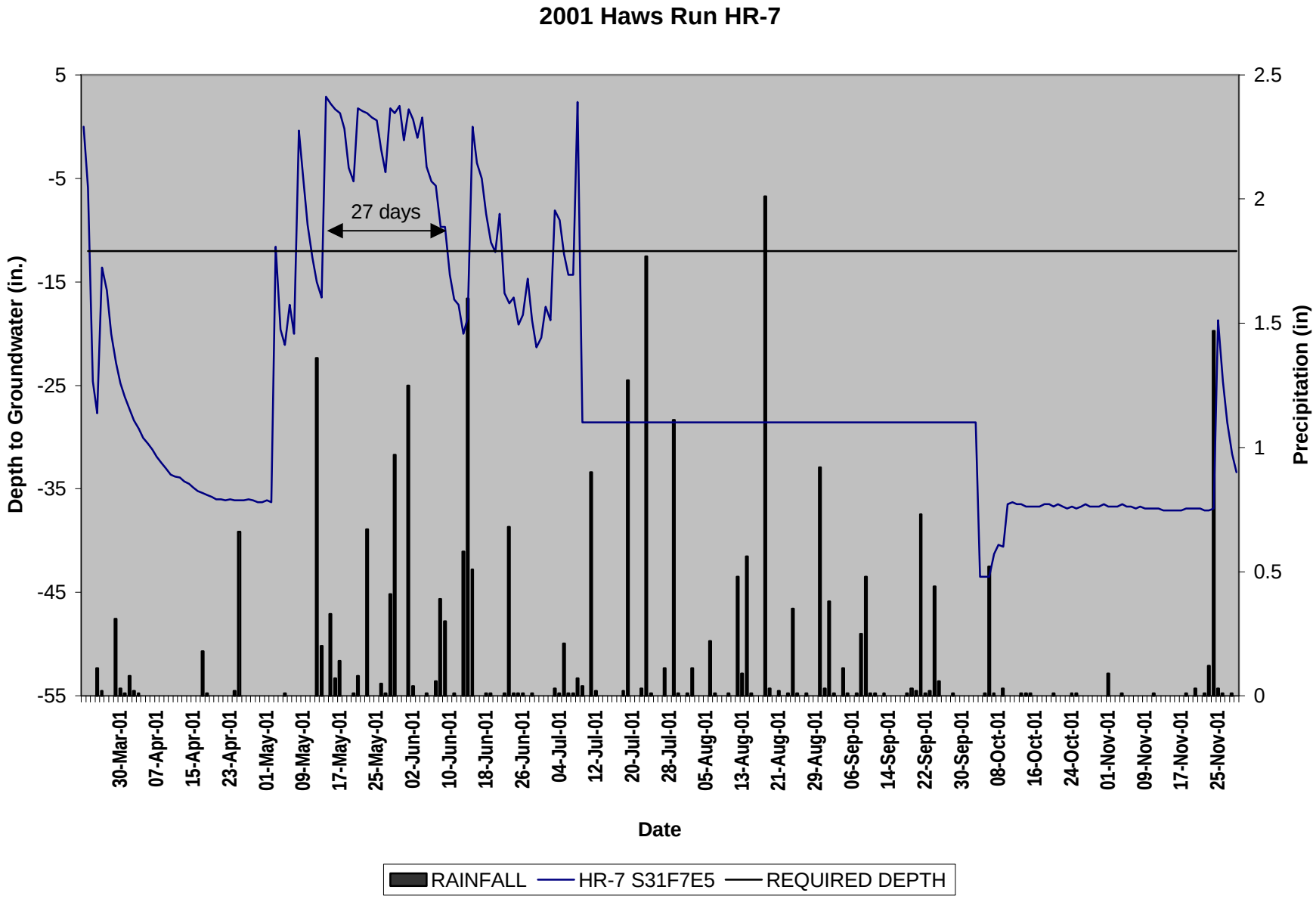

2001 Haws Run HR-2
Depth to Groundwater (in.)
Precipitation (in)
252 days
Date
RAINFALL
HR-2 S31F82D
REQUIRED DEPTH

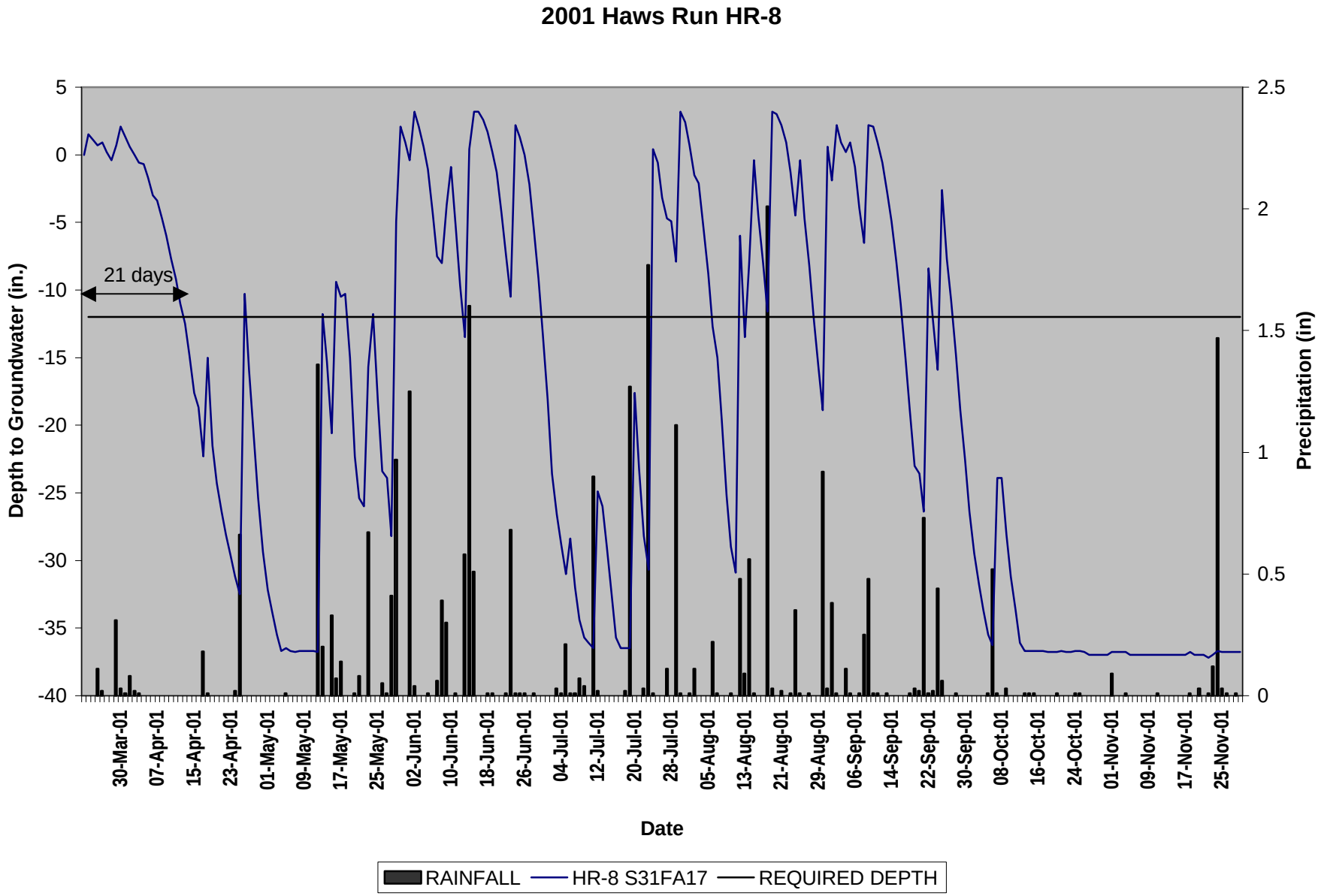

2001 Haws Run HR-3
Depth to Groundwater (in.)
Precipitation (in)
66 days
Date
RAINFALL
HR-3 S31FA50
REQUIRED DEPTH

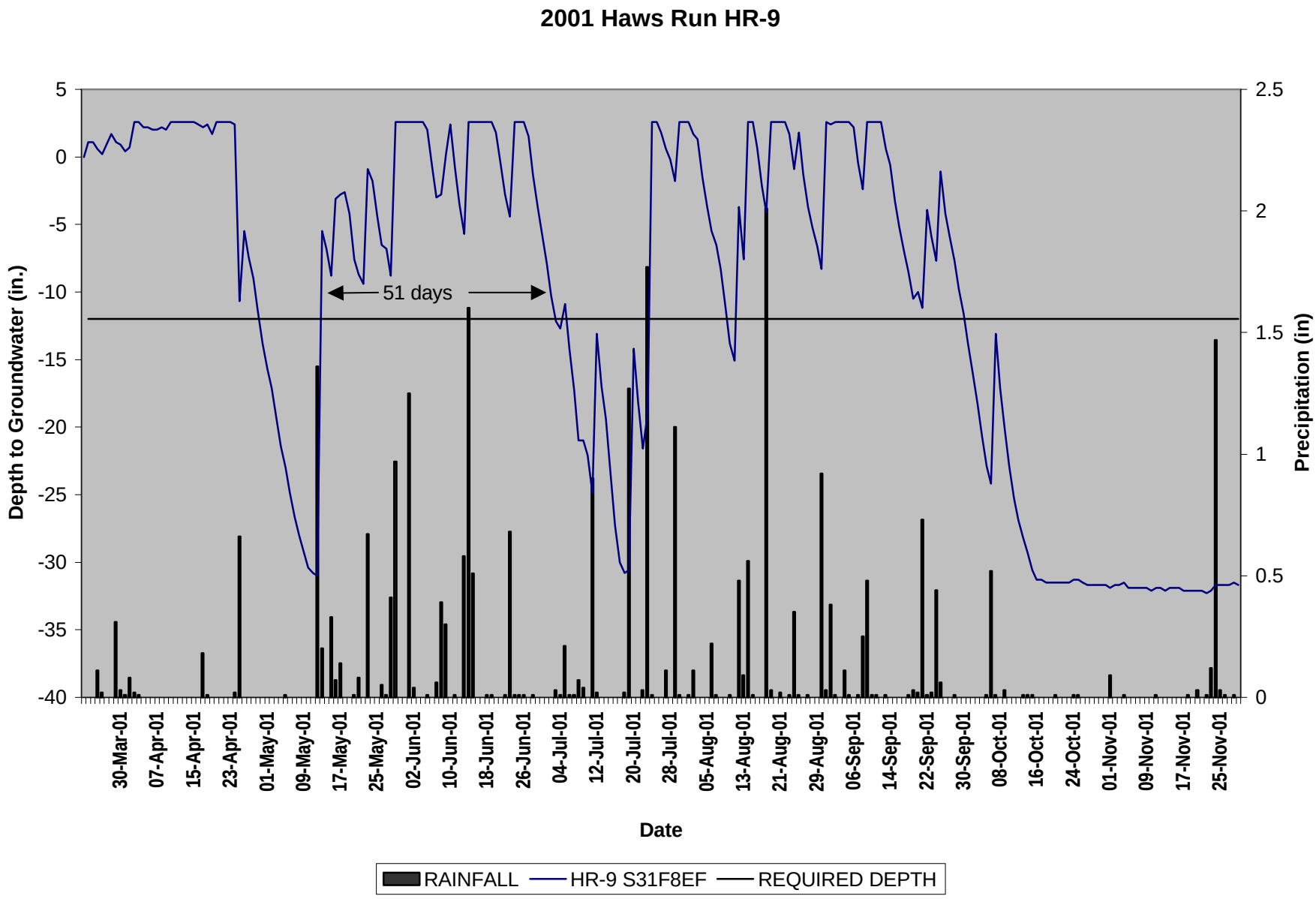

2001 Haws Run HR-4
Depth to Groundwater (in.)
Precipitation (in)
252 days
Date
RAINFALL
HR-4 S31F875
REQUIRED DEPTH

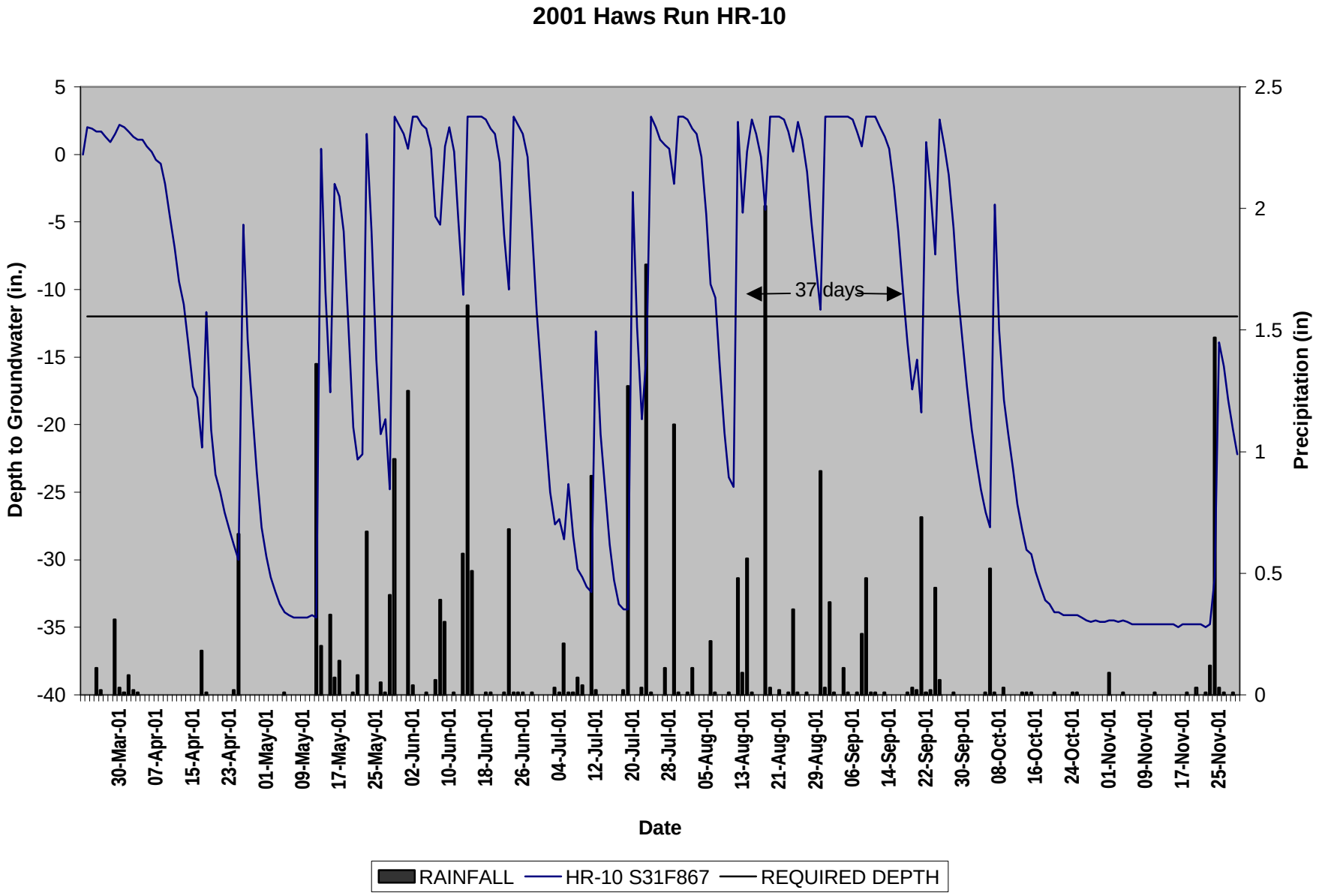

2001 Haws Run HR-5
Depth to Groundwater (in.)
Precipitation (in)
69 days
Date
RAINFALL
HR-5 S316781
REQUIRED DEPTH

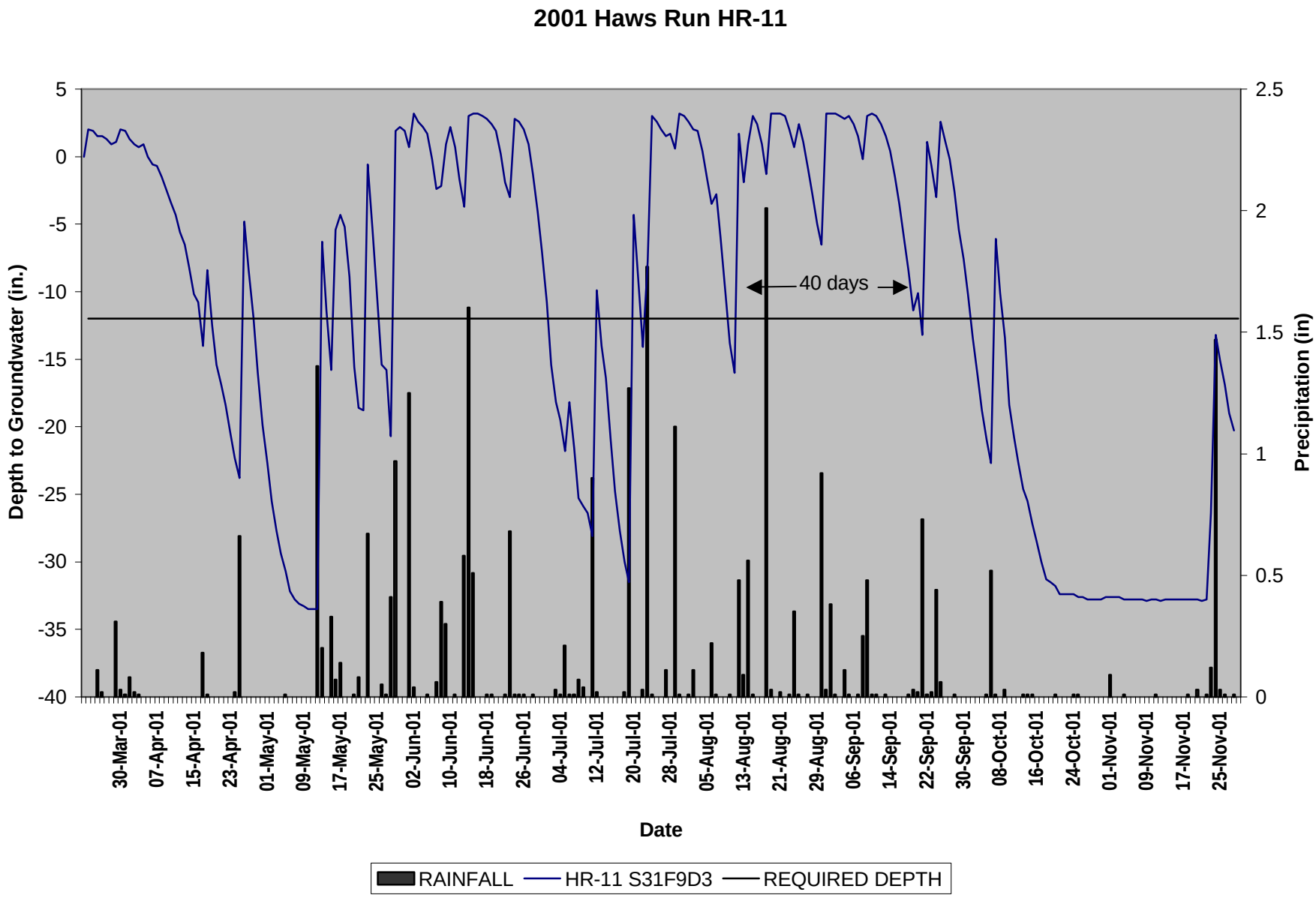

2001 Haws Run HR-6
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
232 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-6 S31F9D5
REQUIRED DEPTH

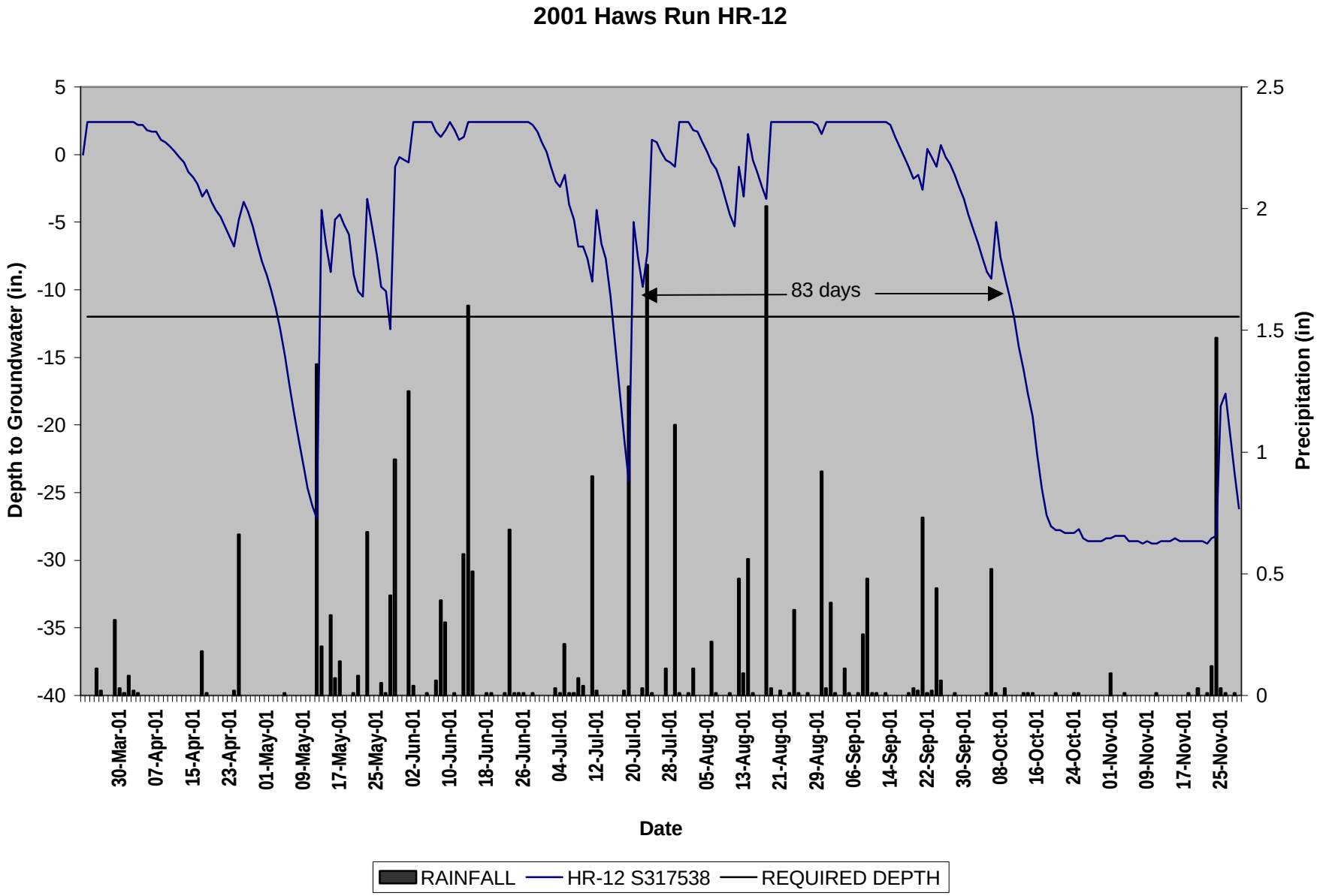

2001 Haws Run HR-7
Depth to Groundwater (in.)
Precipitation (in)
5
-5
-15
-25
-35
-45
-55
2.5
2
1.5
1
0.5
0
27 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-7 S31F7E5
REQUIRED DEPTH

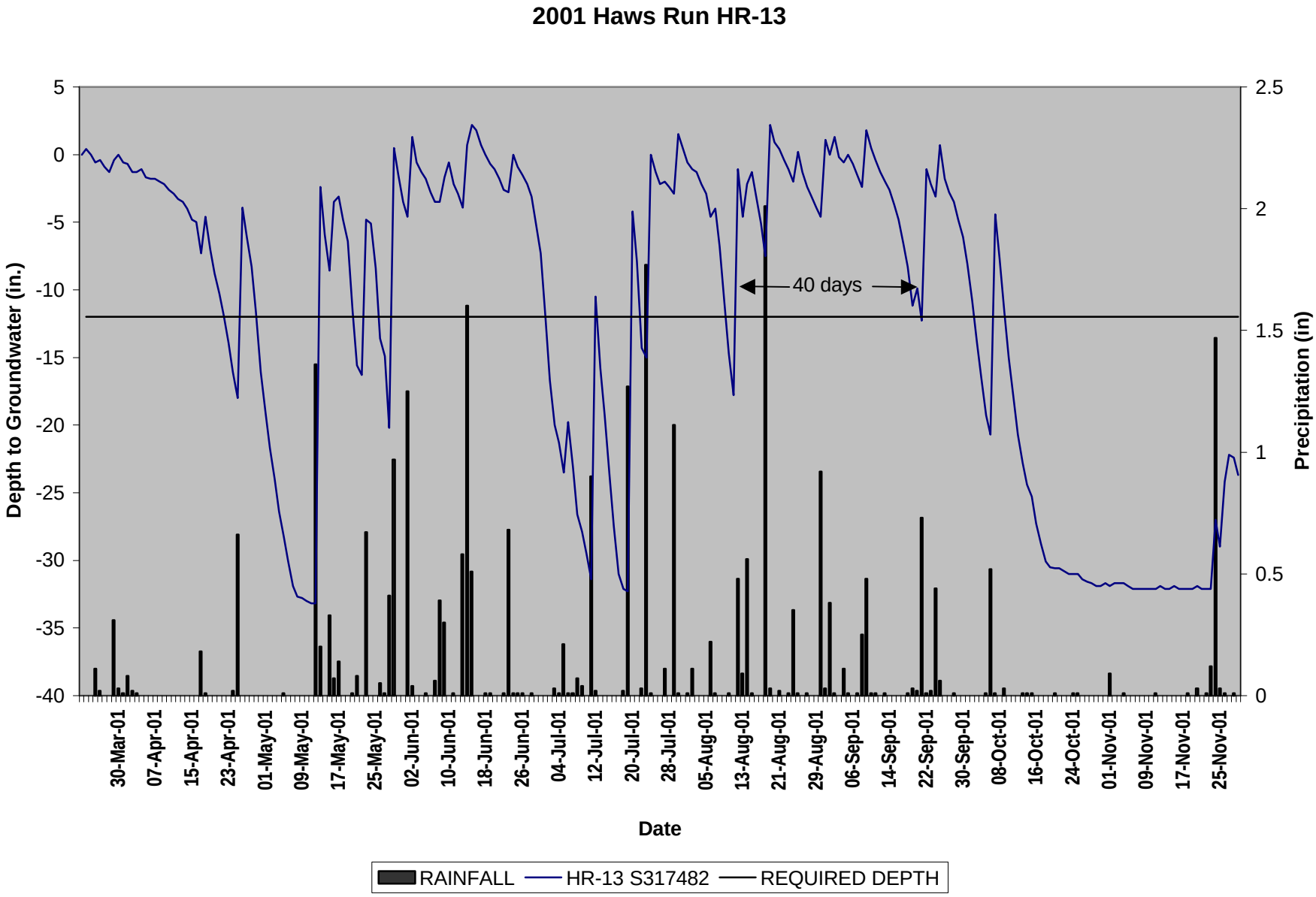

2001 Haws Run HR-8
Depth to Groundwater (in.)
Precipitation (in)
21 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-8 S31FA17
REQUIRED DEPTH

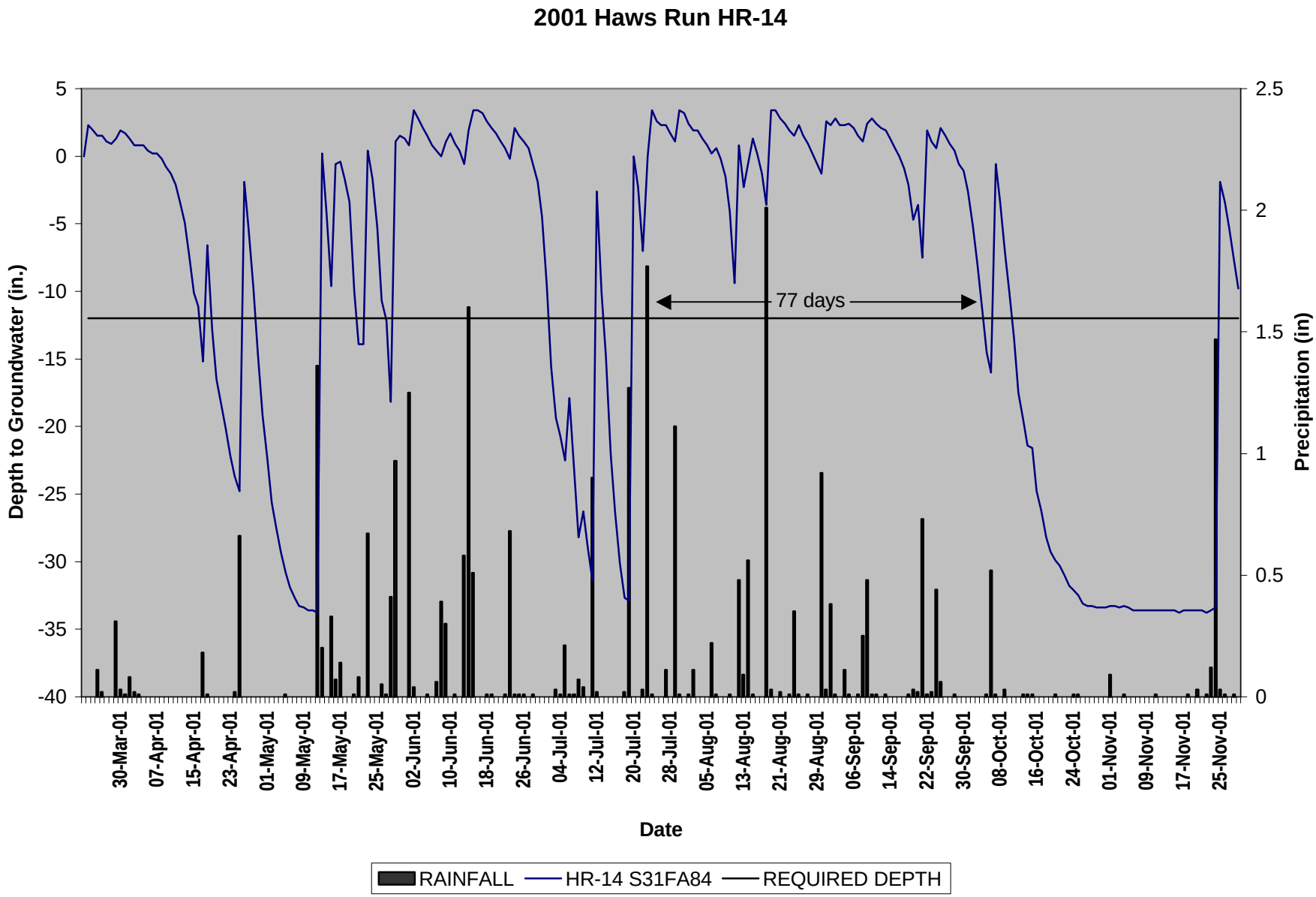

2001 Haws Run HR-9
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
51 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-9 S31F8EF
REQUIRED DEPTH

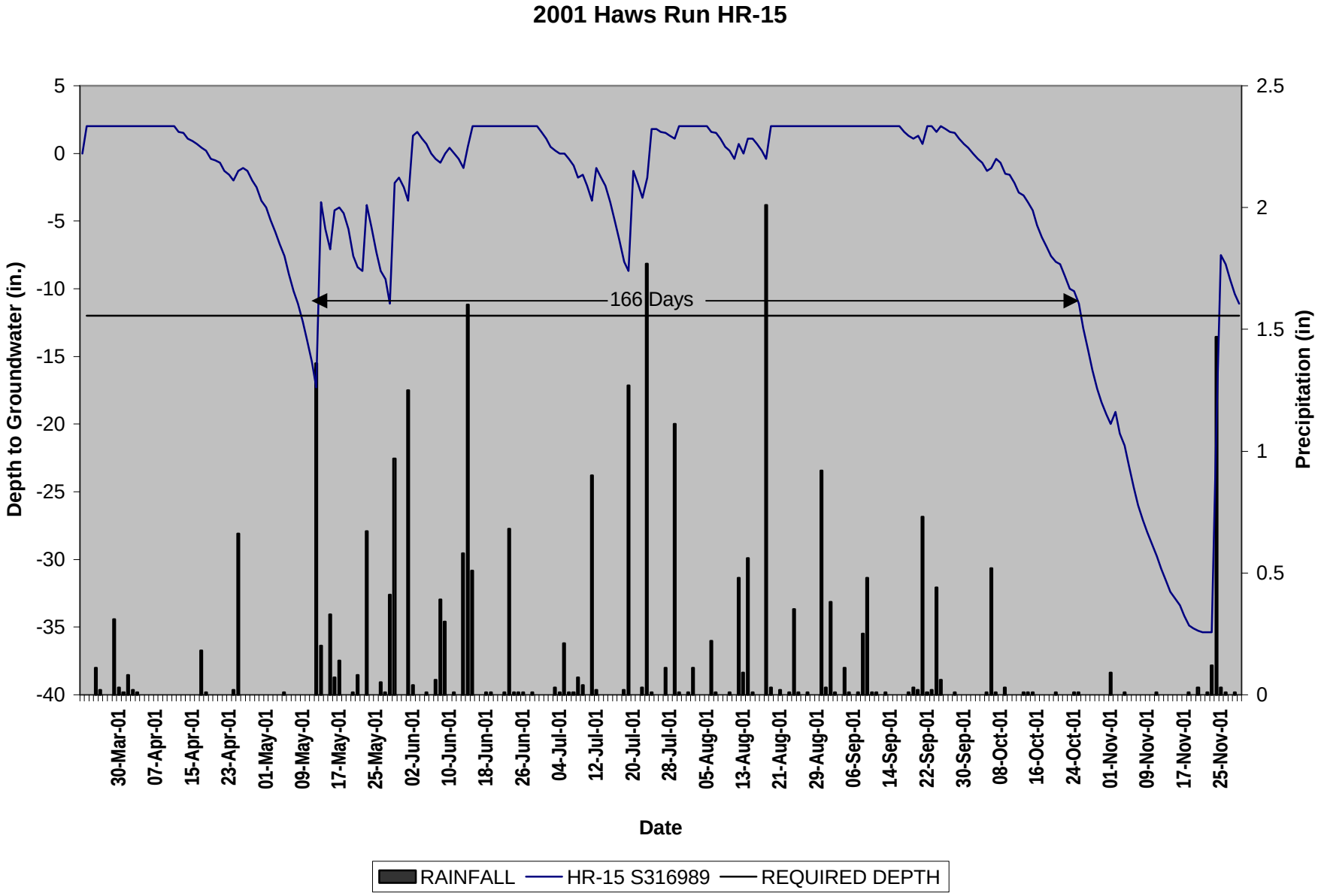

2001 Haws Run HR-10
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
37 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-10 S31F867
REQUIRED DEPTH

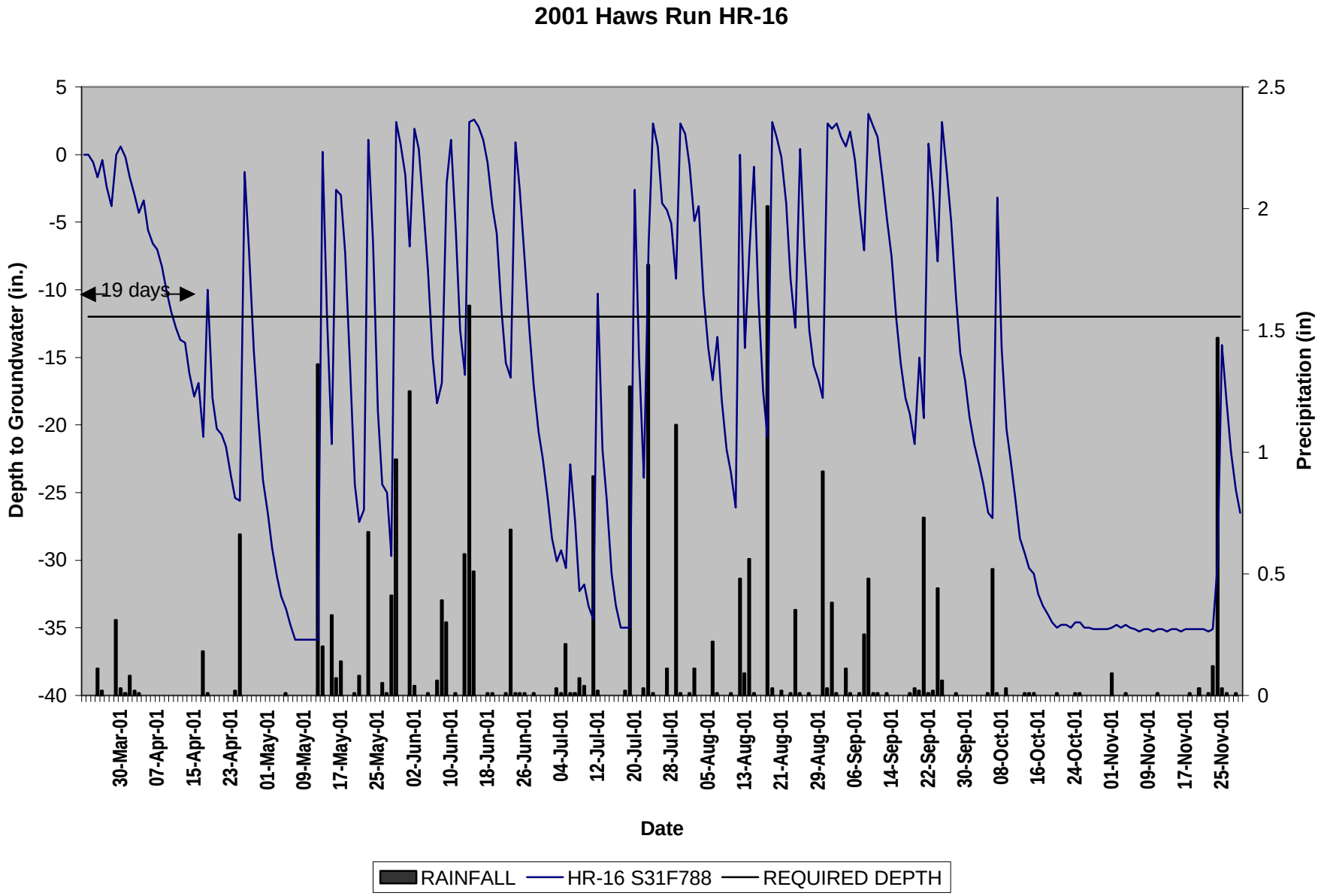

2001 Haws Run HR-11
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
40 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-11 S31F9D3
REQUIRED DEPTH

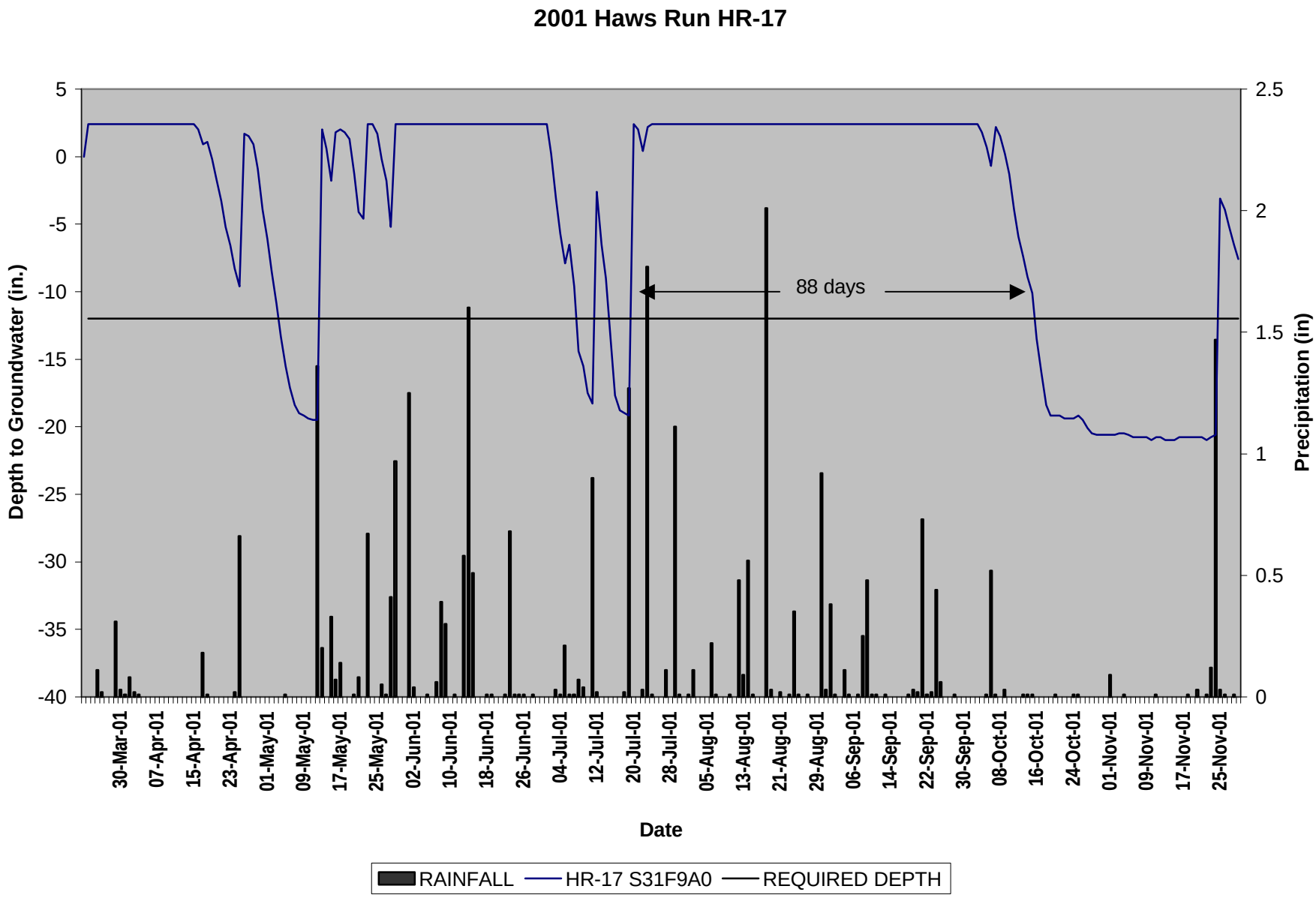

2001 Haws Run HR-12
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
83 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-12 S317538
REQUIRED DEPTH

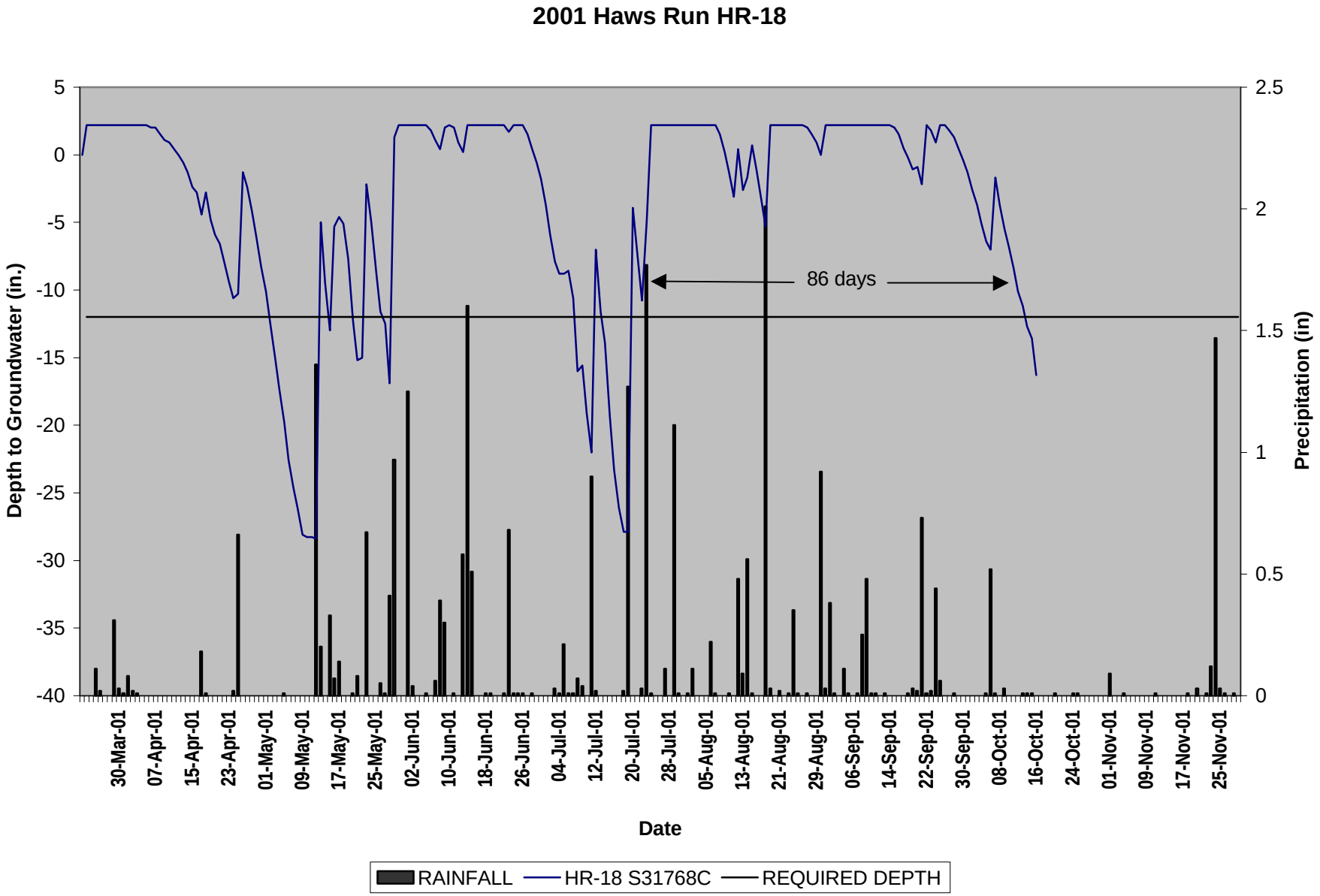

2001 Haws Run HR-13
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
40 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-13 S317482
REQUIRED DEPTH

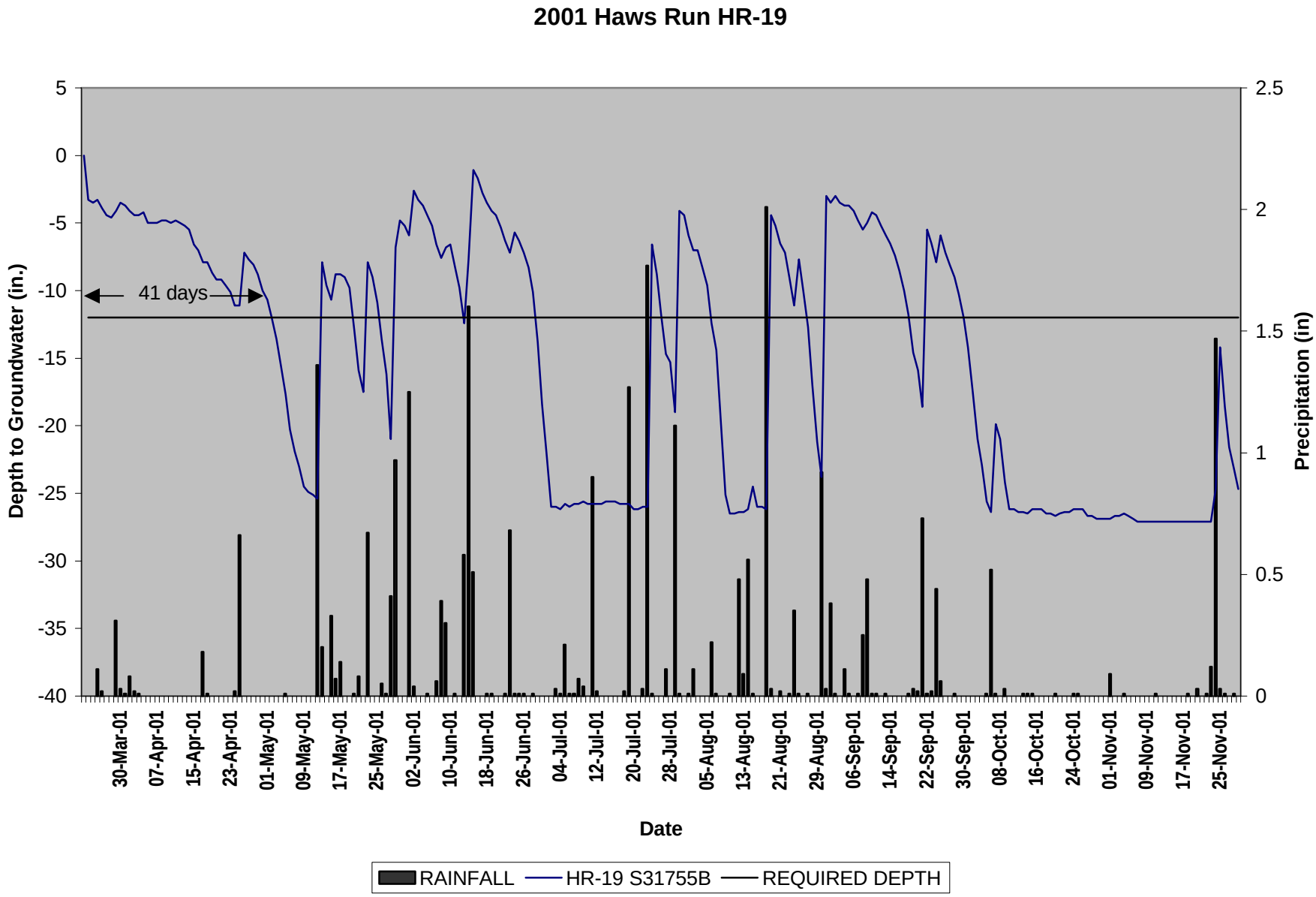

2001 Haws Run HR-14
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
77 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-14 S31FA84
REQUIRED DEPTH

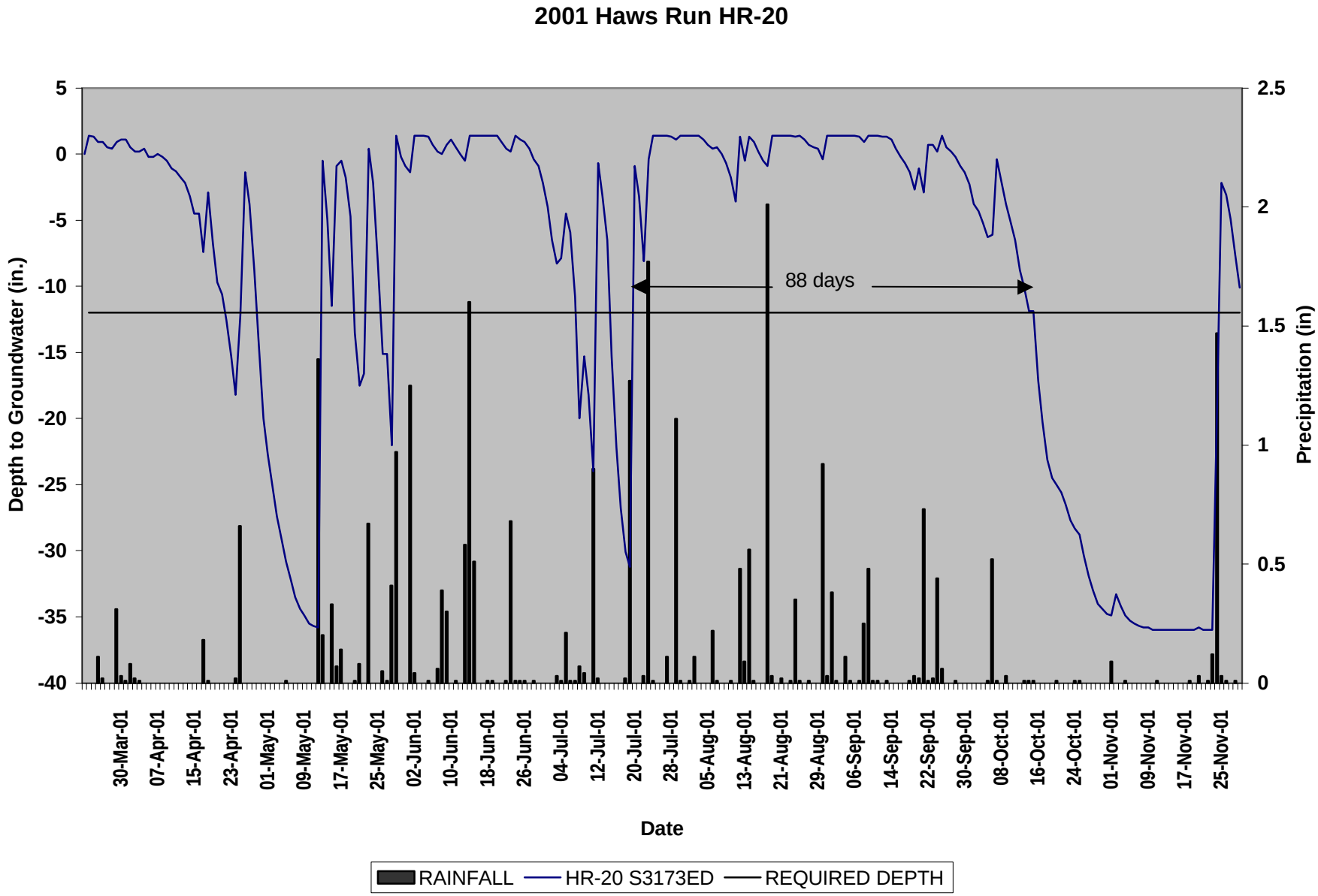

2001 Haws Run HR-15
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
166 Days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-15 S316989
REQUIRED DEPTH

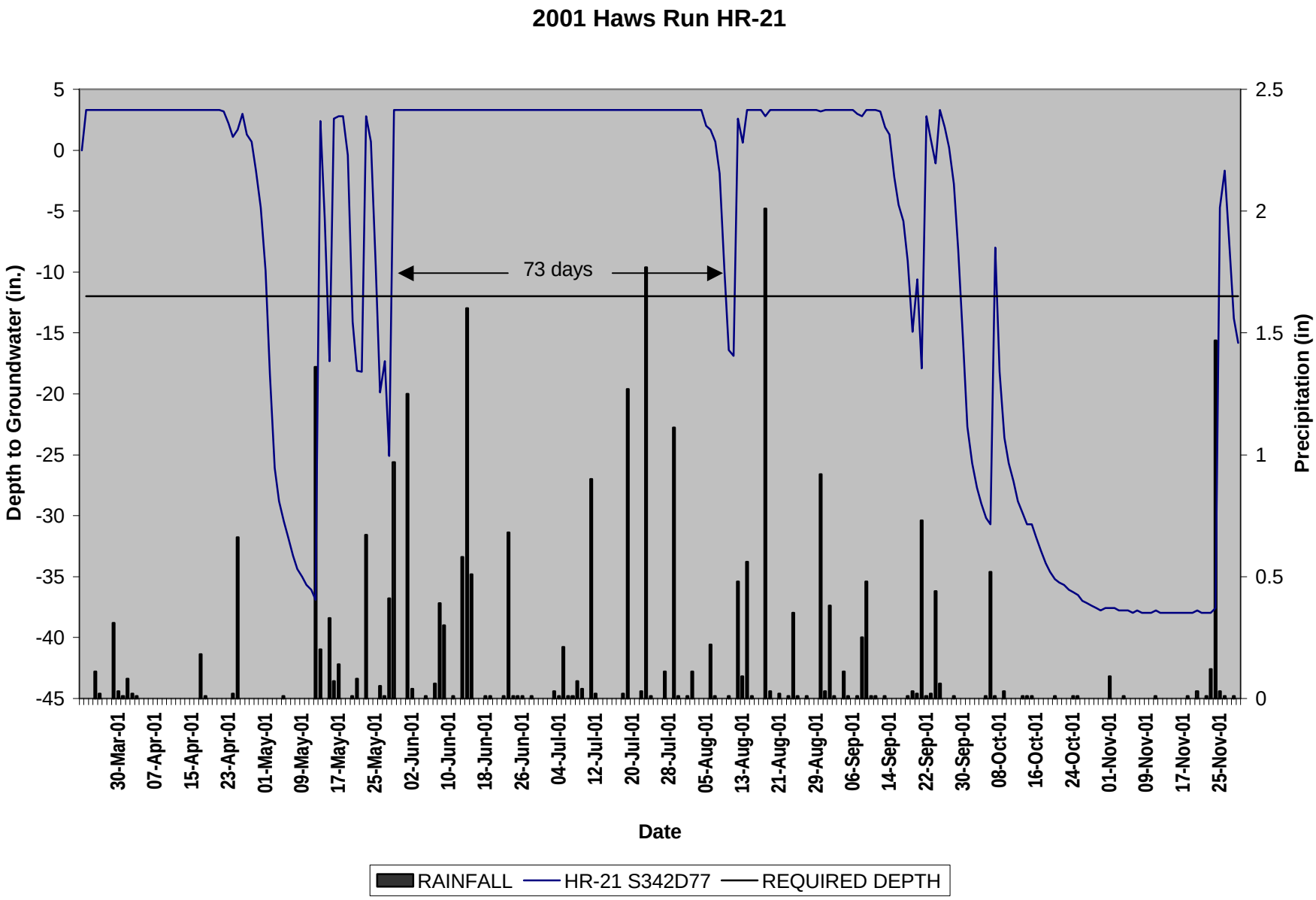

2001 Haws Run HR-16
Depth to Groundwater (in.)
Precipitation (in)
19 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-16 S31F788
REQUIRED DEPTH

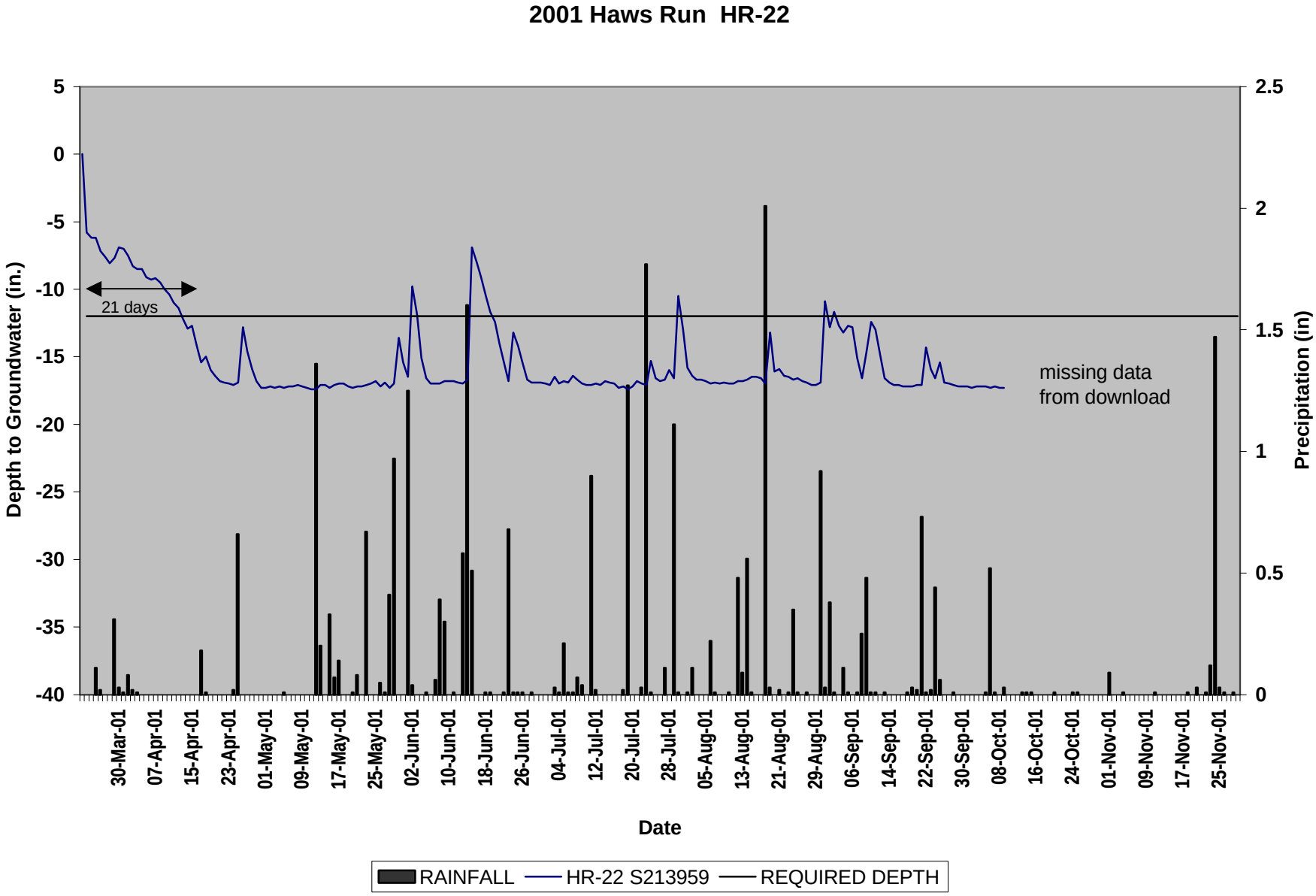

2001 Haws Run HR-17
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
88 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-17 S31F9A0
REQUIRED DEPTH

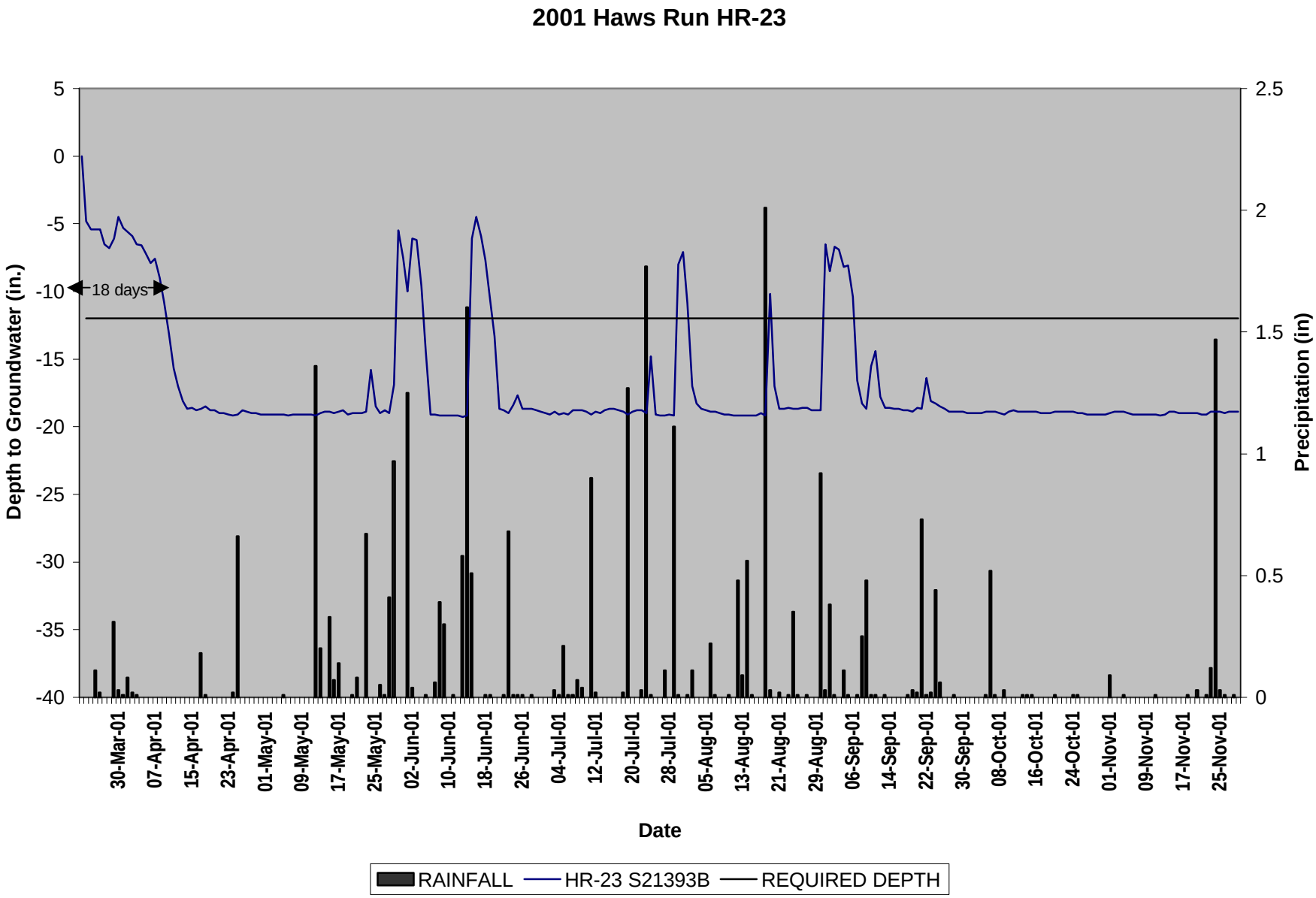

2001 Haws Run HR-18
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
86 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-18 S31768C
REQUIRED DEPTH

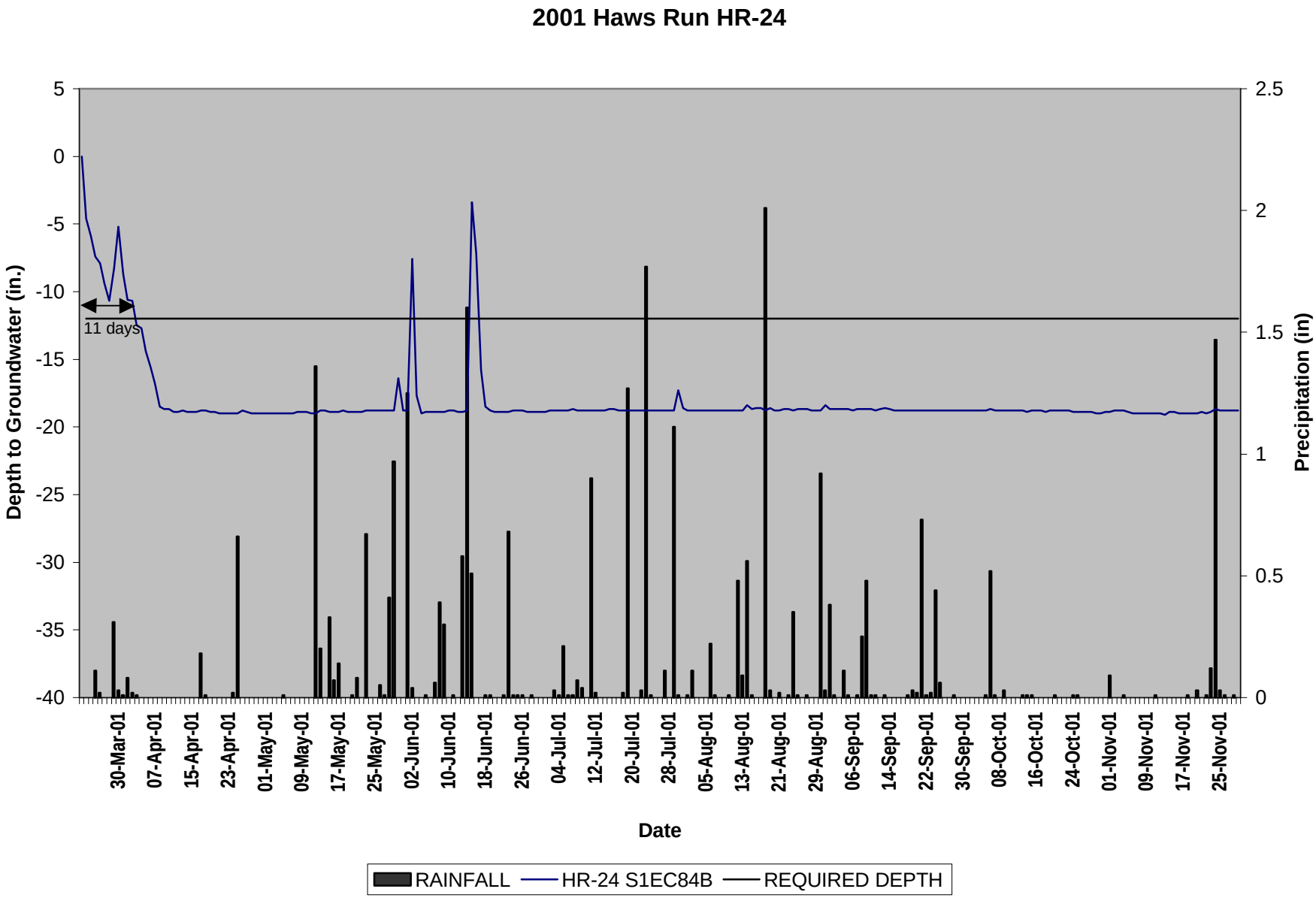

2001 Haws Run HR-19
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
41 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-19 S31755B
REQUIRED DEPTH

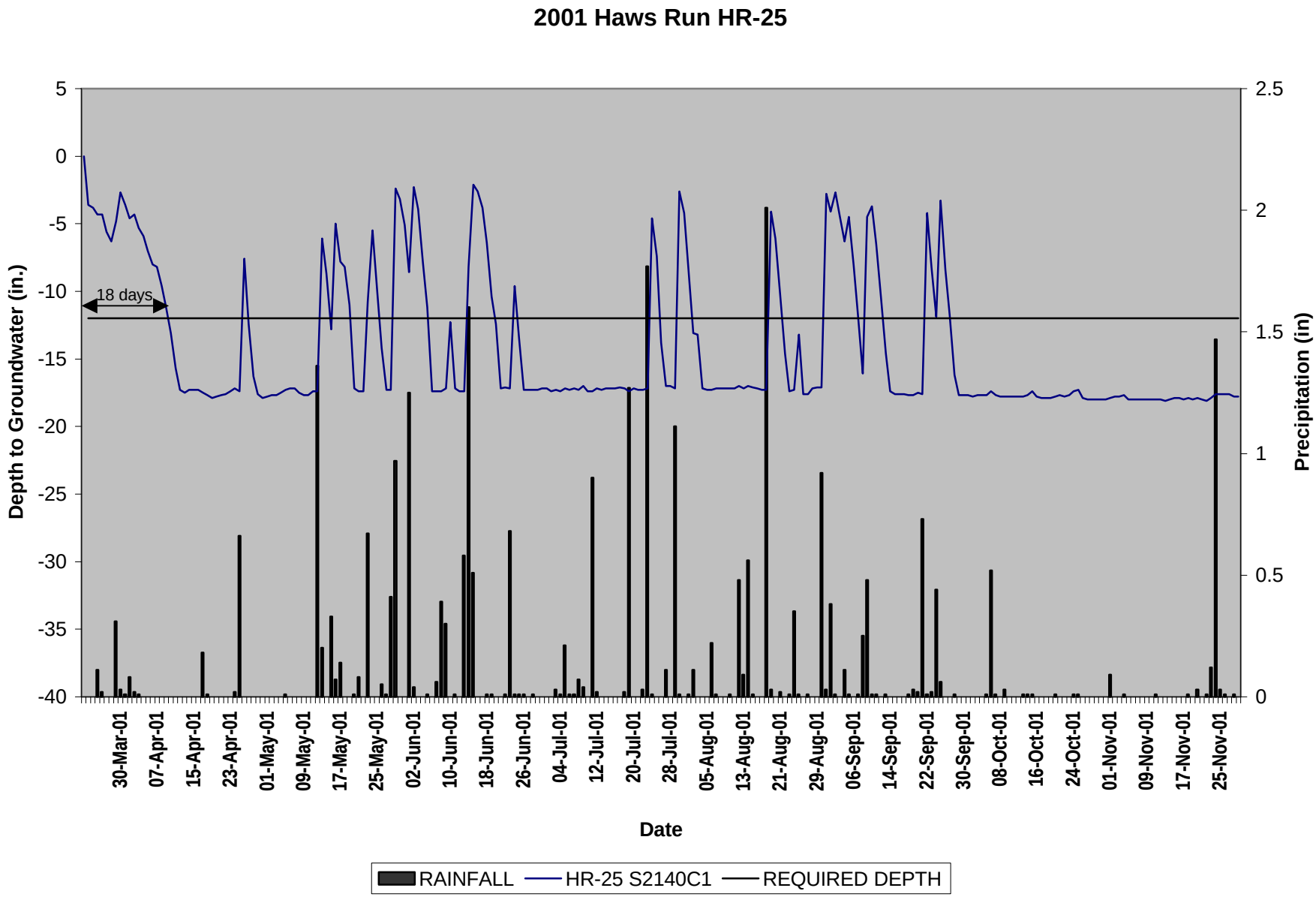

2001 Haws Run HR-20
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
88 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-20 S3173ED
REQUIRED DEPTH


2001 Haws Run HR-21
Depth to Groundwater (in.)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
2.5
2
1.5
1
0.5
0
73 days
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-21 S342D77
REQUIRED DEPTH

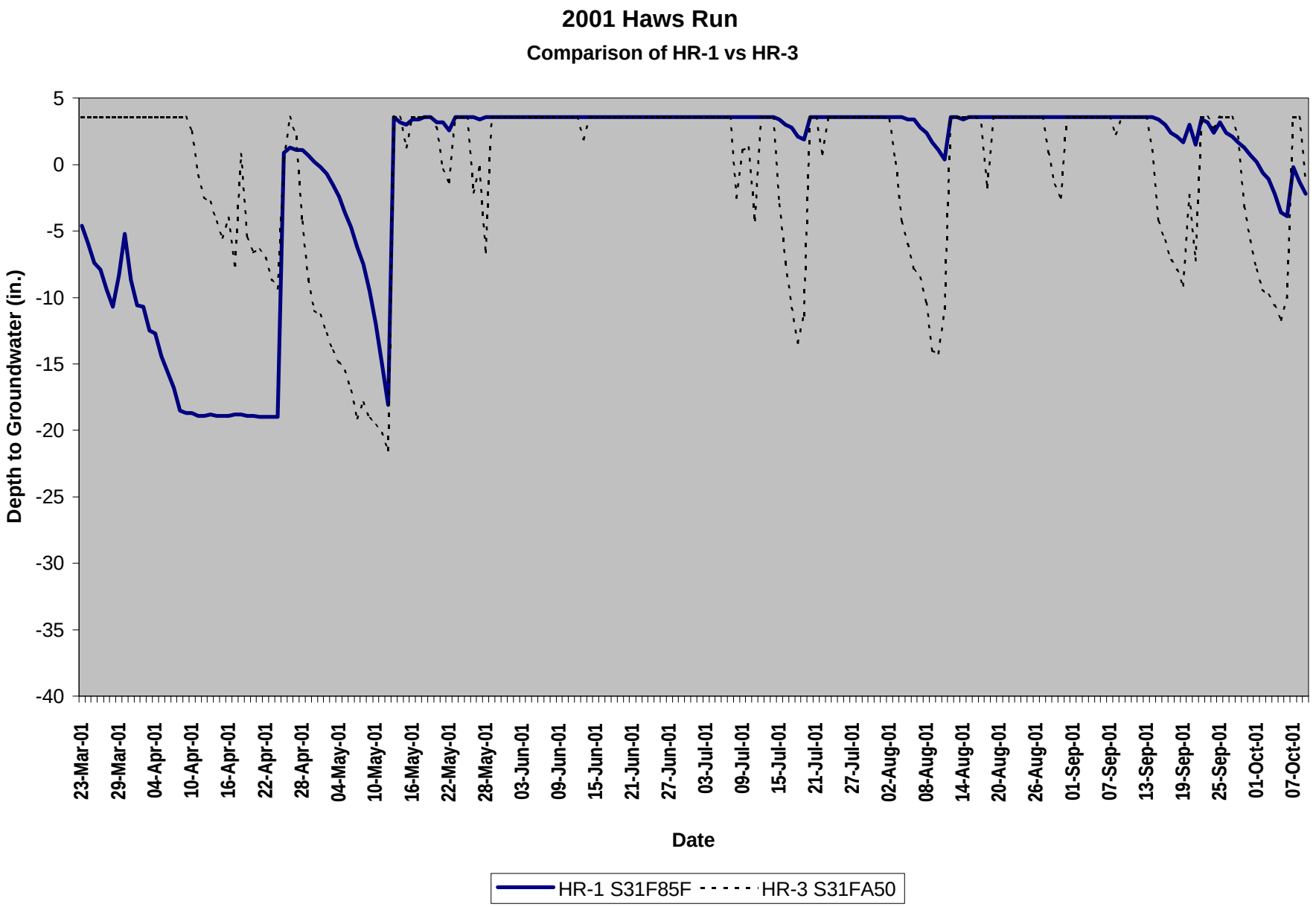

2001 Haws Run HR-22
Depth to Groundwater (in.)
Precipitation (in)
Date
21 days
missing data
from download
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
RAINFALL
HR-22 S213959
REQUIRED DEPTH

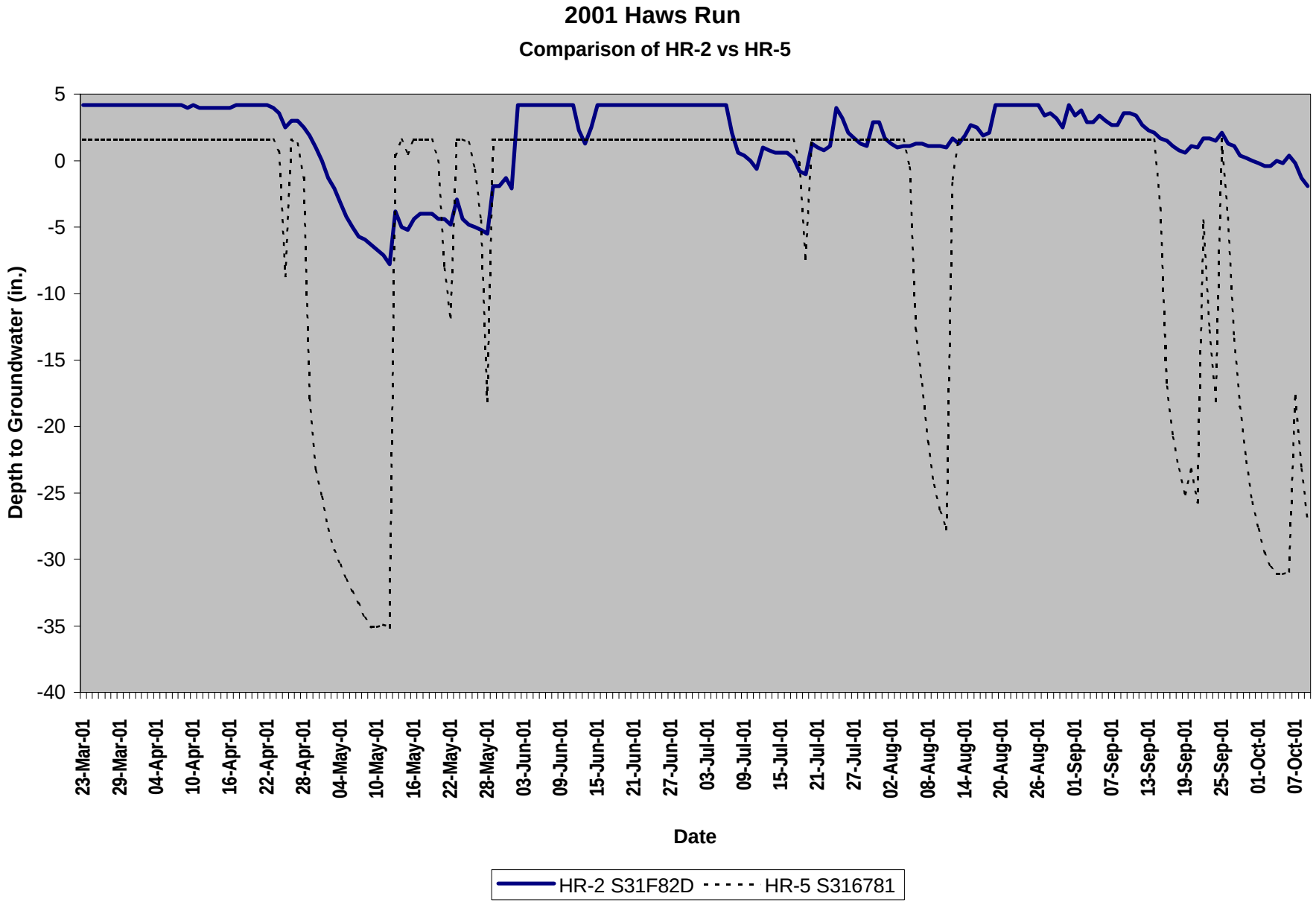

2001 Haws Run HR-23
Depth to Groundwater (in.)
Precipitation (in)
18 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-23 S21393B
REQUIRED DEPTH

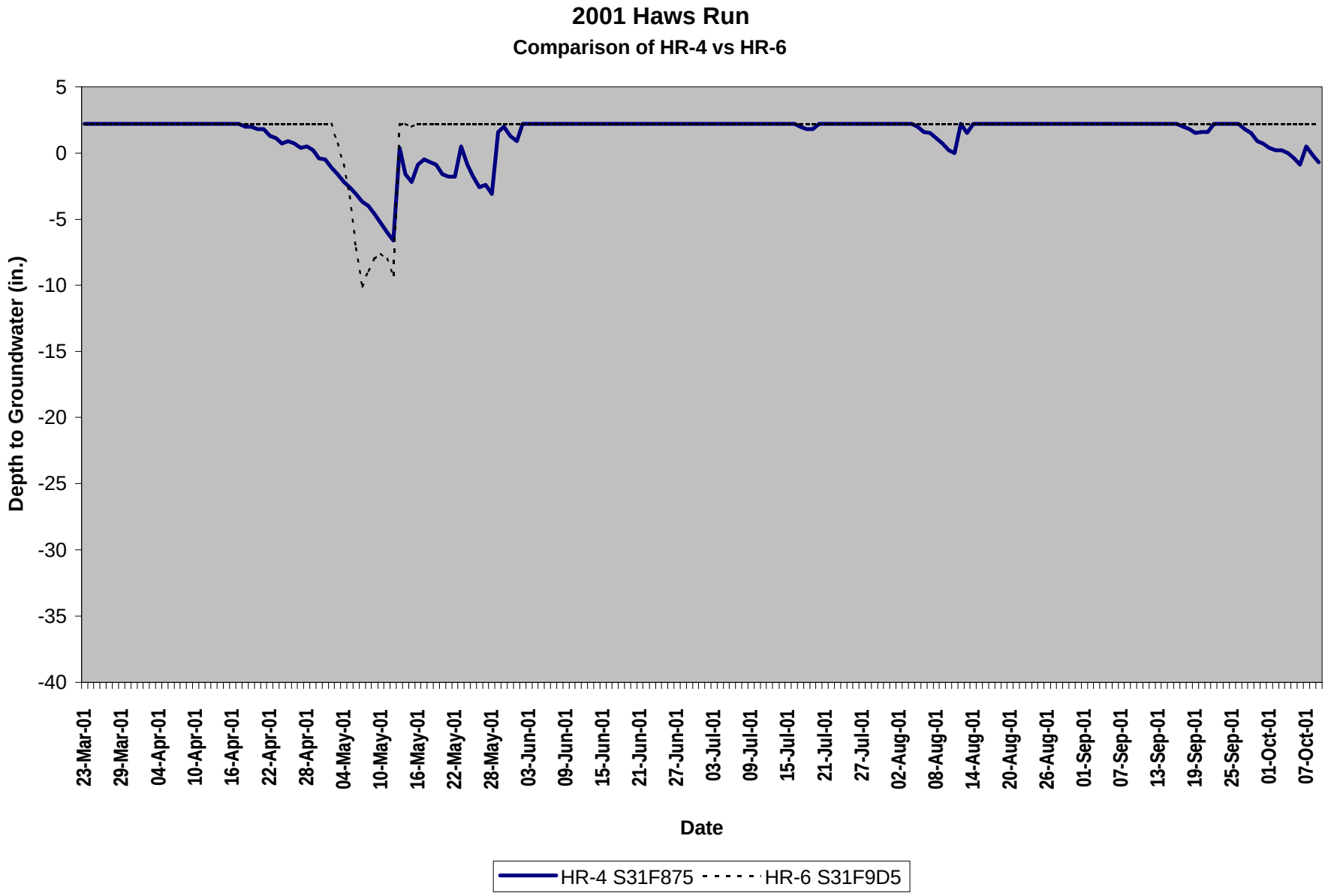

2001 Haws Run HR-24
Depth to Groundwater (in.)
Precipitation (in)
Date
11 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
RAINFALL
HR-24 S1EC84B
REQUIRED DEPTH


2001 Haws Run HR-25
Depth to Groundwater (in.)
Precipitation (in)
18 days
5
0
-5
-10
-15
-20
-25
-30
-35
-40
2.5
2
1.5
1
0.5
0
30-Mar-01
07-Apr-01
15-Apr-01
23-Apr-01
01-May-01
09-May-01
17-May-01
25-May-01
02-Jun-01
10-Jun-01
18-Jun-01
26-Jun-01
04-Jul-01
12-Jul-01
20-Jul-01
28-Jul-01
05-Aug-01
13-Aug-01
21-Aug-01
29-Aug-01
06-Sep-01
14-Sep-01
22-Sep-01
30-Sep-01
08-Oct-01
16-Oct-01
24-Oct-01
01-Nov-01
09-Nov-01
17-Nov-01
25-Nov-01
Date
RAINFALL
HR-25 S2140C1
REQUIRED DEPTH

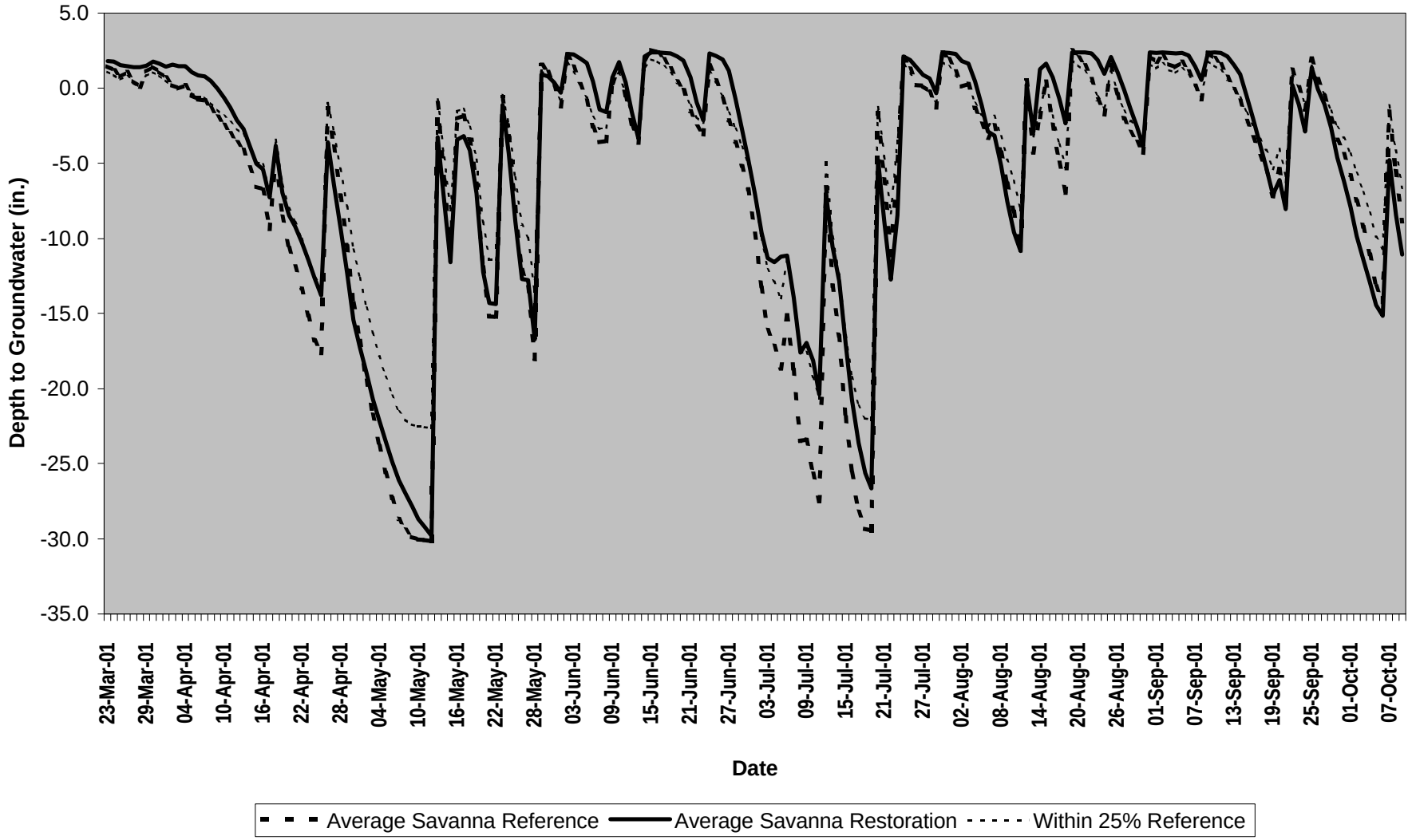
Appendix B
Comparison of Reference and Restoration Gauges


2001 Haws Run
Comparison of HR-1 vs HR-3
Depth to Groundwater (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
23-Mar-01
29-Mar-01
04-Apr-01
10-Apr-01
16-Apr-01
22-Apr-01
28-Apr-01
04-May-01
10-May-01
16-May-01
22-May-01
28-May-01
03-Jun-01
09-Jun-01
15-Jun-01
21-Jun-01
27-Jun-01
03-Jul-01
09-Jul-01
15-Jul-01
21-Jul-01
27-Jul-01
02-Aug-01
08-Aug-01
14-Aug-01
20-Aug-01
26-Aug-01
01-Sep-01
07-Sep-01
13-Sep-01
19-Sep-01
25-Sep-01
01-Oct-01
07-Oct-01
Date
HR-1 S31F85F
HR-3 S31FA50

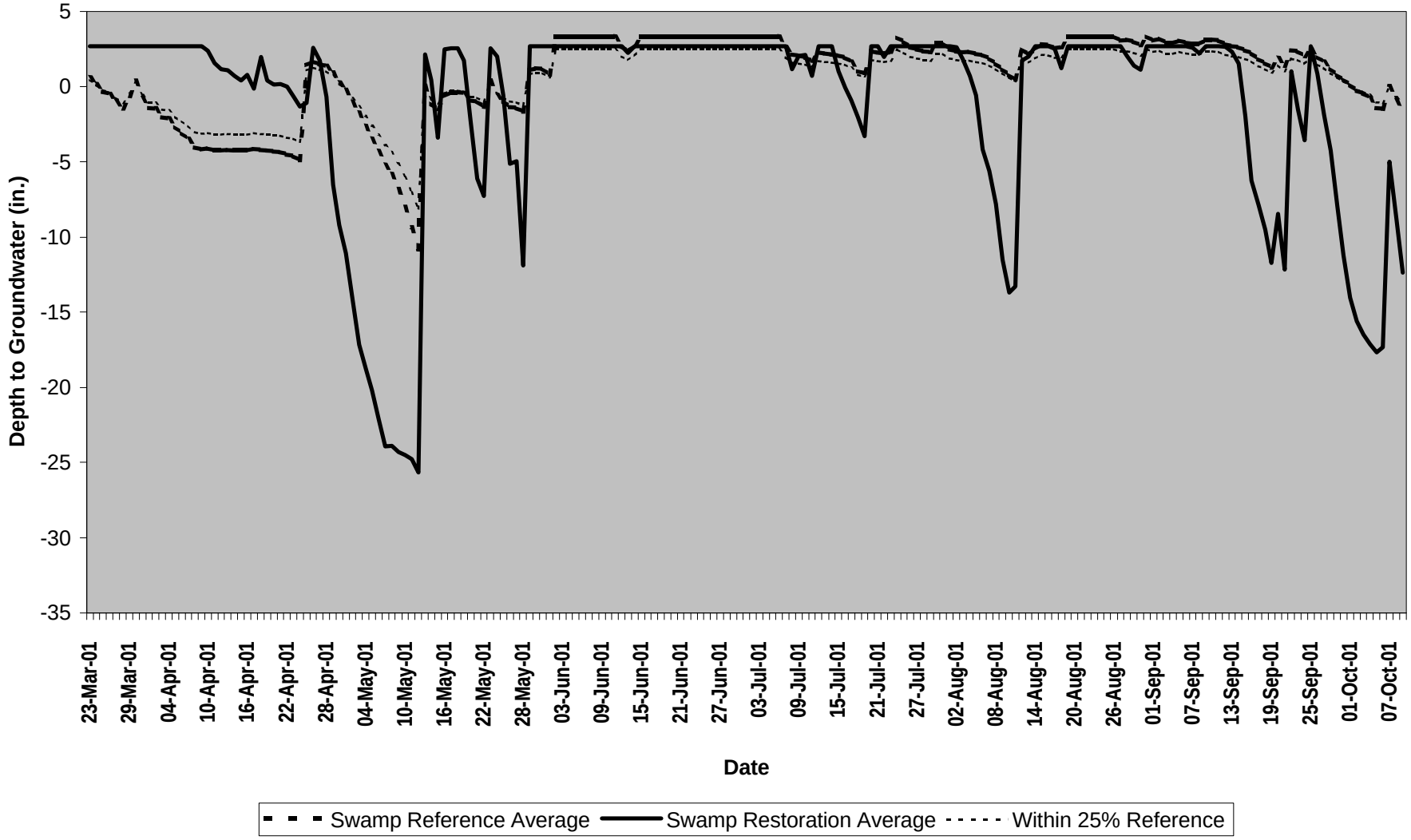

2001 Haws Run
Comparison of HR-2 vs HR-5
Depth to Groundwater (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
23-Mar-01
29-Mar-01
04-Apr-01
10-Apr-01
16-Apr-01
22-Apr-01
28-Apr-01
04-May-01
10-May-01
16-May-01
22-May-01
28-May-01
03-Jun-01
09-Jun-01
15-Jun-01
21-Jun-01
27-Jun-01
03-Jul-01
09-Jul-01
15-Jul-01
21-Jul-01
27-Jul-01
02-Aug-01
08-Aug-01
14-Aug-01
20-Aug-01
26-Aug-01
01-Sep-01
07-Sep-01
13-Sep-01
19-Sep-01
25-Sep-01
01-Oct-01
07-Oct-01
Date
HR-2 S31F82D
HR-5 S316781

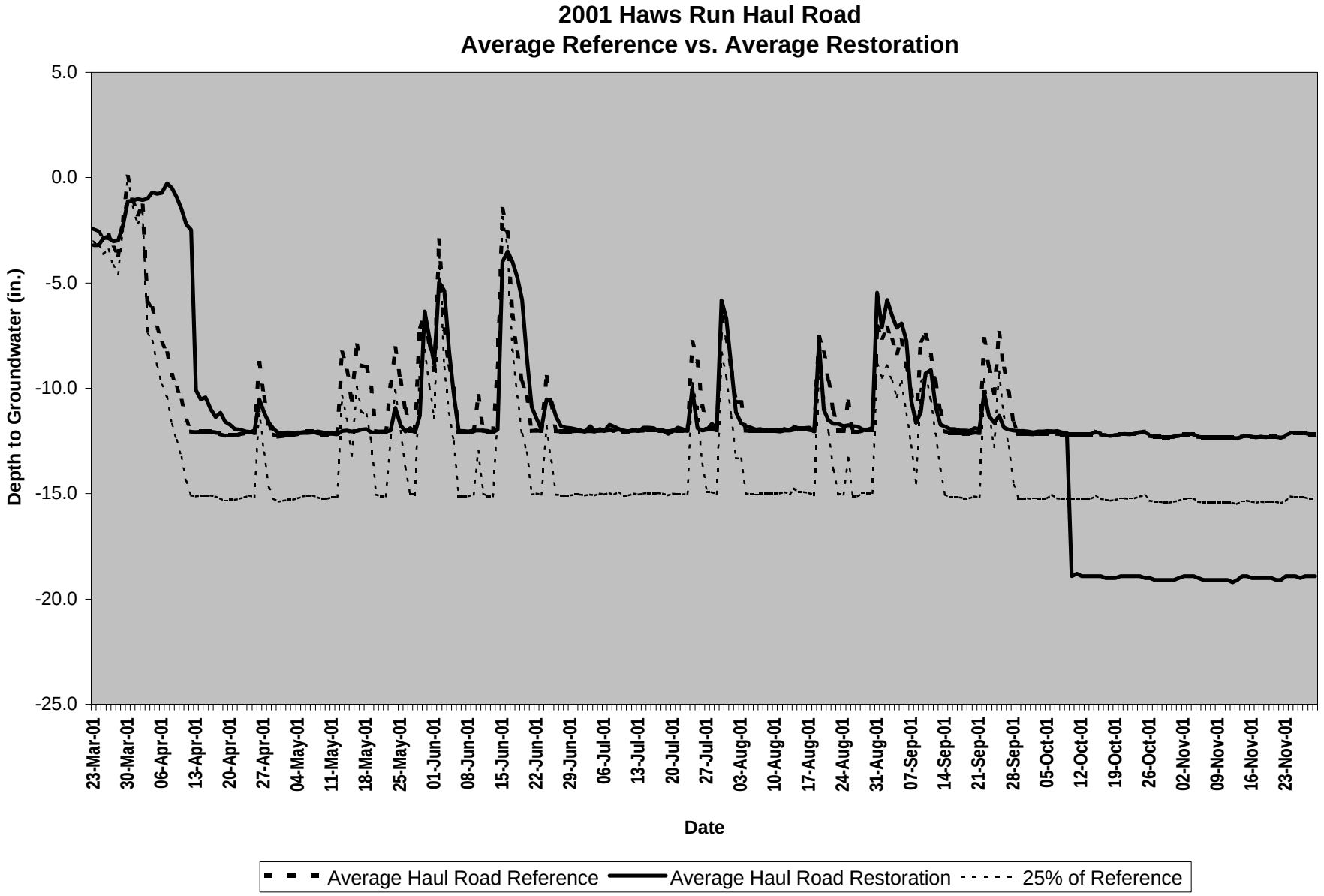

2001 Haws Run
Comparison of HR-4 vs HR-6
Depth to Groundwater (in.)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
23-Mar-01
29-Mar-01
04-Apr-01
10-Apr-01
16-Apr-01
22-Apr-01
28-Apr-01
04-May-01
10-May-01
16-May-01
22-May-01
28-May-01
03-Jun-01
09-Jun-01
15-Jun-01
21-Jun-01
27-Jun-01
03-Jul-01
09-Jul-01
15-Jul-01
21-Jul-01
27-Jul-01
02-Aug-01
08-Aug-01
14-Aug-01
20-Aug-01
26-Aug-01
01-Sep-01
07-Sep-01
13-Sep-01
19-Sep-01
25-Sep-01
01-Oct-01
07-Oct-01
Date
HR-4 S31F875
HR-6 S31F9D5

2001 Haws Run Savanna
Average Reference vs. Average Restoration



2001 Swamp Forest
Average Reference vs. Average Restoration




2001 Haws Run Haul Road
Average Reference vs. Average Restoration
Depth to Groundwater (in.)
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
23-Mar-01
30-Mar-01
06-Apr-01
13-Apr-01
20-Apr-01
27-Apr-01
04-May-01
11-May-01
18-May-01
25-May-01
01-Jun-01
08-Jun-01
15-Jun-01
22-Jun-01
29-Jun-01
06-Jul-01
13-Jul-01
20-Jul-01
27-Jul-01
03-Aug-01
10-Aug-01
17-Aug-01
24-Aug-01
31-Aug-01
07-Sep-01
14-Sep-01
21-Sep-01
28-Sep-01
05-Oct-01
12-Oct-01
19-Oct-01
26-Oct-01
02-Nov-01
09-Nov-01
16-Nov-01
23-Nov-01
Date
Average Haul Road Reference
Average Haul Road Restoration
25% of Reference

Appendix C Site Photos

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

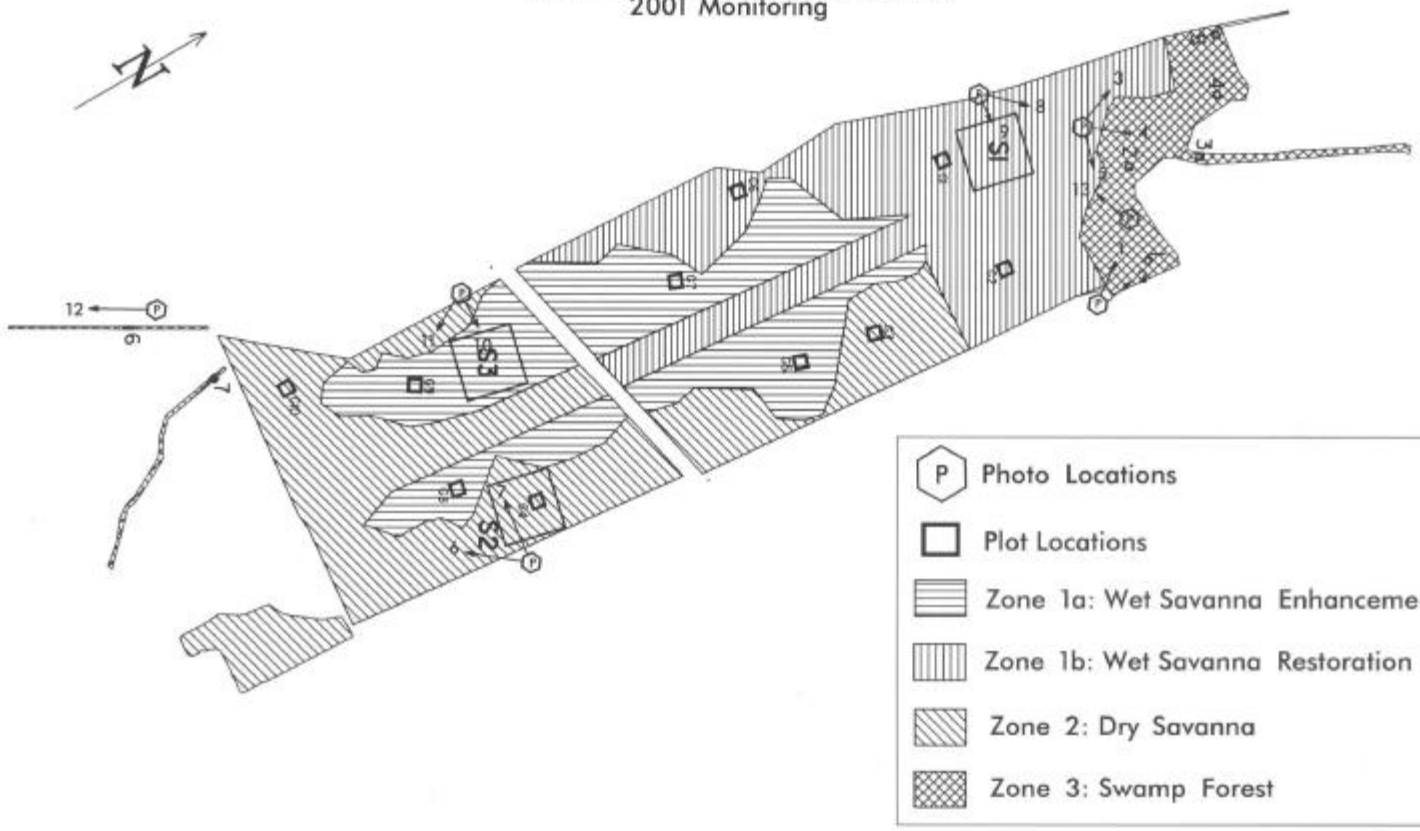
Photo 11

Photo 12

Photo 13

HAWS RUN MITIGATION SITE

Planting Plan
Photo Locations, and Plot Locations
2001 Monitoring



Appendix D

Slope Repair Plan

Haws Run
Pender and Onslow Counties
Tip Project R-2405WM

State Project Number 6.259002T

June 8, 2000

Project Description

The Haws Run Mitigation site was purchased in 1995 by the NCDOT to provide compensatory mitigation for unavoidable impacts to wetlands resulting from highway construction in the region. Haws Run provides the following types of mitigation:

Bottomland HW	30 ac restoration, 25 ac enhancement, 171 ac preservation
Pine Savanna	81 ac restoration, 99 ac enhancement, 11 ac preservation
Mesic Savanna	113 ac enhancement

Northern Slope Erosion

Several washouts have occurred along the northern side of the site adjacent to the swamp forest area. Rapid rising of the water table underneath the pine savanna during Hurricane Floyd rainfall had resulted in slope failures where the water table surfaces near the swamp. These failures experienced further headwall erosion to the point where they acted as foci for surface water runoff, also drastically increased during the hurricane. These washouts resulted in the deposition of some sediment into the swamp forest area.

Proposed Slope Repair

NCDOT recommends grading the slope to 4:1 and backfilling the washouts. This reduced slope will minimize the potential for failure during rapid rises in the savanna area water table and erosion by surface water runoff. NCDOT recommends installing stone lined drainage channels for surface water drainage from savanna to swamp forest. NCDOT also recommends providing a low berm at top of slope along northern perimeter to direct water toward drainage channels. This should eliminate the potential of surface erosion on the slope face between the savanna and the swamp forest.

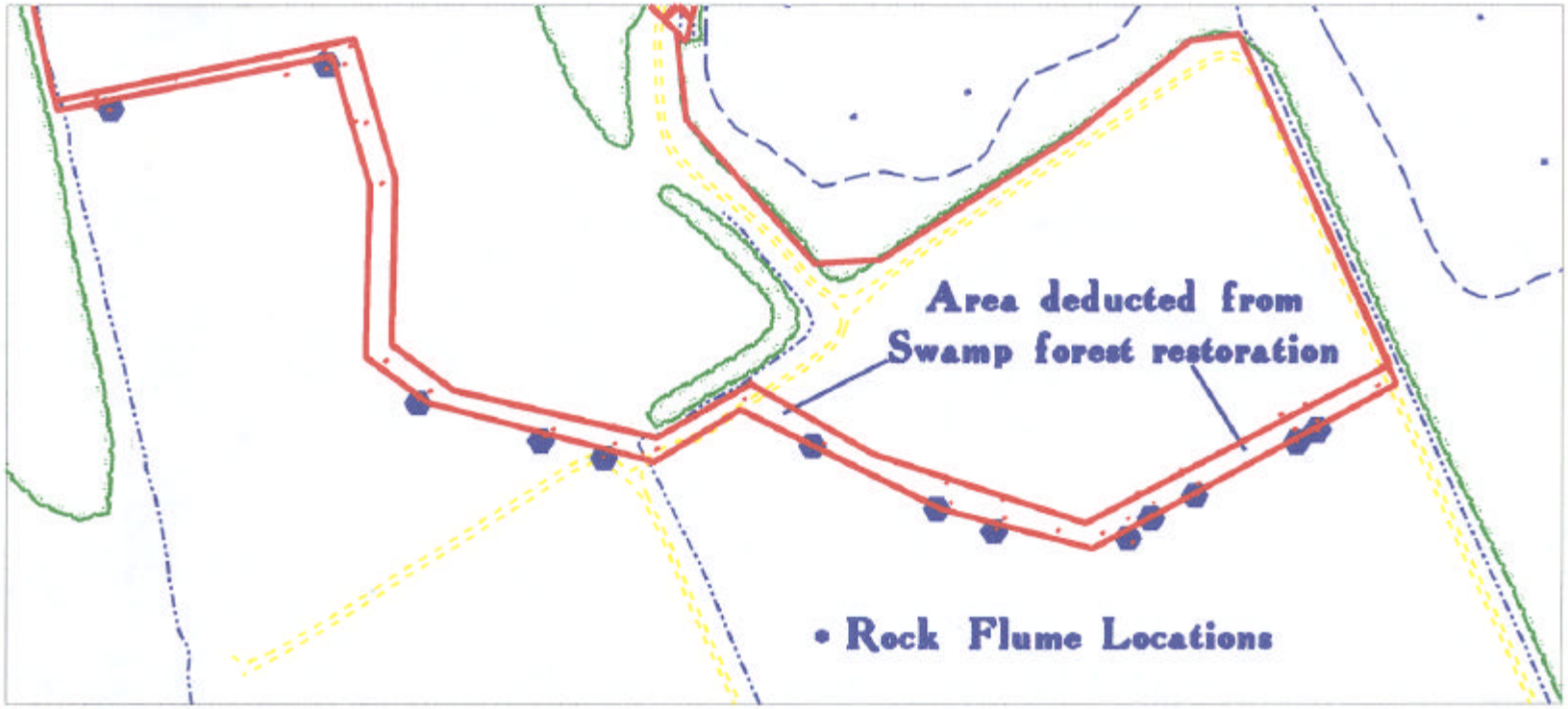
Sediment Deposition in Swamp Forest

At the toe of the slope where erosion has deposited sediment into the swamp forest, NCDOT proposes to leave this material undisturbed for the following reasons:

1. The sediment layer represents a minor change in swamp forest topography as one would find in nature.
2. The sediment layer has not adversely impacted the planted trees.
3. The NCDOT feels it would do more harm than good by moving equipment in (and out) to try and pull this small amount of material out of swamp forest.

Proposed Schedule

Early June –	Resource agency approval to proceed
July 1 –	Bid Package to Division
September 1 –	Repair of slope to begin
November 1 -	Repair completed


Area deducted from
Swamp forest restoration
• Rock Flume Locations
...\Paugh\hawsruncadd\flumes.dgn 02/11/2002 08:27:50 AM

Wetland Debits

Rivers Run	IMC Plan			Radius	TIP CREDIT	TIP CREDIT	TIP CREDIT	TIP CREDIT	TIP CREDIT	TIP CREDIT	TIP CREDIT	TIP CREDIT
Pender/Onslow Co.												
Habitat	Acres at Start	Acres Remaining			U-2107	R-3405C	U-3616	R-2633CC	U-2734	Sec. Rd. (Pender)	U-92A	R-2405A
Swamp Forest Restoration	26	3.12	12.00		14.0				3.0	0.84	0.14	4.0
Swamp Forest Enhancement	26	26	100.00									
Swamp Forest Preservation	171	171	100.00									
Wet Savanna Restoration	81	49.35	60.84			14.64	17					
Wet Savanna Enhancement	89	89	100.00									
Wet Savanna Preservation	11	11	100.00									
Dry Savanna Enhancement	113	113	100.00									
TOTAL	475	443.56	93.34					proposed	proposed			