

MBMG OPEN-FILE REPORT 436

**BASIC HYDROGEOLOGIC DATA FOR:
THE WEST-BILLINGS AREA (1999-2000), YELLOWSTONE COUNTY,
MONTANA**

**John L. Olson
Jon C. Reiten**

Montana Bureau of Mines and Geology

**Prepared in cooperation with the
Yellowstone Conservation District**

June, 2001

TABLE OF CONTENTS

INTRODUCTION	1
LOCATION SYSTEM	2
GROUND-WATER DATA	3
Ground-Water Quality Analyses	4
Stable Isotope Analyses.....	7
Tritium-Helium-3 Analyses	8
Well Hydrographs.....	9
 SURFACE-WATER DATA	81
Surface-Water Quality Analyses	82
Surface-Water Field Measurements	85
Automated Probe Data, Canyon Creek, 1999	100

INTRODUCTION

The following report is a compilation of ground-water and surface-water monitoring data collected in the west-Billings area, in Yellowstone County, Montana between January 1999 and April 2001. Data in this document supplement a separate MBMG report titled "Hydrogeology of the West-Billings Area: Impacts of Land-Use Changes on Water Resources" (Olson and Reiten, 2002). The project area includes the Yellowstone River valley from Division Street in the City of Billings, and west to approximately the Yellowstone County line. Data collection and compilation were completed by the MBMG as part of a project sponsored and administered by the Yellowstone Conservation District. The project was primarily funded by a Clean Water Act Section 319 grant administered by the Montana Department of Environmental Quality (DEQ). Additional funding and support were provided by the Montana Water Center, the US Bureau of Reclamation, and the Montana Department of Natural Resources.

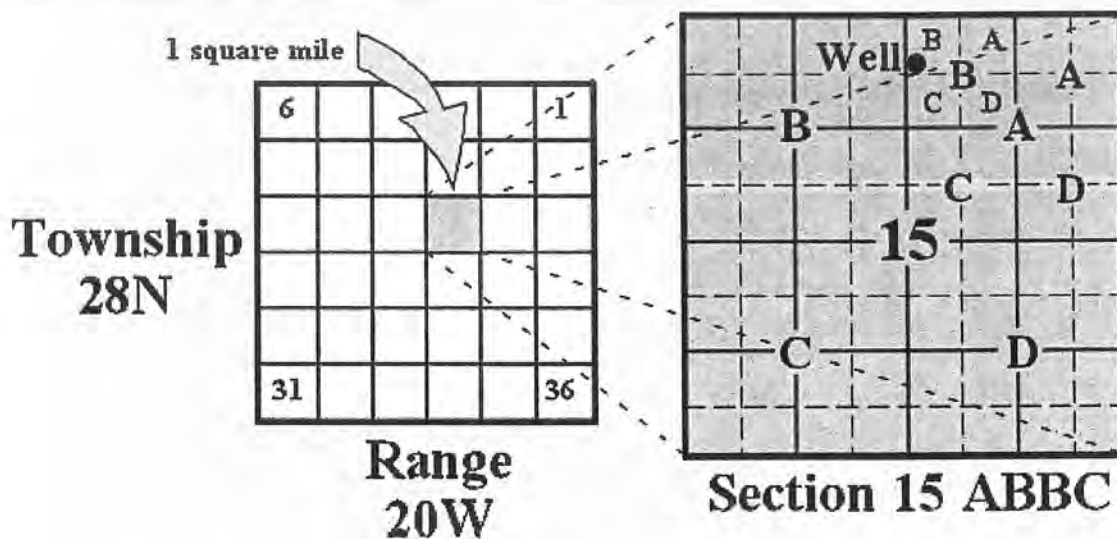
LOCATION SYSTEM

Locations of monitoring and other data sites are located based on the U.S Bureau of Land Management system of subdivision of public lands. The first identifier number indicates the township north or south of the base line; the second, the range east or west of the principal meridian and the third, the section in which the site is located (see example and figure below). The letters following the section number identify the location within the section by successive quarter divisions.

It is important to note that the order of quarter-tract designations is exactly reverse from that commonly used by surveyors; here the order begins with the largest quarter and progresses to the smallest. Thus in the example above, the described sites would have a legal description of the SW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of the NE $\frac{1}{4}$ in Section 15 Township 20 North, Range 20 West.

Example: Find well number M:35209 located in 28N 20W 15 ABBC

To locate the well in the Township, Range, and Section, read the tract (ABCD) designations from left to right, largest tract to smallest tract. Beginning in the center of the section, travel to the 'A' in the center of the northeast quarter. From there, travel to the 'B' in the center of the northwest quarter of the northeast quarter. From there travel to the 'B' in the northwest quarter of the northwest quarter of the northeast quarter. From there, travel to the 'C' or southwest quarter of the northwest quarter of the northwest quarter of the northeast quarter of section 15.



GROUND-WATER DATA

Ground-water sample analyses

Mnumber	Site Name	Location (TRS)	Sample Date and Time	Lab pH	Field pH	Lab Conductance (umhos)	Field Conductance (umhos)	Field Water Temperature oC
92840	Apostle Lutheran	01S-25E-1-CBBB	9/28/1999 10:30	7.91	7.23	2540	2800	--
93058	Giessick-0	01S-25E-8-BAAA	9/21/1999 15:00	7.41	7.49	3660	4040	17.4
93305	Eldergrove	01S-25E-18-DDDC	9/29/1999 15:30	8.00	7.52	1533	1564	12.2
98264	Thom	02S-24E-22-CBCC	10/1/1999 10:30	7.85	7.55	649		15.2
151382	Church of Christ	01S-25E-4-DDDC	9/29/1999 16:00	--	--			--
154210	Gable	01S-25E-26-AADD	9/29/1999 14:20	--	7.24		2030	13.2
171243	Slough-1	01S-25E-15-ACCC	9/29/1999 13:45	7.87	7.41	3510	4000	11.8
171243	Slough-1	01S-25E-15-ACCC	2/2/2000 0:00		7.65			10.9
171243	Slough-1	01S-25E-15-ACCC	3/20/2000 0:00	7.45	7.49	3610	3500	11.7
171243	Slough-1	01S-25E-15-ACCC	6/22/2000 0:00		7.35		3320	11.4
171243	Slough-1	01S-25E-15-ACCC	7/31/2000 10:05		7.52		3510	12.1
171246	Bell-1	01S-25E-10-AABC	9/21/1999 14:20	7.52	7.32	1312	1290	13.1
171246	Bell-1	01S-25E-10-AABC	2/11/2000 0:00		7.4		1352	12
171246	Bell-1	01S-25E-10-AABC	3/20/2000 7:26	7.34	7.51	1220	1000	11.4
171246	Bell-1	01S-25E-10-AABC	6/22/2000 14:25		7.32		1280	11.9
171246	Bell-1	01S-25E-10-AABC	7/31/2000 10:30		7.43		1160	12.2
171247	Giessick-1	01S-25E-8-ABBB	9/21/1999 15:30	7.45	7.42	5720	6300	13.6
171247	Giessick-1	01S-25E-8-ABBB	3/20/2000 13:40	7.36	7.82	5900		7.82
171247	Giessick-1	01S-25E-8-ABBB	6/22/2000 14:02		7.19		5790	11.1
171248	Thomas-1	01S-25E-29-BCCC	9/23/1999 8:30	7.48	7.75	1116	1120	14.1
171248	Thomas-1	01S-25E-29-BCCC	1/5/2000 0:00		7.27		2000	11.9
171248	Thomas-1	01S-25E-29-BCCC	3/20/2000 20:24	7.19	7.39	1962	1700	10.8
171248	Thomas-1	01S-25E-29-BCCC	6/22/2000 11:20		7.35		680	11.9
171250	Jones-2	01S-25E-21-DDAD	9/21/1999 9:20	7.59	7.68	696	770	12.7
171250	Jones-2	01S-25E-21-DDAD	7/31/2000 9:30		7.58		677	12.7
171251	Saunders-1	01S-25E-21-DAAA	9/21/1999 10:00	7.39	7.4	1087	747	12.7
171252	Saunders-2	01S-25E-21-DAAA	9/21/1999 10:45	7.39	7.34	1826	1917	14.2
171253	Bond-1	02S-25E-4-BBAB	9/23/1999 9:00	7.32	7.43	734	756	12.6
171253	Bond-1	02S-25E-4-BBAB	3/20/2000 0:00	7.36	7.64	599	1400	7.6
171253	Bond-1	02S-25E-4-BBAB	6/22/2000 11:00		7.39		603	10.2
171253	Bond-1	02S-25E-4-BBAB	7/31/2000 0:00		7.45		610	12.3
171256	Weber-1	01S-26E-18-DDCC	9/20/1999 10:57	7.75	7.63	1398	1190	16.7
171257	Armstrong-1	01S-26E-19-BBBD	9/22/1999 10:10	7.49	7.53	991	1070	13.4
171257	Armstrong-1	01S-26E-19-BBBD	1/5/2000 0:00		7.53		1209	12.4
171257	Armstrong-1	01S-26E-19-BBBD	3/20/2000 17:02	7.49	7.59	1120		12.3
171257	Armstrong-1	01S-26E-19-BBBD	6/22/2000 9:55		7.45		1075	13.9
171257	Armstrong-1	01S-26E-19-BBBD	7/31/2000 9:00		7.66		1071	14.1
171258	Goodman-1	01S-25E-25-BCBC	9/22/1999 9:00	7.42	7.45	1563	1633	11.6
171259	Ditchfalls-1	02S-24E-4-CDAA	9/23/1999 10:30	7.67	7.73	725	764	17.9
171261	Golfeast	02S-24E-7-DAAA	9/30/1999 10:00	7.82	7.37	4890	5200	11.5
171261	Golfeast	02S-24E-7-DAAA	2/2/2000 0:00		7.84			10.9
171261	Golfeast	02S-24E-7-DAAA	3/20/2000 0:00	6.9	7.68	4480	4500	11.9
171261	Golfeast	02S-24E-7-DAAA	6/22/2000 0:00		7.33		4100	12.2
171261	Golfeast	02S-24E-7-DAAA	7/31/2000 11:35		7.39		3750	12.6
171262	Golfwest	02S-24E-7-BCBD	10/6/1999 12:00	7.63		2310	2360	12.2
171263	Streck-1	02S-24E-19-BCCC	9/30/1999 0:00	8.37	7.48	1720	1850	12.6
171263	Streck-1	02S-24E-19-BCCC	2/2/2000 0:00		7.54			9.7
171263	Streck-1	02S-24E-19-BCCC	3/2/2000 0:00	7.4	7.52	1820	1800	11.2
171263	Streck-1	02S-24E-19-BCCC	6/22/2000 13:25		7.54		1766	11.8
171264	Shay-1	02S-23E-13-BBAB	10/6/1999 12:40	7.83		2220	2200	12.2
171264	Shay-1	02S-23E-13-BBAB	2/2/2000 0:00		7.74		2100	9.9
171264	Shay-1	02S-23E-13-BBAB	3/20/2000 0:43	7.4	7.5	2200	1800	12.4
171264	Shay-1	02S-23E-13-BBAB	6/22/2000 13:00		7.46		2190	11.9
171265	Firpark-1	02S-24E-10-BACD	9/23/1999 0:00	7.51		2160		14.5
172300	Olsen	01S-25E-17-BBBB	10/6/1999 10:00	7.89	7.38	2210	2200	12.9

Ground-water sample analyses

Common ions (milligrams per liter)

Mnumber	Calcium	Chloride	Bicarbonate	Carbonate	Fluoride	Iron	Potassium	Magnesium	Manganese	Sodium	Nitrate (as N)	Nitrite (as N)	Total Phosphate	Ortho-Phosphate	Silicate	Sulfate
92840	208.0	36.80	594.1	<1	<.5	<.05	7.63	132.0	<.01	281	5.44	--	<.05	<.5	26.7	1,198
93058	331.0	26.42	388.0	<1	<1.0	<.05	8.85	184.0	.014	440	12.26	--	<1.0	<1.0	21.5	2,133
93305	104.0	11.59	572.2	<1	<.5	<.025	4.24	71.4	.034	200	4.85	--	<.05	<.5	15.2	419
98264	86.2	4.46	329.9	<1	<.5	.034	3.38	28.2	.006	32	1.86	--	<.05	<.5	25.9	140
151382	--	--	--	--	--	--	--	--	--	--	<.05	--	--	--	--	--
154210	--	--	--	--	--	--	--	--	--	--	9.08	--	--	--	--	--
171243	139.0	22.32	512.4	<1	<.5	<.05	7.96	138.0	.121	641	1.36	--	<.5	<.5	18.7	1,965
171243	--	--	--	--	--	--	--	--	--	--	0.58	--	--	--	--	--
171243	144.0	19.10	511.2	<1	1.151	<.05	8.55	137.0	.099	697	3.63	<.05	<1.0	<1.0	20.0	1,939
171243	--	--	--	--	--	--	--	--	--	--	3.59	--	--	--	--	--
171243	--	--	--	--	--	--	--	--	--	--	1.22	--	--	--	--	--
171246	120.0	14.87	567.3	<1	0.55	<.025	3.95	64.7	.526	90	5.55	--	<.05	<.5	14.9	329
171246	--	--	--	--	--	--	--	--	--	--	4.28	--	--	--	--	--
171246	129.0	12.58	512.4	<1	0.60	1.17	3.44	68.2	.462	84	4.90	<.05	<.05	<.5	20.3	313
171246	--	--	--	--	--	--	--	--	--	--	5.35	--	--	--	--	--
171246	--	--	--	--	--	--	--	--	--	--	5.80	--	--	--	--	--
171247	492.0	31.31	549.0	<1	<.5	<.01	11.8	434.0	.987	874	<.05	--	<.5	<.5	13.4	3,953
171247	415.0	41.46	586.8	<1	<.5	<.1	12.2	440.0	.555	1,100	<.5	<.5	<.5	<.5	14.4	4,606
171247	--	--	--	--	--	--	--	--	--	--	<.05	--	--	--	--	--
171248	99.2	8.52	343.1	<1	.531	.068	5.30	52.2	1.70	64	0.52	--	<.05	<.05	17.5	340
171248	--	--	--	--	--	--	--	--	--	--	0.64	--	--	--	--	--
171248	215.0	18.34	410.4	<1	0.53	<.05	7.52	123.0	.605	143	1.80	<.05	<.05	<.05	21.9	843
171248	--	--	--	--	--	--	--	--	--	--	0.06	--	--	--	--	--
171250	72.0	9.17	370.4	<1	0.56	<.01	4.97	28.8	.092	45	8.61	--	<.05	<.05	17.5	108
171250	--	--	--	--	--	--	--	--	--	--	7.00	--	--	--	--	--
171251	64.9	12.38	396.7	<1	0.53	.125	3.83	36.9	.062	104	<.05	--	<.05	<.05	11.5	225
171252	128.0	25.00	557.5	<1	0.57	<.025	4.91	90.5	.499	200	<.05	--	<.05	<.05	11.3	629
171253	60.8	11.46	385.5	<1	0.66	<.01	3.25	29.4	.202	46	5.13	--	<.05	<.05	21.0	58
171253	60.3	9.75	369.9	<1	0.58	<.015	2.66	30.0	.116	43	0.64	<.05	<.05	<.05	23.6	54
171253	--	--	--	--	--	--	--	--	--	--	0.92	--	--	--	--	--
171253	--	--	--	--	--	--	--	--	--	--	0.17	--	--	--	--	--
171256	101.0	32.10	379.4	<1	0.82	<.005	8.63	62.5	1.31	161	3.56	--	<.05	<.05	16.9	476
171257	74.2	9.74	331.8	<1	0.59	<.01	4.69	44.0	.474	73	6.27	--	<.05	<.05	8.86	170
171257	--	--	--	--	--	--	--	--	--	--	4.79	--	--	--	--	--
171257	102.0	13.78	449.0	<1	0.63	<.025	5.37	61.0	.067	83	2.30	<.05	<.05	<.05	12.6	307
171257	--	--	--	--	--	--	--	--	--	--	4.42	--	--	--	--	--
171257	--	--	--	--	--	--	--	--	--	--	9.74	--	--	--	--	--
171258	135.0	9.05	428.2	<1	<.05	<.025	6.51	63.4	.28	160	3.44	--	.50	.50	20.0	654
171259	63.4	16.82	278.2	<1	0.79	<.01	2.73	19.8	.119	69	<.05	--	<.05	<.05	18.9	170
171261	449.0	93.43	519.7	<1	<.5	<.1	11.2	281.0	1.57	668	5.27	--	<.5	<.5	19.9	3,061
171261	--	--	--	--	--	--	--	--	--	--	1.51	--	--	--	--	--
171261	449.0	77.98	341.6	<1	<.5	<.05	10.0	295.0	.330	606	4.06	<.5	<.5	<.5	21.6	2,931
171261	--	--	--	--	--	--	--	--	--	--	2.21	--	--	--	--	--
171261	--	--	--	--	--	--	--	--	--	--	1.50	--	--	--	--	--
171262	320.0	9.62	427.0	<1	<.05	<.05	5.76	141.0	.052	80	1.56	--	<.05	<.05	15.0	1,124
171263	126.0	18.51	461.2	<1	0.54	<.025	6.40	107.0	1.46	160	3.95	--	<.05	<.05	28.5	681
171263	--	--	--	--	--	--	--	--	--	--	5.05	--	--	--	--	--
171263	168.0	22.66	469.7	<1	0.58	<.05	7.80	146.0	1.52	250	7.17	<.05	<.05	<.05	30.2	874
171263	--	--	--	--	--	--	--	--	--	--	5.04	--	--	--	--	--
171264	238.0	46.47	488.0	<1	<.05	1.21	5.99	119.0	2.66	193	1.31	--	<.05	<.05	18.9	1,009
171264	--	--	--	--	--	--	--	--	--	--	<.05	--	--	--	--	--
171264	245.0	25.42	425.8	<1	<.05	.40	5.84	128.0	1.89	140	2.63	<.05	<.05	<.05	20.6	1,072
171264	--	--	--	--	--	--	--	--	--	--	0.87	--	--	--	--	--
171265	186.0	31.56	317.2	<1	0.73	<.025	4.67	68.5	.223	230	<.05	--	<.05	<.05	25.4	926
172300	159.0	12.39	405.0	<1	0.621	<.005	5.29	113.0	0.11	219	7.88	--	--	--	--	--

Trace metals (micrograms per liter)

6

Stable isotope analytical summary

Mnumber	Site Name	Location (TRS)	Sample Date	$\delta^{18}\text{O}$ (Water)	$\delta^2\text{H}$ (Water)	$\delta^{15}\text{N}$ (nitrate)	$\delta^{18}\text{O}$ (nitrate)	$\delta^{13}\text{C}$ (DIC)	$\delta^{34}\text{S}$ (Sulfate)
172389	BBWC	02S-24E-13-AABB	9/27/1999 10:00	-16.99	-133.2	-	-	-8.02	-2.59
171253	Bond	02S-25E-4-BBAB	7/31/2000 12:00	-	-	-	-	-	-
171246	Bell-1	01S-25E-10-AABC	7/31/2000 10:30	-	-	23	6.4	-	-
171250	Jones-2	01S-25E-21-DDAD	09/21/99 09:20	-17.29	-132.6	6.7	-	-14.89	-11.557
171250	Jones-2	01S-25E-21-DDAD	7/31/2000 9:30	-	-	15.3	0.43	-	-
92840	Apostle Lutheran	01S-25E-1-CBBB	09/28/99 10:30	-16.35	-126.6	18	-	-14.23	-13.37
93058	Giesick-0	01S 25E 25 BCBC	09/21/99 15:00	-17.26	-132.2	19.5	-	-13.11	-16.38
93305	Eldergrove	01S-25E-18-DDDC	09/29/99 15:30	-17.09	-132.2	14.1	-	-13.57	-10.11
93939	City of Billings, Comanche Park	01S 26E 8 BDDA	7/31/2000 12:15	-15.43	-	-	-	-	-
94118	City of Billings, Ponderosa Park	01S-26E-16-ABCB	7/31/2000 13:00	-16.55	-	15.1	0.68	-	-
151382	Church of Christ	01S-25E-4-DDDC	09/29/99 16:00	-	-	20.6	-	-	-
154210	Gable	01S-25E-26-AADD	09/29/99 14:20	-	-	8	-	-	-
158589	Crystal Springs Subdivision	01S 25E 33 ACDA	7/31/2000 12:30	-16.43	-	-	-	-	-
158941	Yellowstone County Club	01N-25E-30-BBCA	7/31/2000 10:50	-16.58	-	-	-	-	-
171243	Slough-1	01S-25E 15 ACCC	09/29/99 13:45	-16.93	-131.1	23.7	-	-11.78	-14.66
171243	Slough-1	01S-25E 15 ACCC	7/31/2000 10:05	-	-	24	**	-	-
171251	Saunders-1	01S 25E 21 DAAA	09/21/99 10:00	-16.69	-131.6	-	-	-13.45	-14.369
171252	Saunders-2	01S 25E 21 DAAA	09/21/99 10:45	-16.43	-130.1	-	-	-12.24	-13.165
171257	Armstrong	01S 26E 19 BBBD	09/22/99 10:10	-17.32	-134.1	9.4	-	-13.62	-9.289
171257	Armstrong	01S 26E 19 BBBD	7/31/2000 9:00	-	-	9.4	-1.10	-	-
171264	Shay	01S 23E 13 BBAB	10/06/99 12:40	-16.93	-129.7	16.8	-	-14.09	-11.69
171258	Goodman-1	01S 25E 25 BCBC	09/22/99 09:00	-17.39	-135.6	-	-	-13.67	-10.582
171261	Golf East	02S 24E 7 DAAA	09/30/99 10:00	-15.5	-126.4	18.8	-	-15.26	-24.24
171261	Golf East	02S 24E 7 DAAA	7/31/2000 11:35	-	-	18.8	**	-	-
---	July Rain Composite	01N-26E-32-ABBB	Jul-00	-7.11	-76.94	-	-	-	-

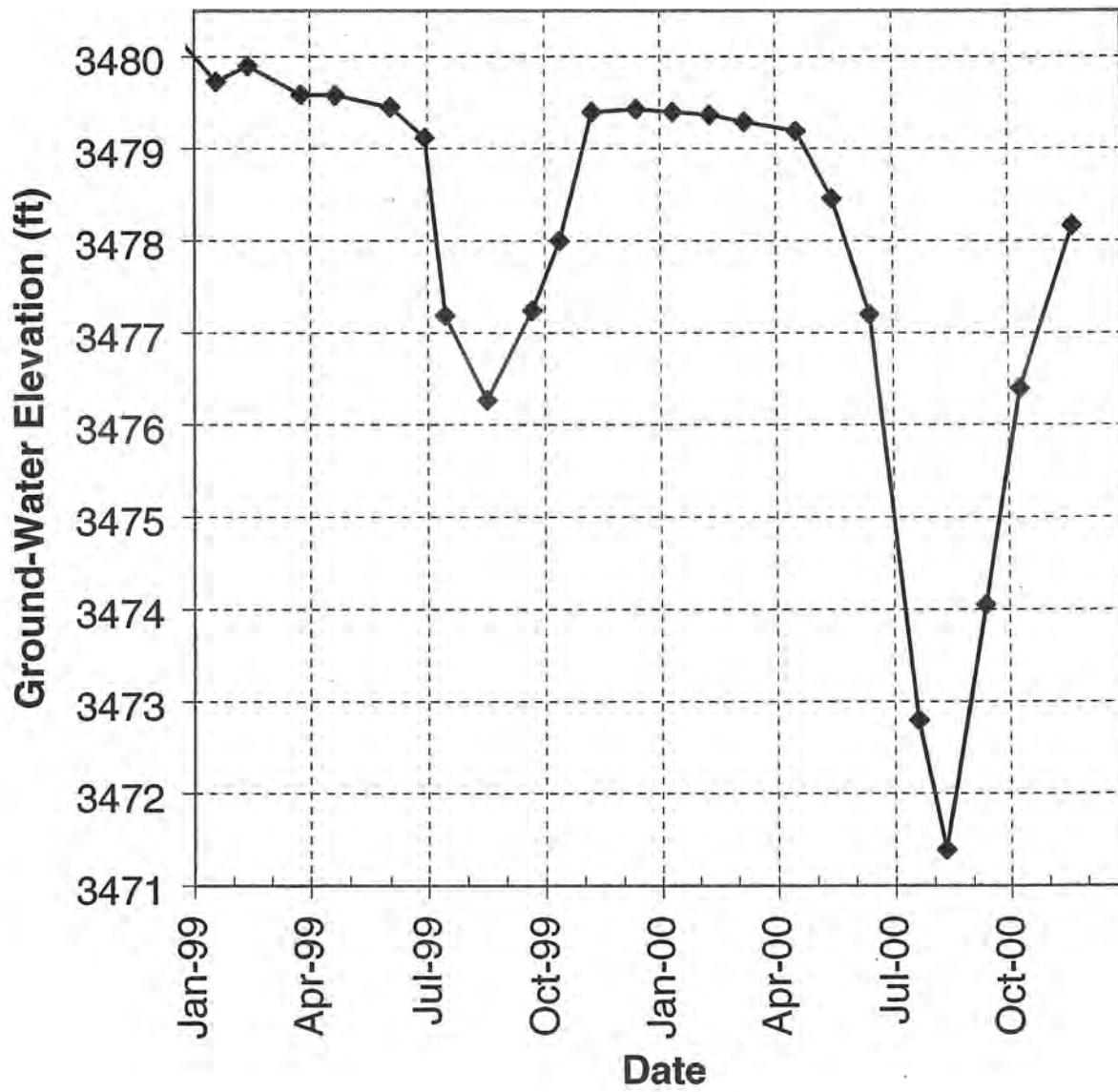
Tritium-helium-3 ground-water age

Mnumber	Site name	Location (TRS)	Sample date and time	Tritium (TU)	Tritium error +/- (TU)	Tritogenic helium-3 (TU)	Tritium+ helium-3 (TU)	Age using Ne only (years)	Age using calculated excess air from N ₂ , Ar, and Ne (years)	Age qualifier
171253	Bond	02S-25E-4-BBAB	7/31/2000 12:00	21.60	2.10	7.99	29.59	1.60	0.10	<1
92840	Apostle Lutheran	01S-25E-1-CBBB	09/28/99 10:30	20.80	1.04	16.71	37.51	14.50	14.00	
93058	Giesick-0	01S 25E 25 BCBC	09/21/99 15:00	30.52	1.53	65.42	95.94	32.30	31.60	>32
93305	Eldergrove	01S-25E-18-DDDC	09/29/99 15:30	29.20	1.50	Stripped of He				--
154210	Gable	01S-25E-26-AADD	09/29/99 14:20	21.08	1.05	17.31	38.39	15.40	14.40	
171243	Slough-1	01S-25E 15 ACCC	09/29/99 13:45	24.31	1.22	28.21	52.52	20.70	20.60	
171251	Saunders-1	01S 25E 21 DAAA	09/21/99 10:00	22.79	1.14	35.35	58.14	26.10	25.80	
171257	Armstrong	01S 26E 19 BBBD	09/22/99 10:10	14.83	0.74	8.06	22.89	7.90	7.00	
171248	Thomas	01S-25E29-BCCC	09/23/99 08:30	13.71	0.69	6.17	19.88	4.40	3.60	

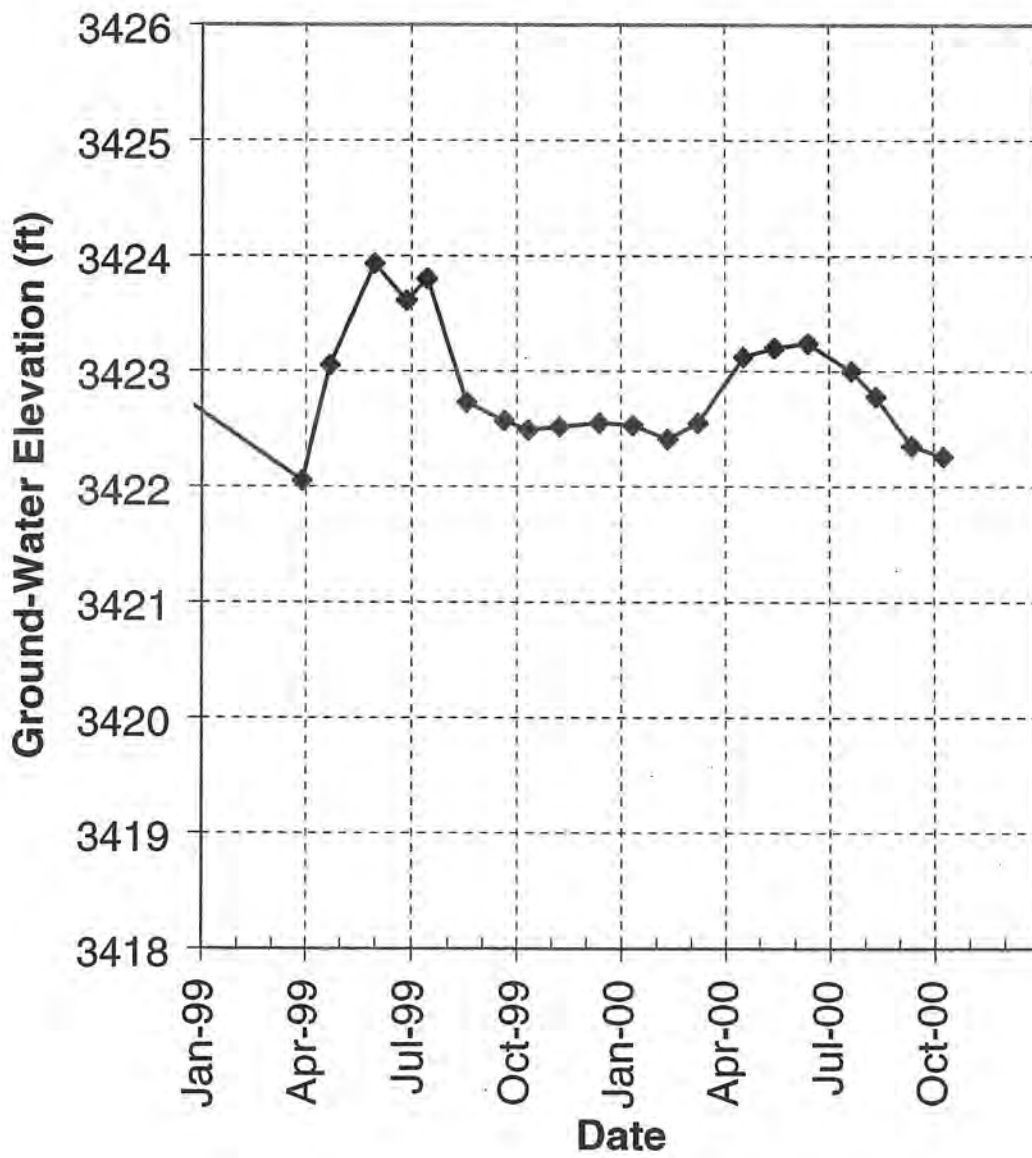
Mnumber	Site name	Location (TRS)	Sample date and time	Noble Gas Data (Values in ccSTP/g)					
				N ₂₈	Ar ₄₀	Ne ₂₀	He ₃	He ₄	R/Ra
171253	Bond	02S-25E-4-BBAB	7/31/2000 12:00	2.10E-02	4.02E-04	2.28E-07	8.46E-14	7.00E-08	0.877
92840	Apostle Lutheran	01S-25E-1-CBBB	09/28/99 10:30	1.85E-02	3.86E-04	1.87E-07	1.26E-13	5.07E-08	1.804
93058	Giesick-0	01S 25E 25 BCBC	09/21/99 15:00	3.77E-02	5.91E-04	4.50E-07	5.58E-13	1.39E-07	2.915
93305	Eldergrove	01S-25E-18-DDDC	09/29/99 15:30	7.98E-03	1.73E-04	7.92E-08	2.58E-14	1.55E-08	1.215
154210	Gable	01S-25E-26-AADD	09/29/99 14:20	2.31E-02	3.82E-04	2.40E-07	1.56E-13	7.14E-08	1.589
171243	Slough-1	01S-25E 15 ACCC	09/29/99 13:45	2.61E-02	4.50E-04	4.43E-07	3.14E-13	1.99E-07	1.140
171251	Saunders-1	01S 25E 21 DAAA	09/21/99 10:00	2.18E-02	4.63E-04	2.49E-07	2.75E-13	6.76E-08	2.944
171257	Armstrong	01S 26E 19 BBBD	09/22/99 10:10	1.98E-02	4.11E-04	2.50E-07	1.12E-13	9.92E-08	0.818
171248	Thomas	01S-25E29-BCCC	09/23/99 08:30	1.46E-02	2.96E-04	2.08E-07	8.90E-14	9.15E-08	0.705

R=3He/4He ratio of sample; Ra=3He/4He ratio of air standard

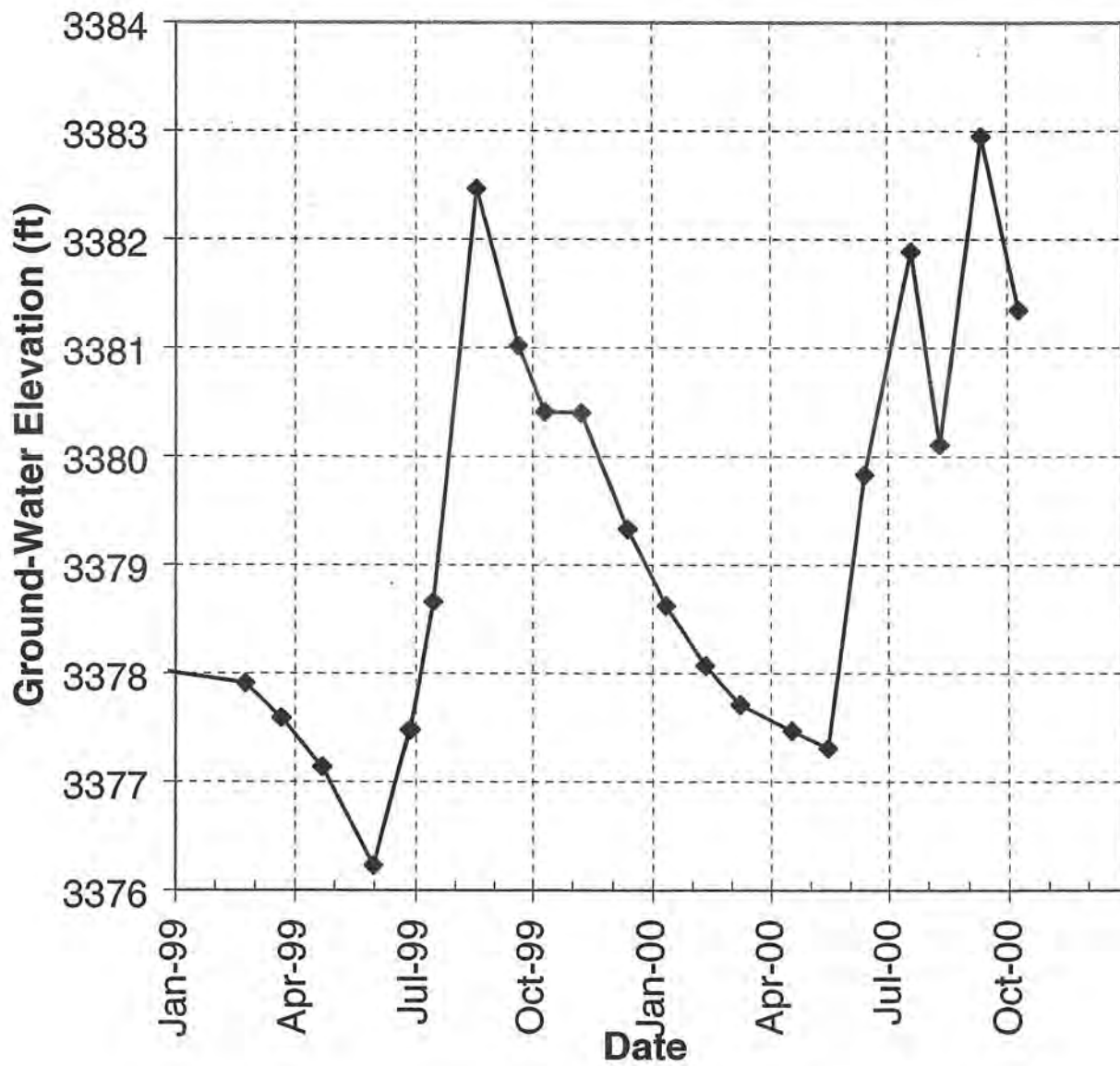
M:155351, HERMES CYNTHIA
01N-24E-23-ADDB
Alt=3500 ft ,TD=52 ft



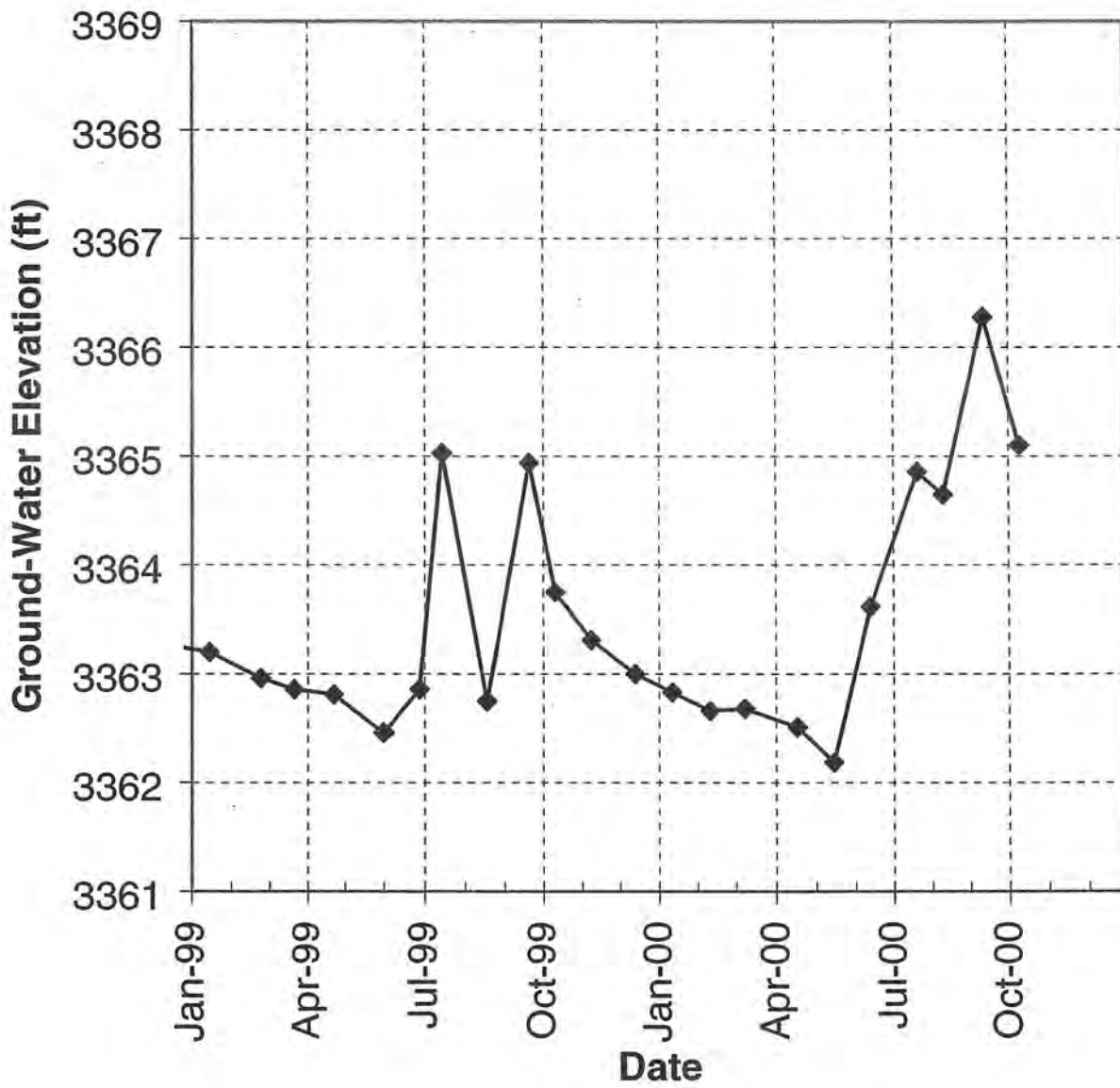
M:158591, DALTON JESSIE
01N-24E-35-CCCB
Alt=3435 ft ,TD=28 ft



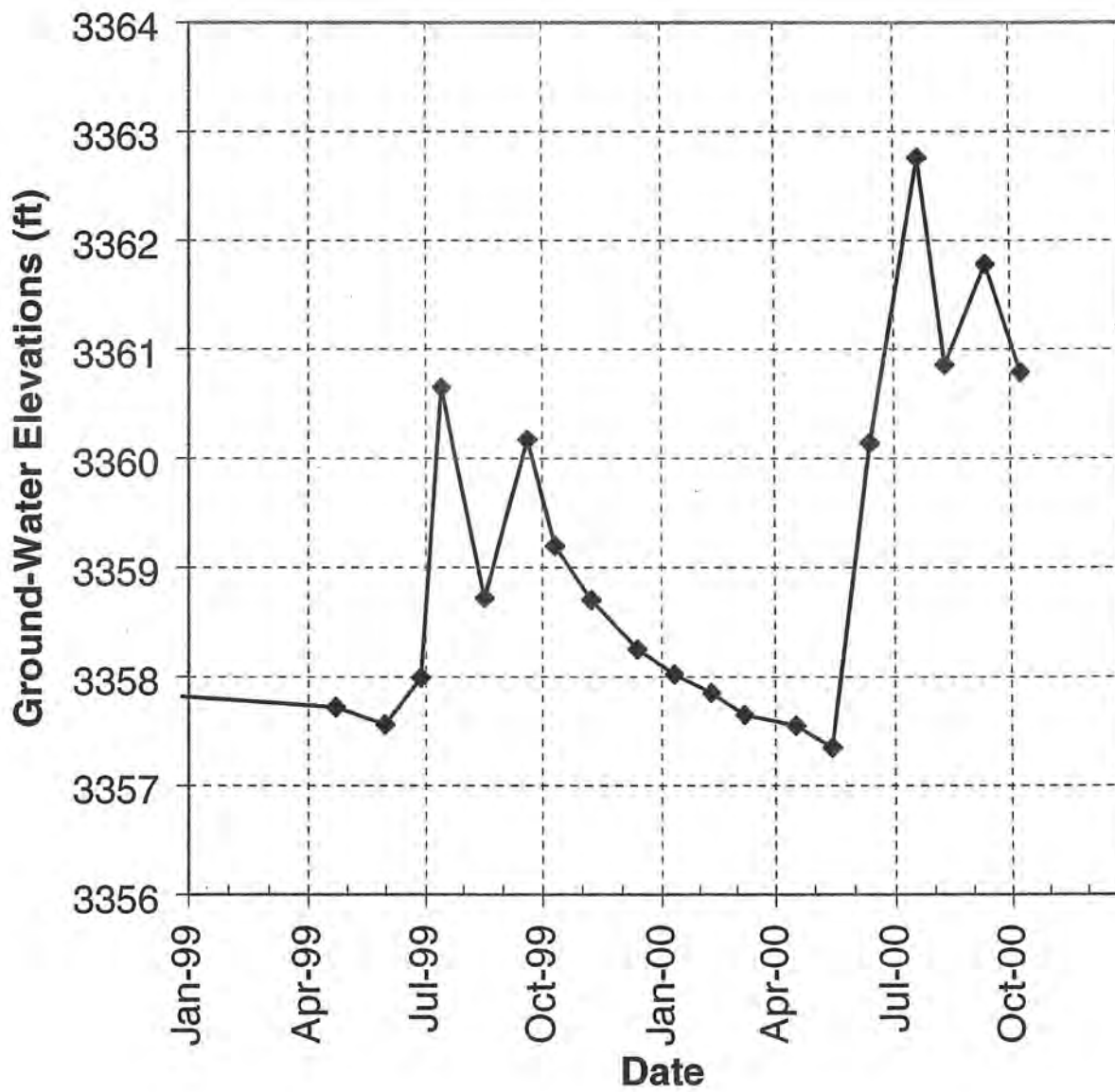
M:10399, WILSON BARB
01N-24E-35-DADD
Alt=3390 ft ,TD=100 ft



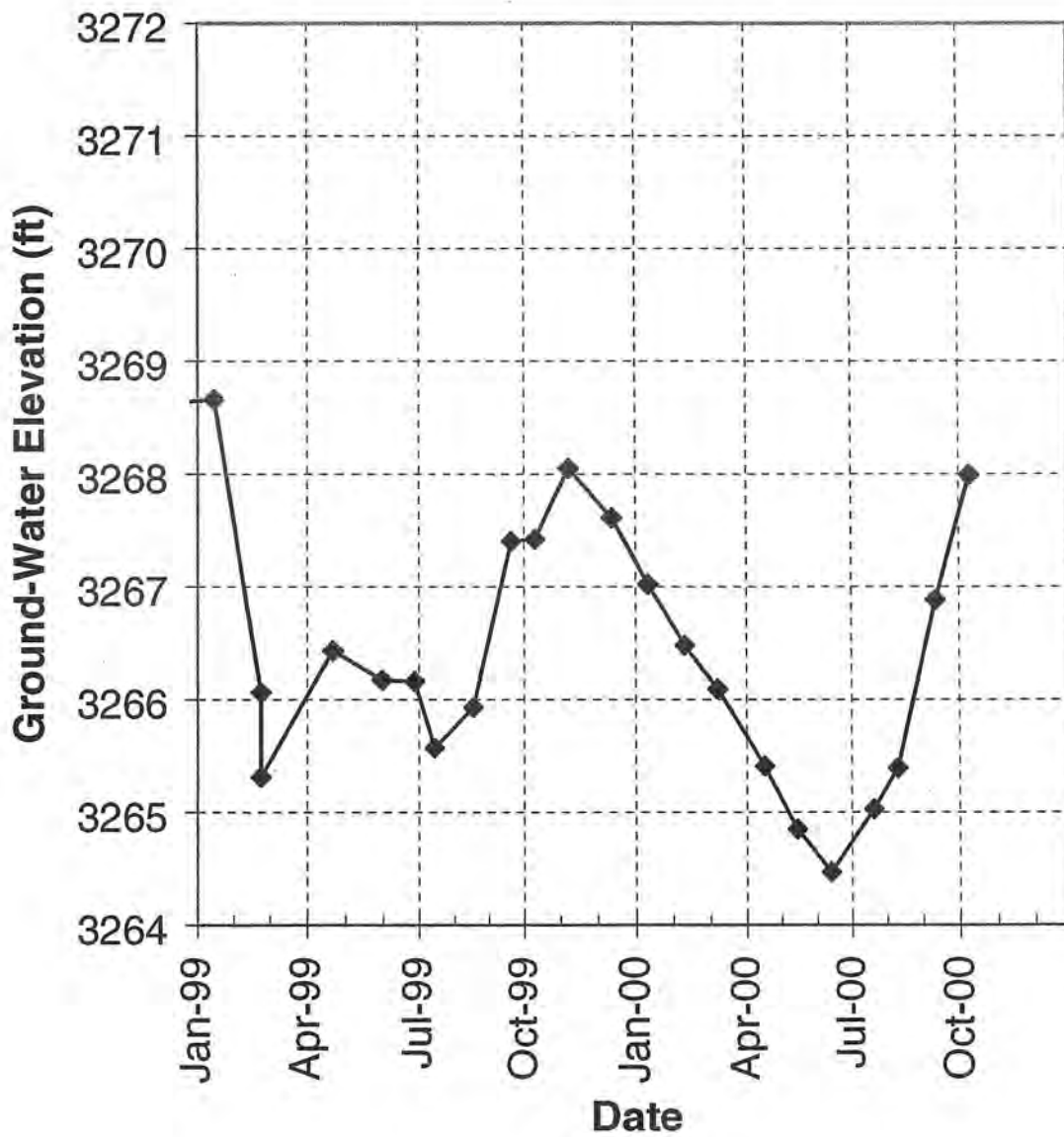
M:10456, MESSER JOHN
01N-25E-31-BAAA
Alt=3370 ft ,TD=180 ft



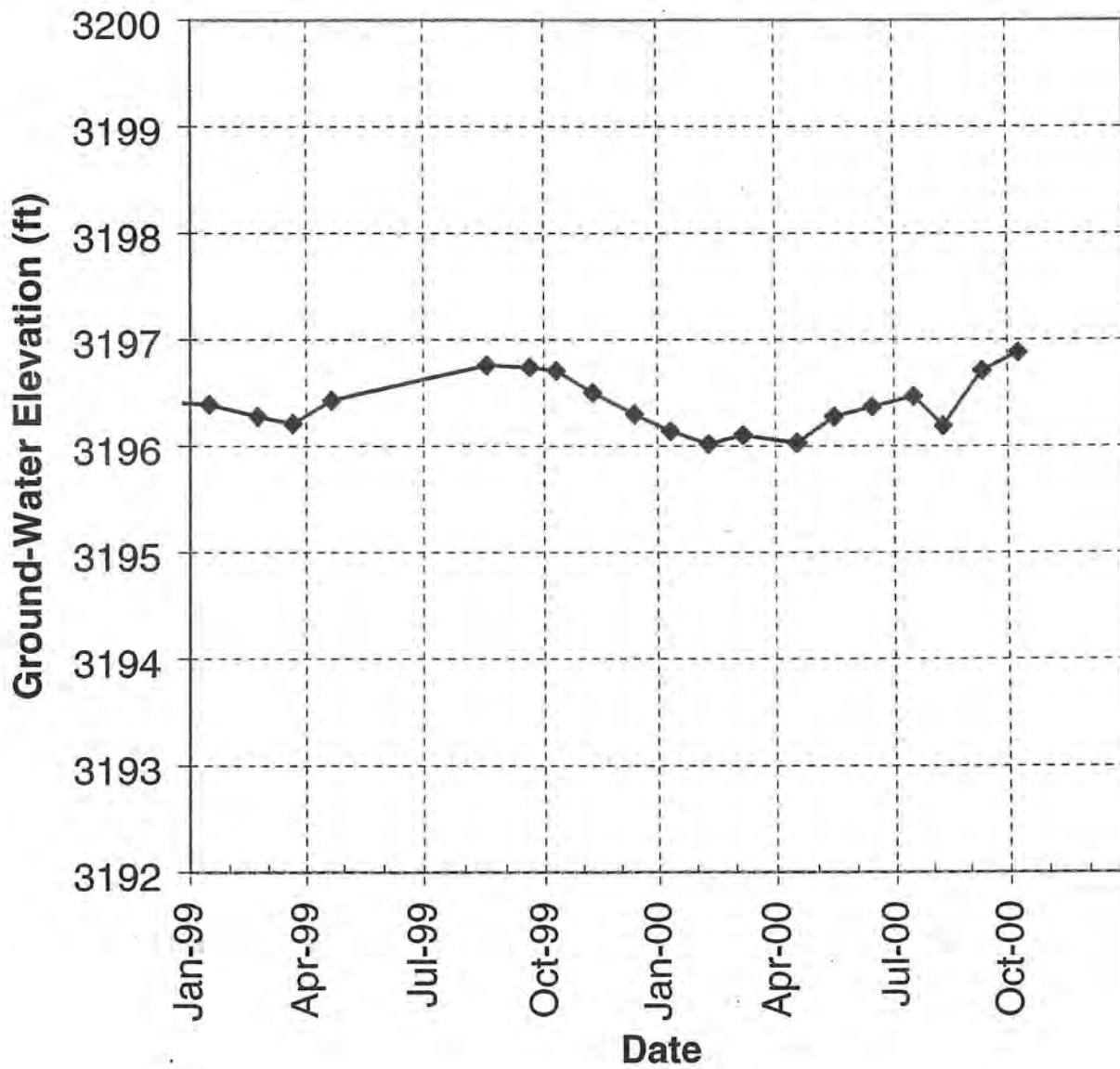
M:10457, CARAWAY HERB
01N-25E-31-BABA
Alt=3370 ft ,TD=19 ft



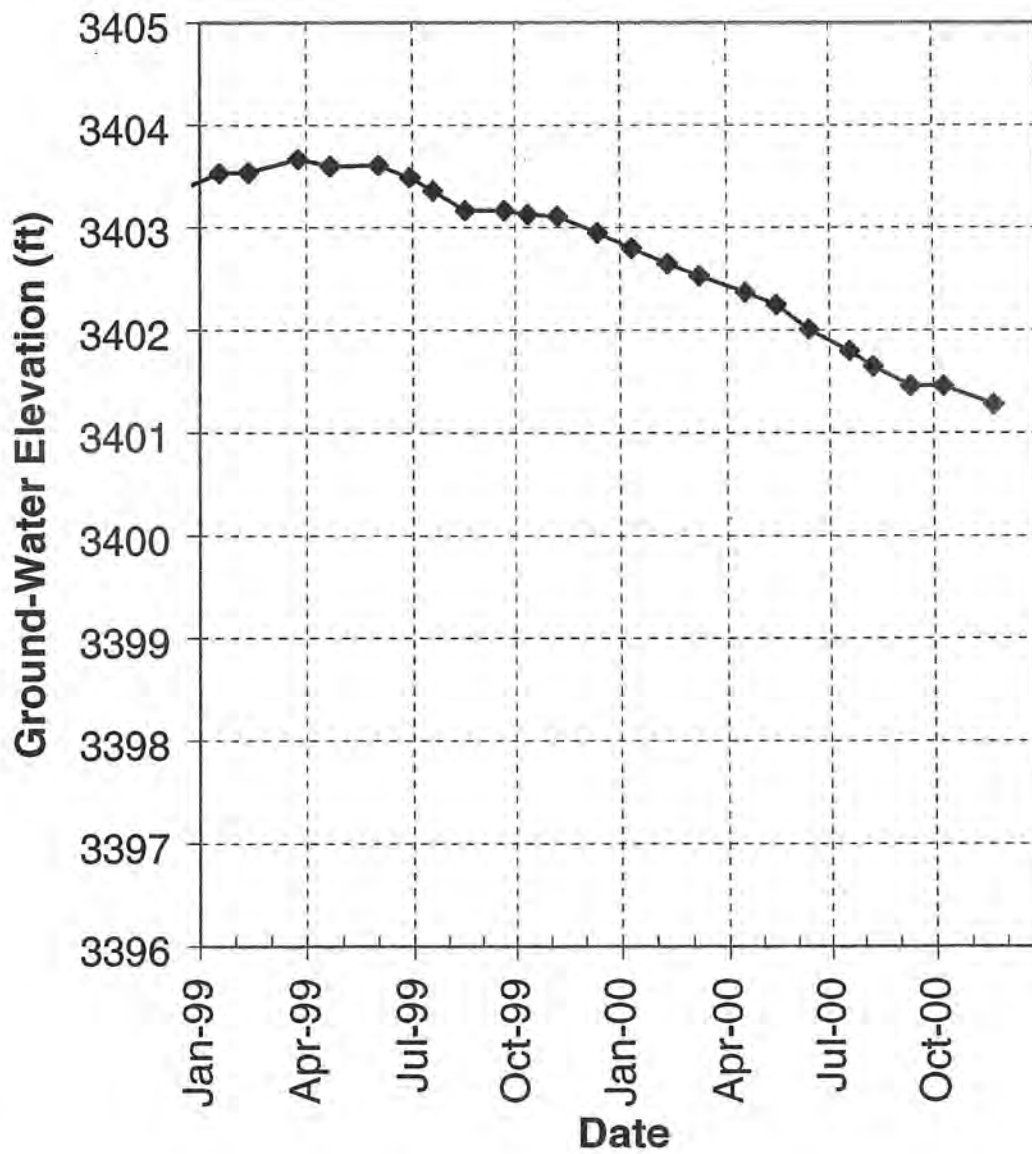
M:10471, HANSON CLARENCE
01N-25E-33-ABDD
Alt=3342 ft ,TD=138 ft



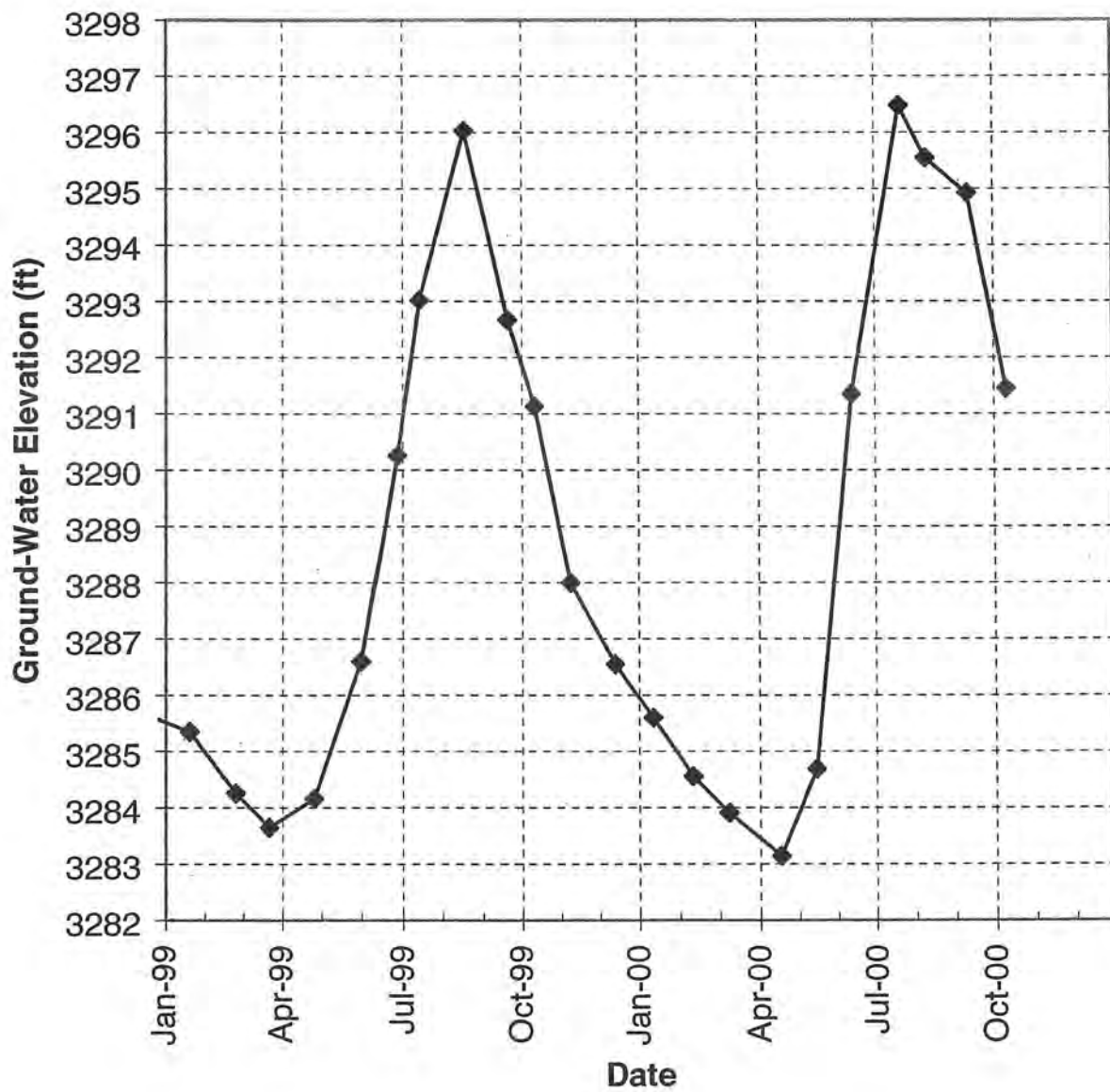
M:10615, EVERGREEN PARK
01N-25E-36-DDBB
Alt=3205 ft ,TD=21 ft



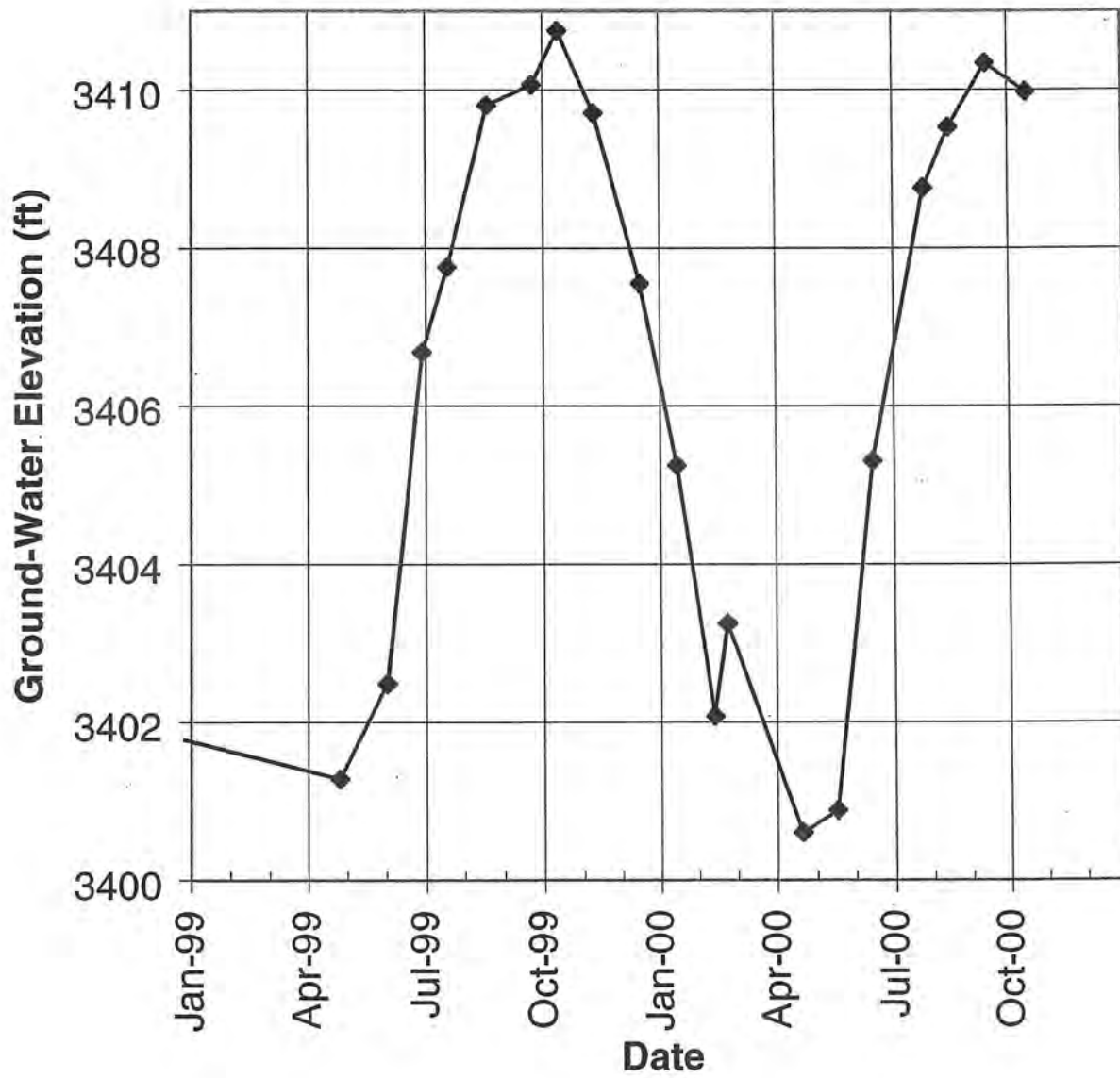
M:158941, YELLOWSTONE COUNTRY CLUB
01N-25E-30-BBCA
Alt=3415 ft ,TD=18 ft



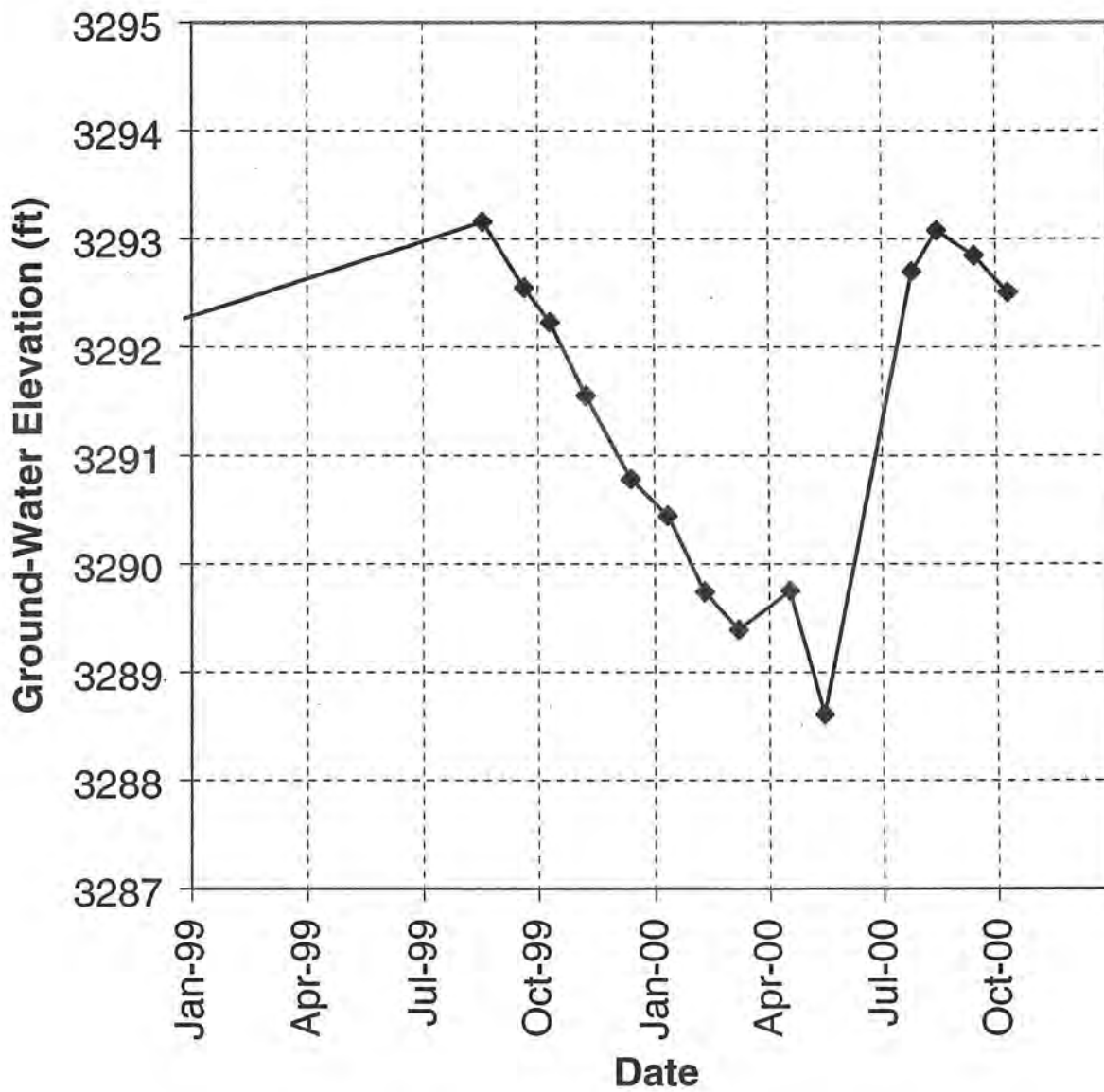
M:92757, WALTER VIRGIL
01S-24E-25-BABA
Alt=3325 ft ,TD=50 ft



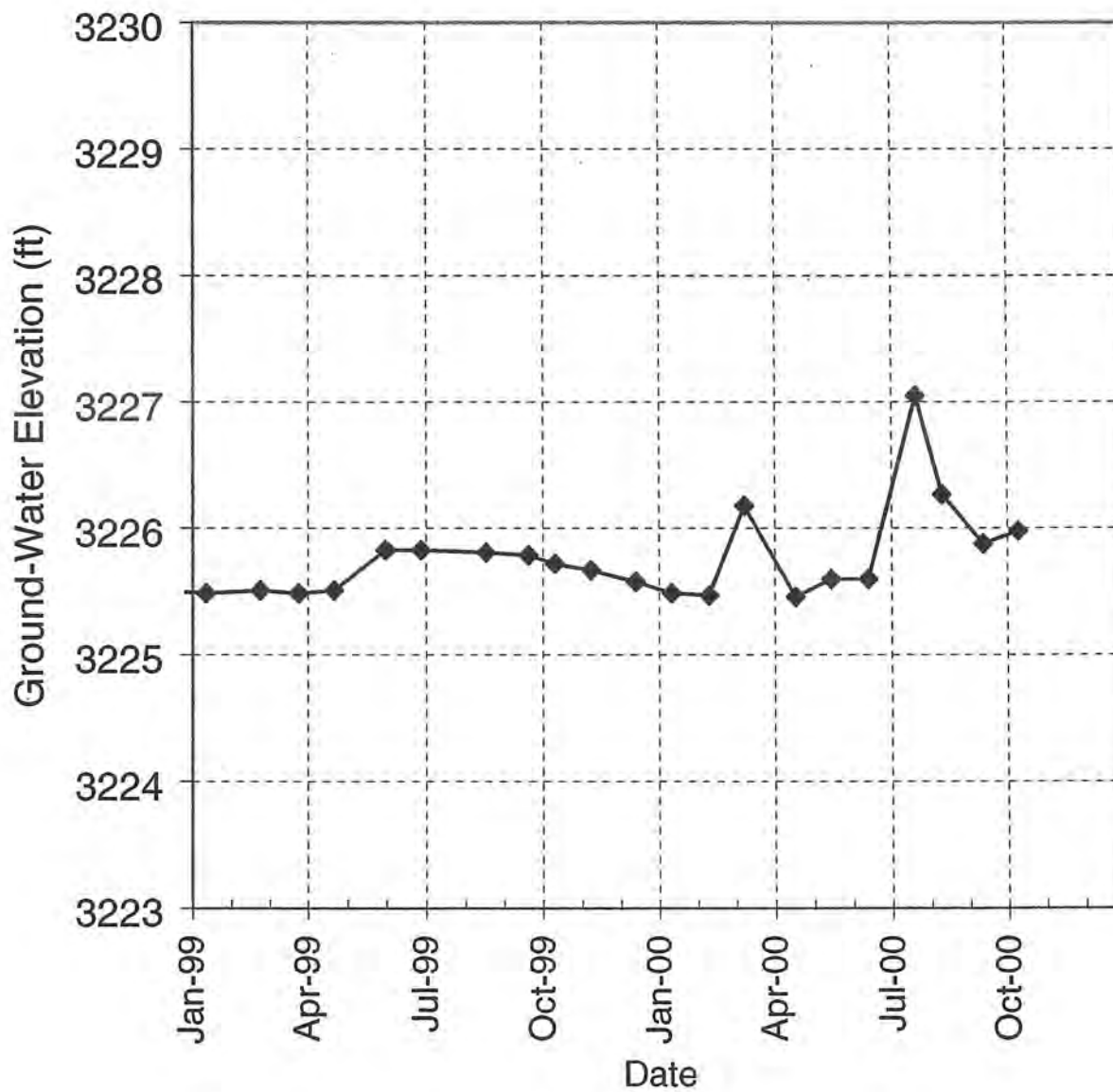
M:158556, NORTHERN SKIES AVIATION
01S-24E-34-CBCB
Alt=3475 ft ,TD=90 ft



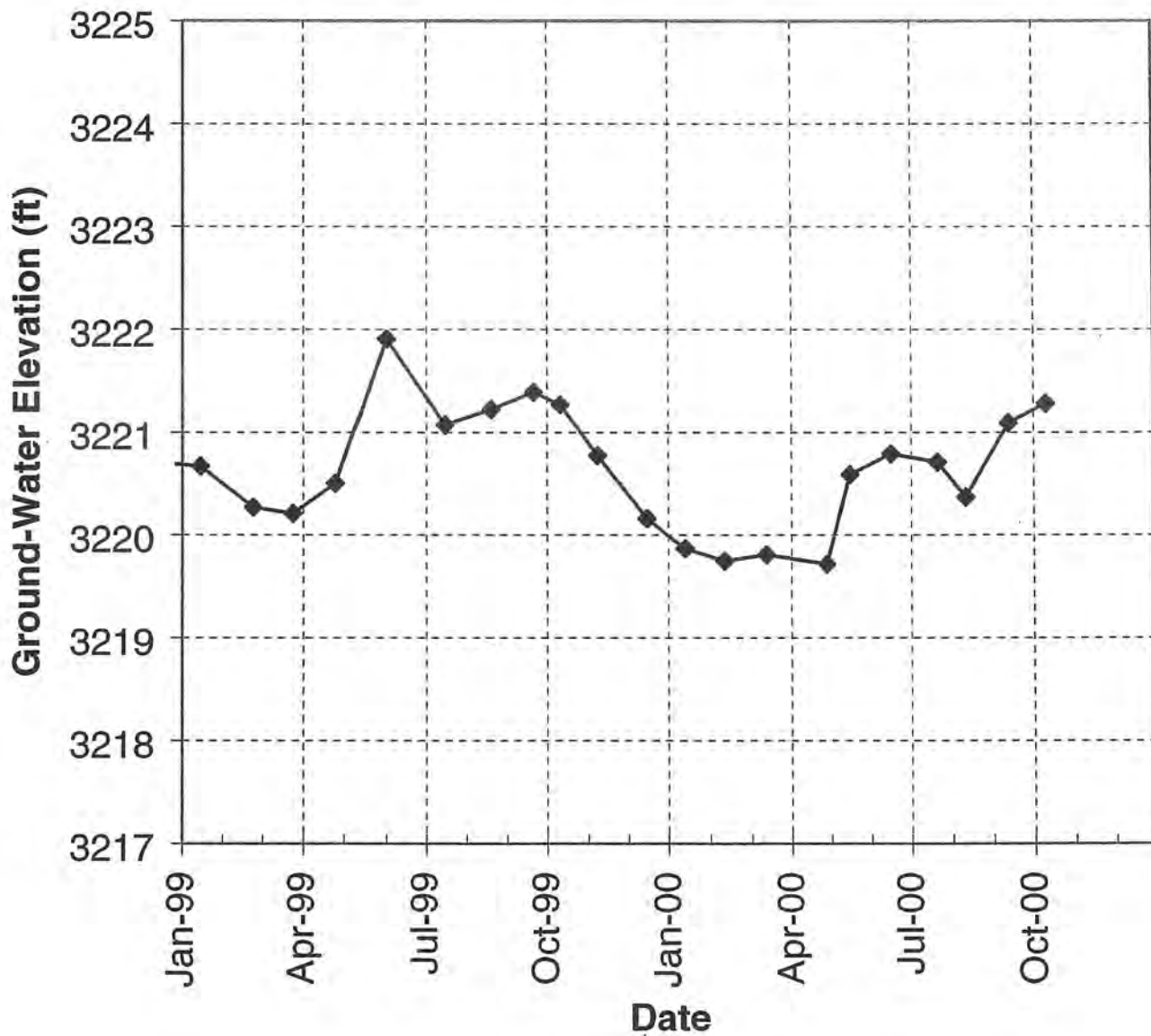
M:92777, DAUGHERTY THOMAS
01S-24E-36-AABA
Alt=3295 ft ,TD=38 ft



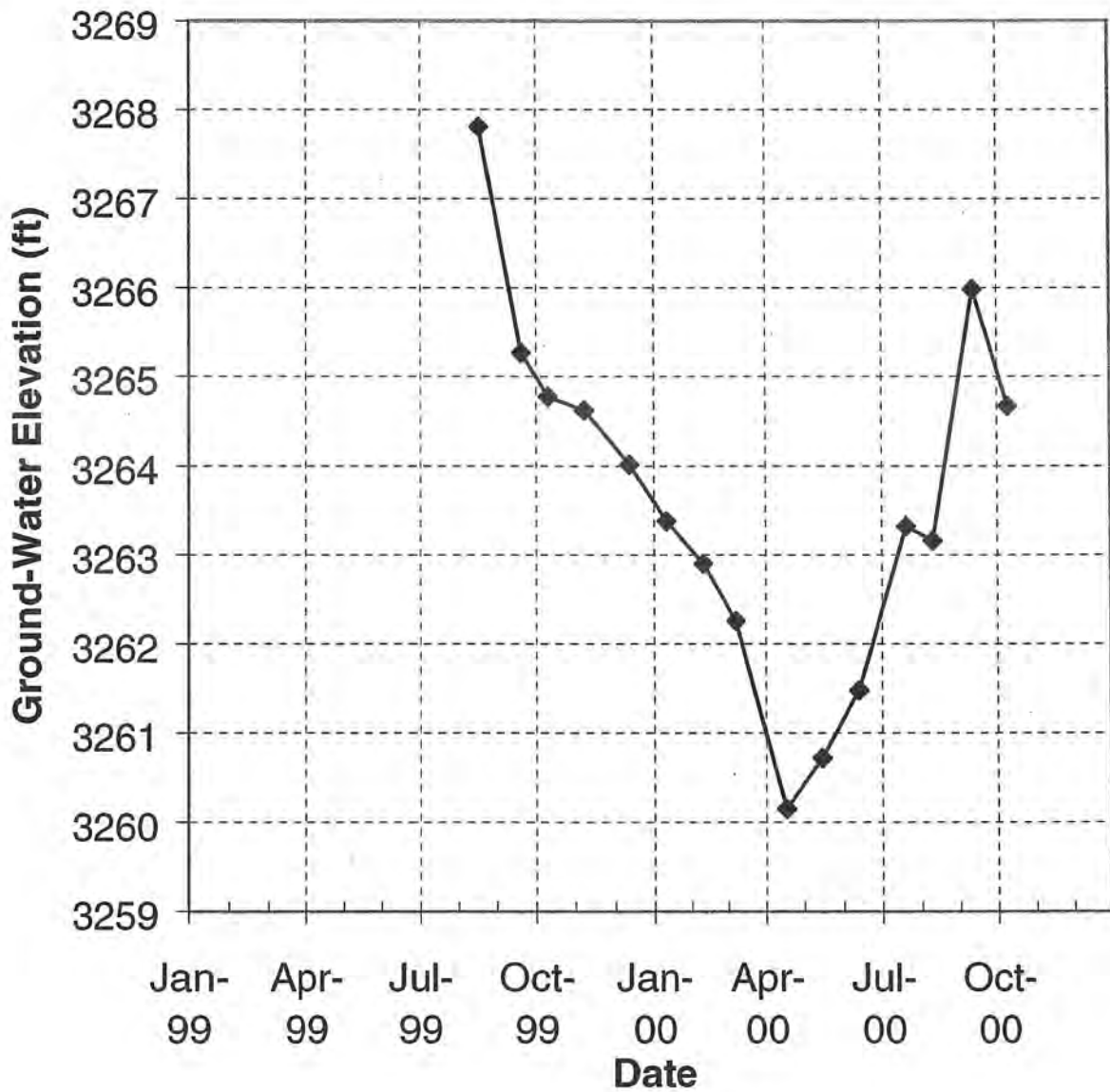
M:92833, YEGEN PETER & ZELLAH
01S-25E-1-BBBB
Alt=3235 ft ,TD=45 ft



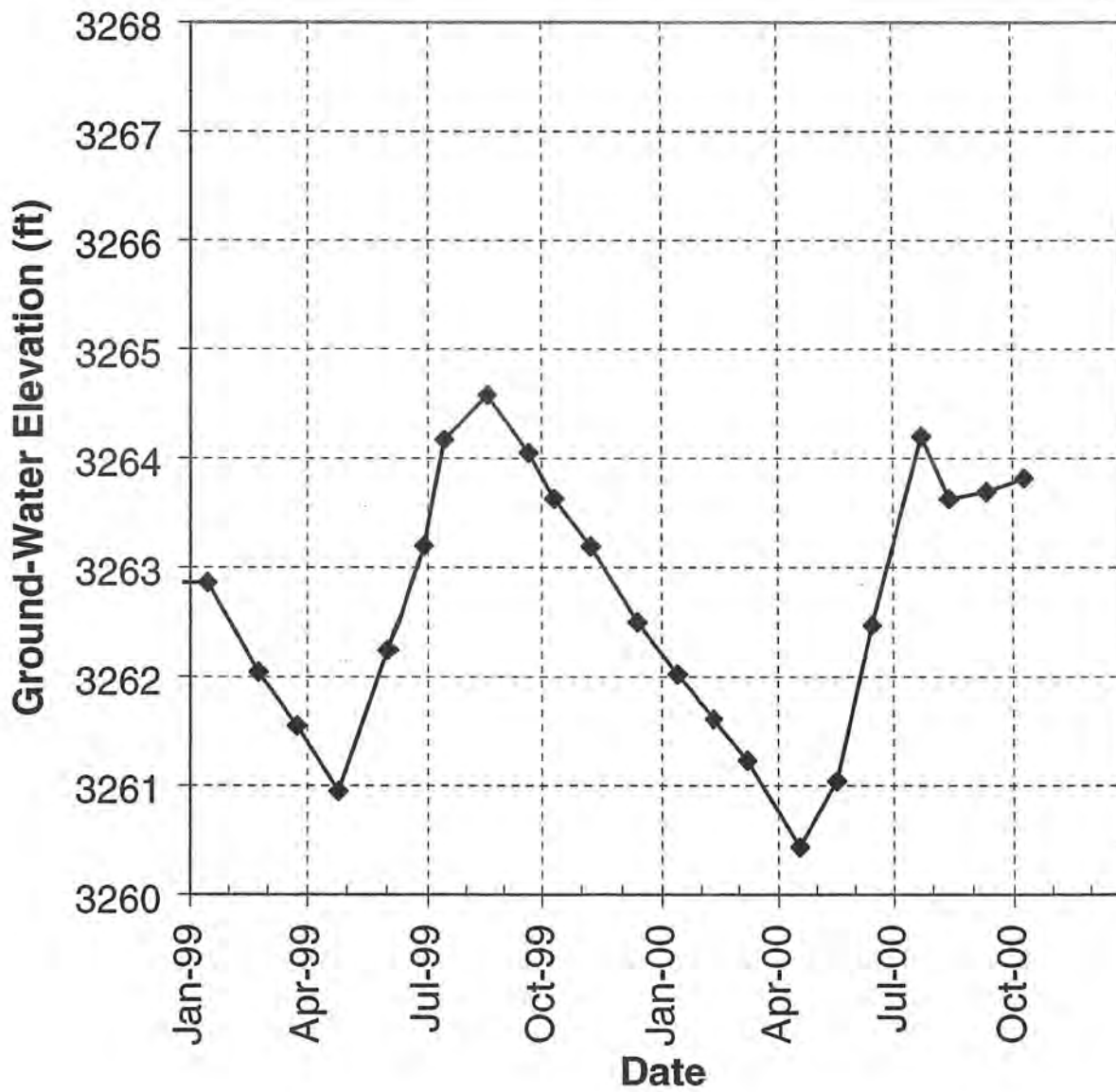
M:92840, APOSTLES LUTHERAN CHURCH
01S-25E-1-CBBB
Alt=3230 ft ,TD=27 ft



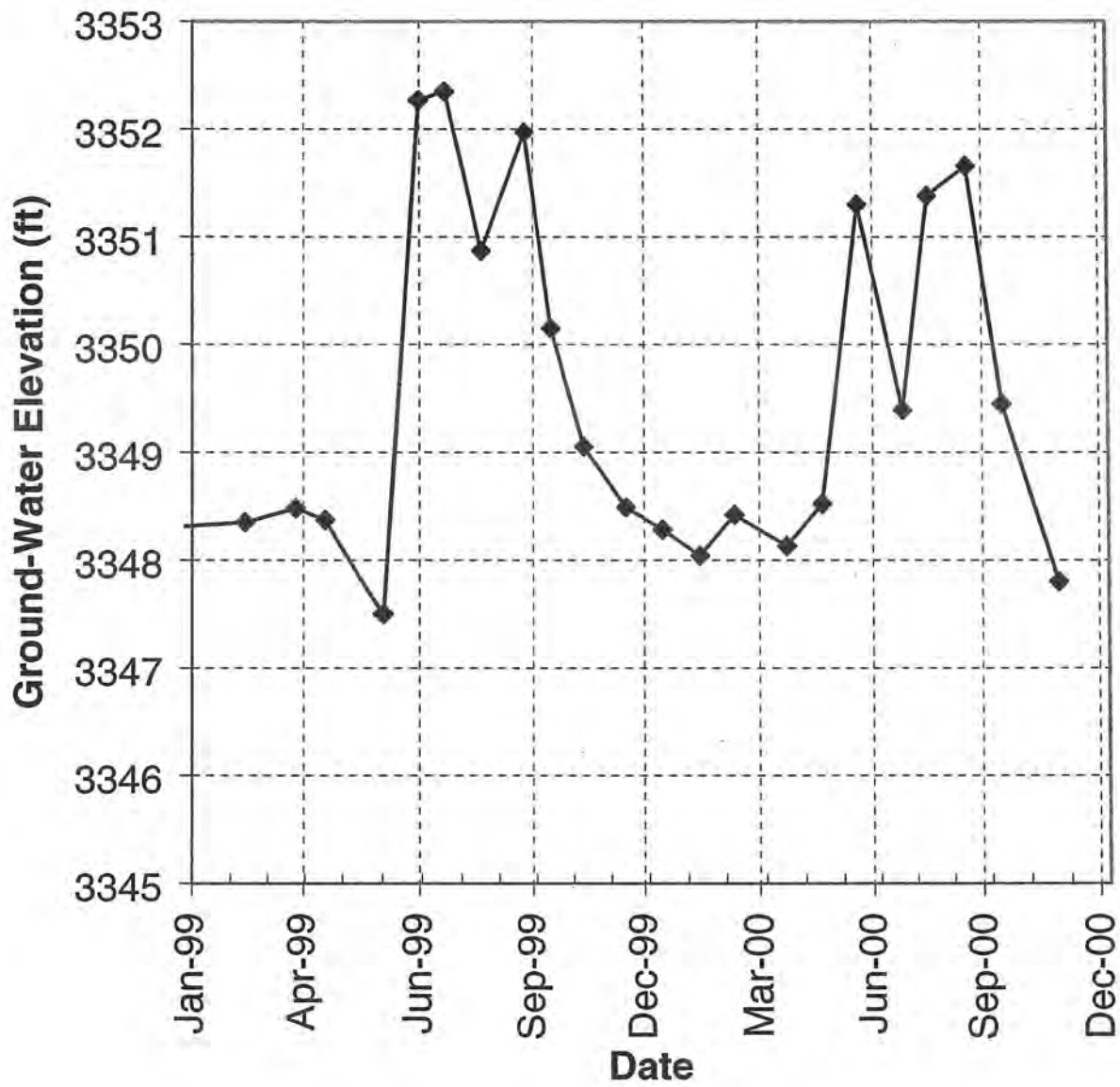
M:147423, GUNDELICH SHANE
01S-25E-3-BAD
Alt=-- ft ,TD=67 ft



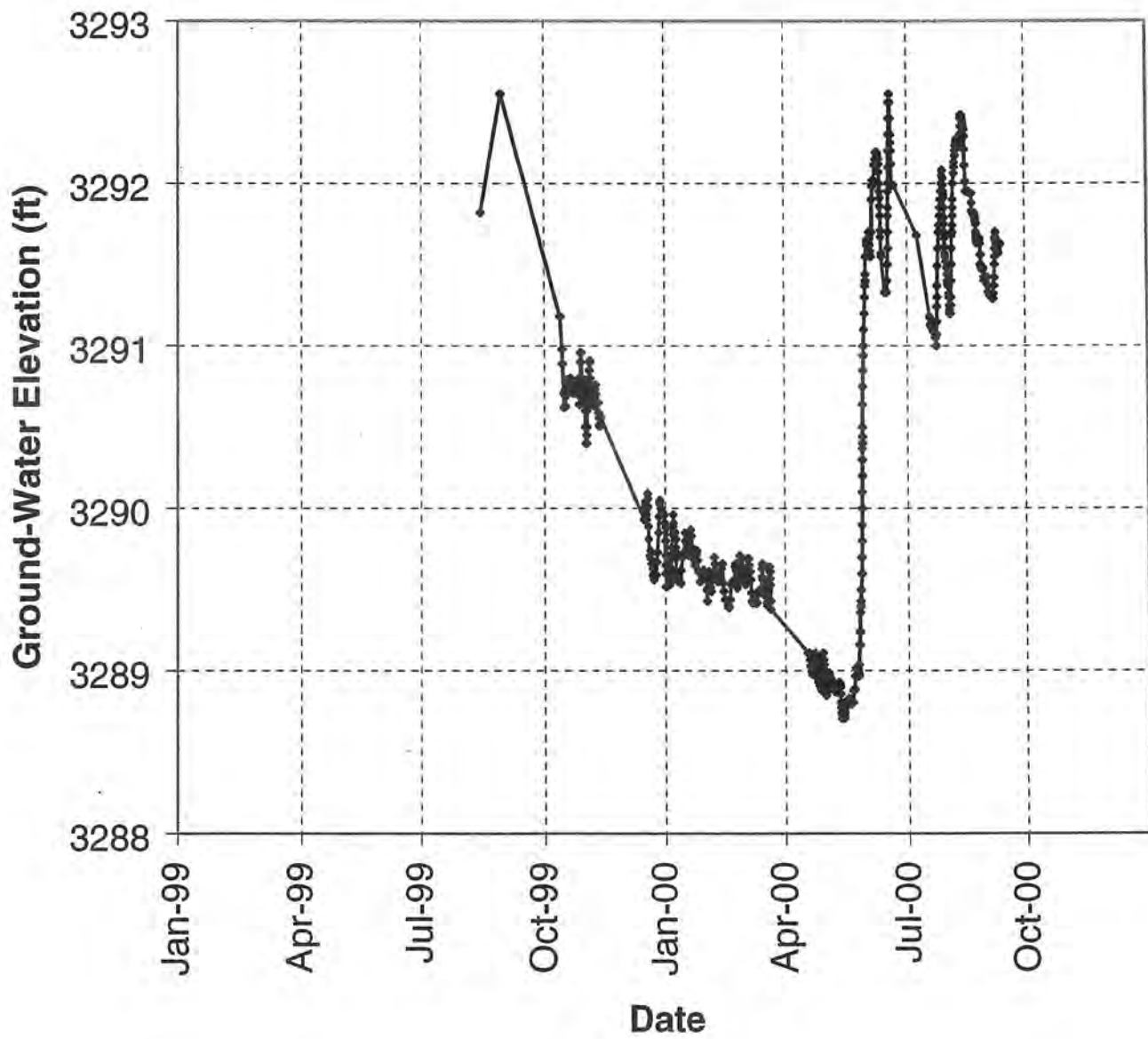
M:151382, CHURCH OF CHRIST
01S-25E-4-DDDC
Alt=3275 ft ,TD=65 ft



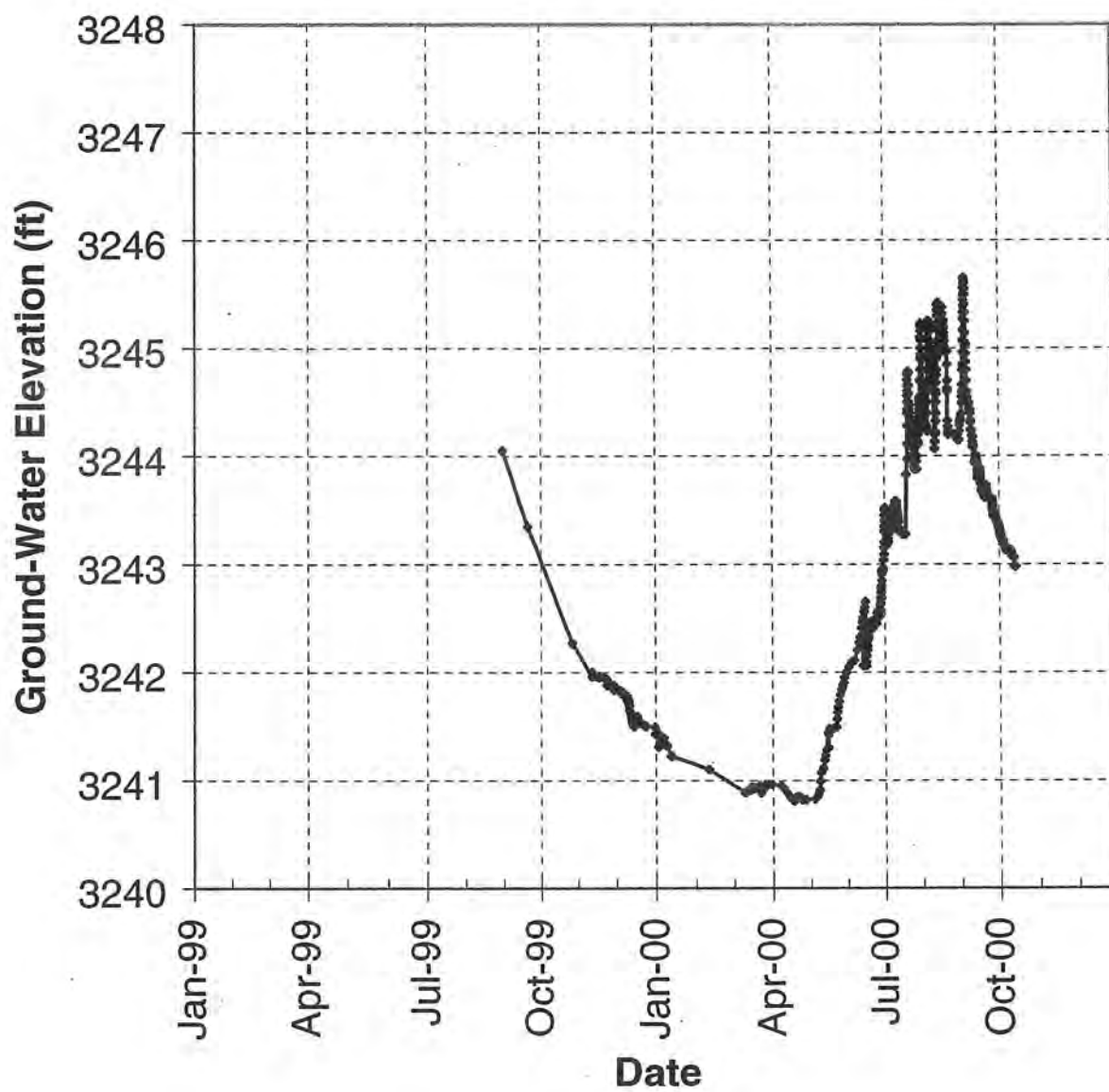
M:705285, SCHLAEPPI NEIL
01S-25E-6-AABB
Alt=3355 ft ,TD=16 ft



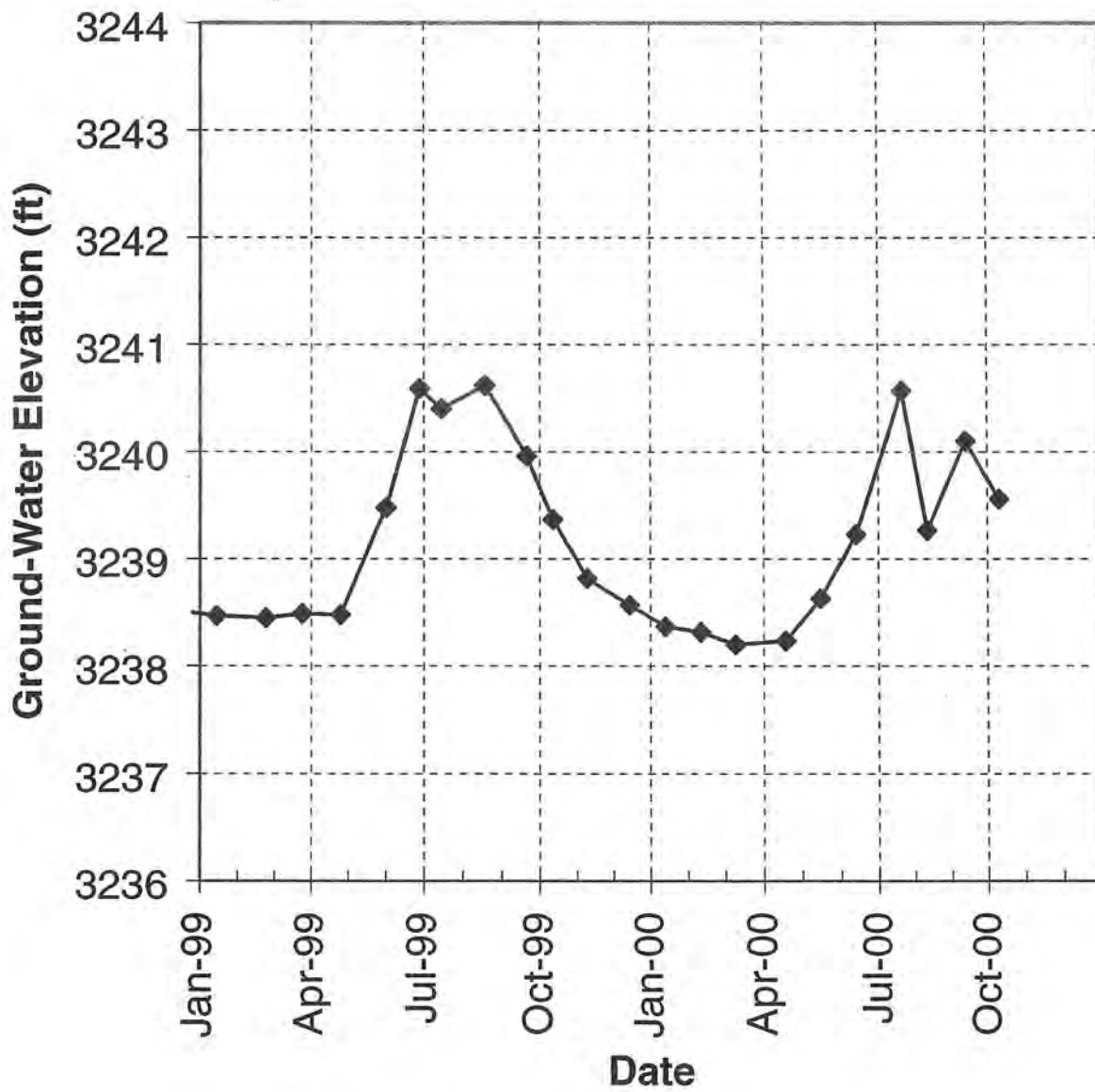
M:171247, GIESICK-1
01S-25E-8-ABBB
Alt=3294 ft ,TD=24 ft



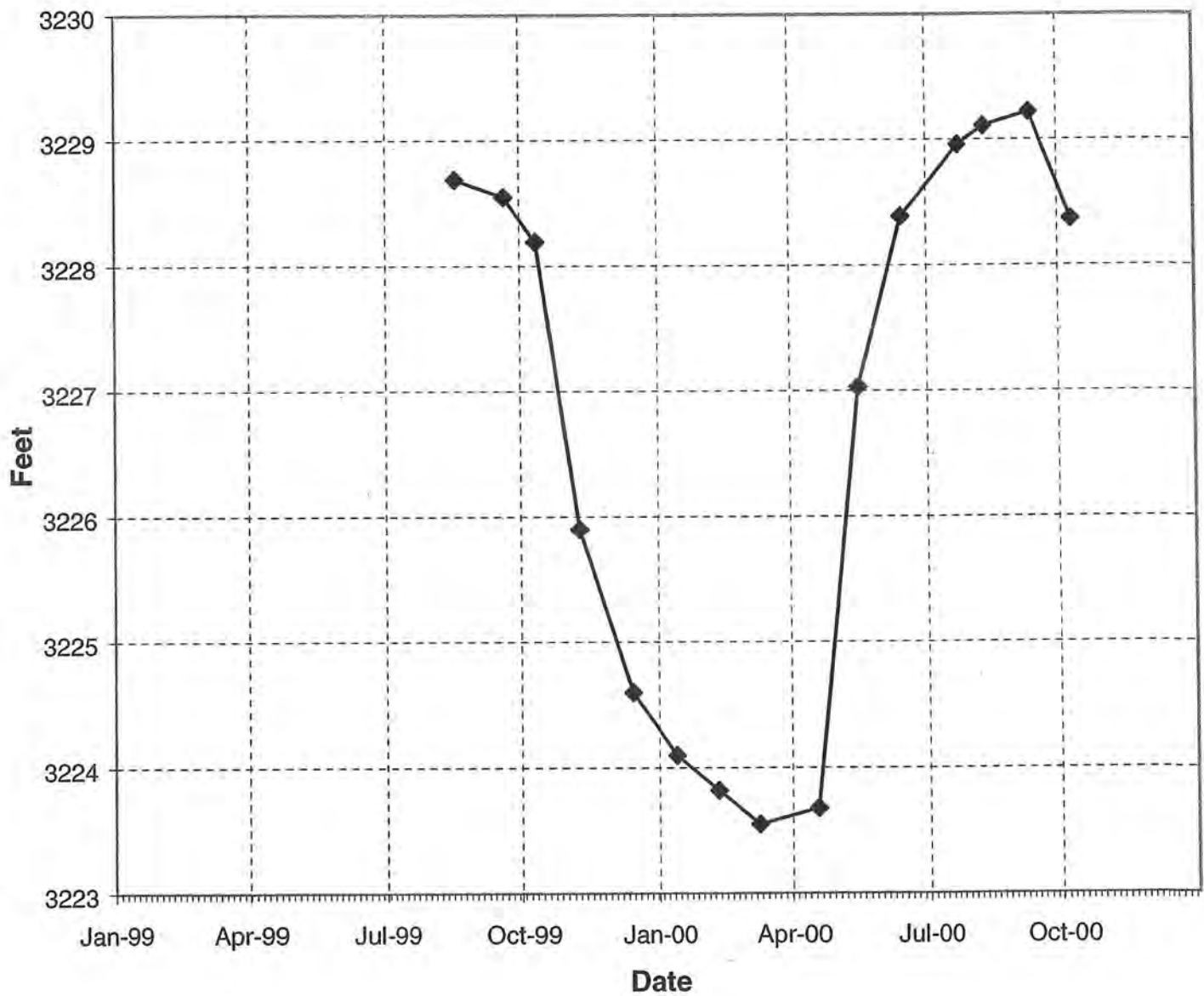
M:171246, BELL-1
01S-25E-10-AABC
Alt=3255 ft ,TD=35 ft



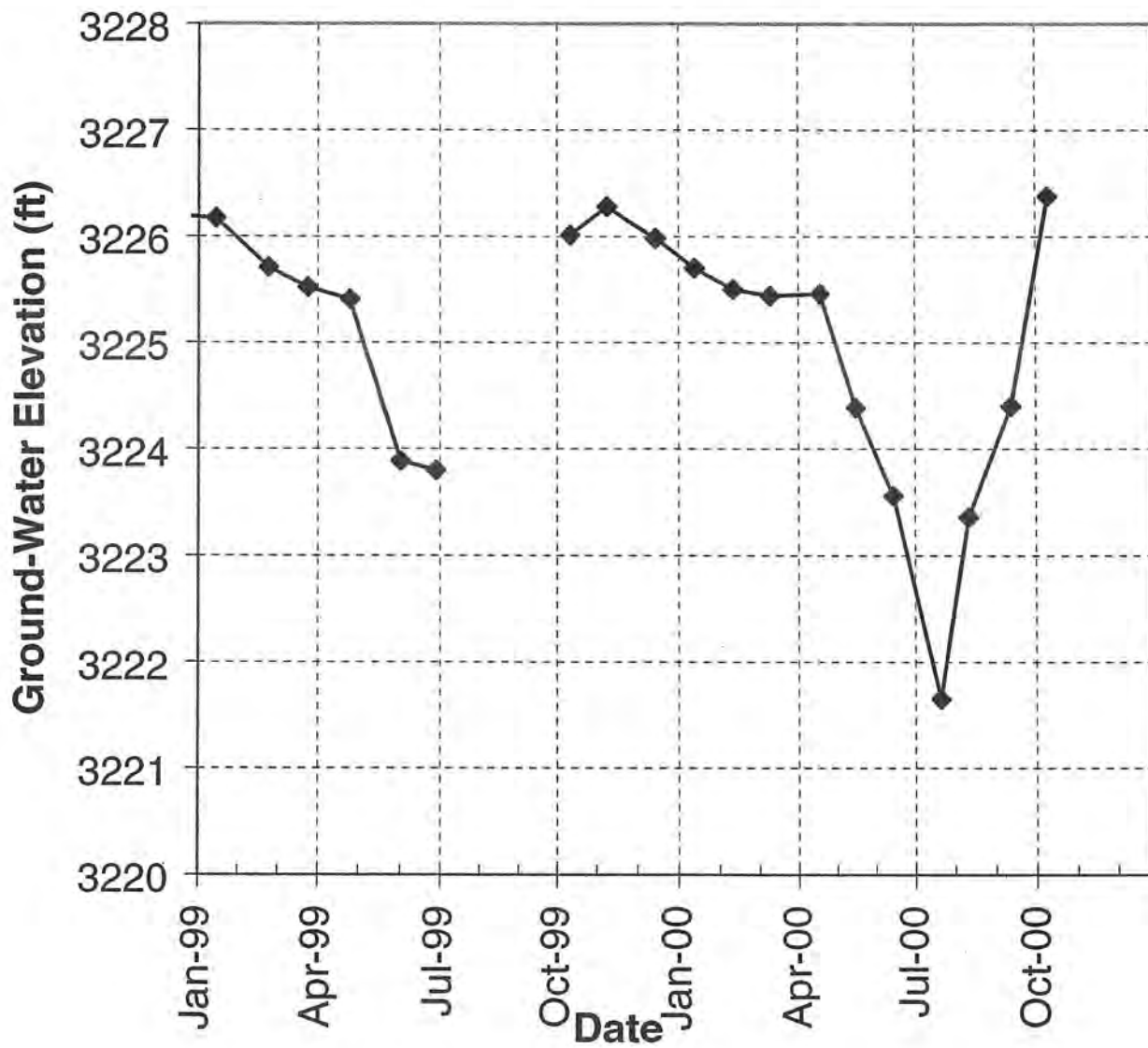
M:93073, EMMANUEL BAPTIST CHURCH
01S-25E-10-ADDC
Alt=3250 ft ,TD=42 ft



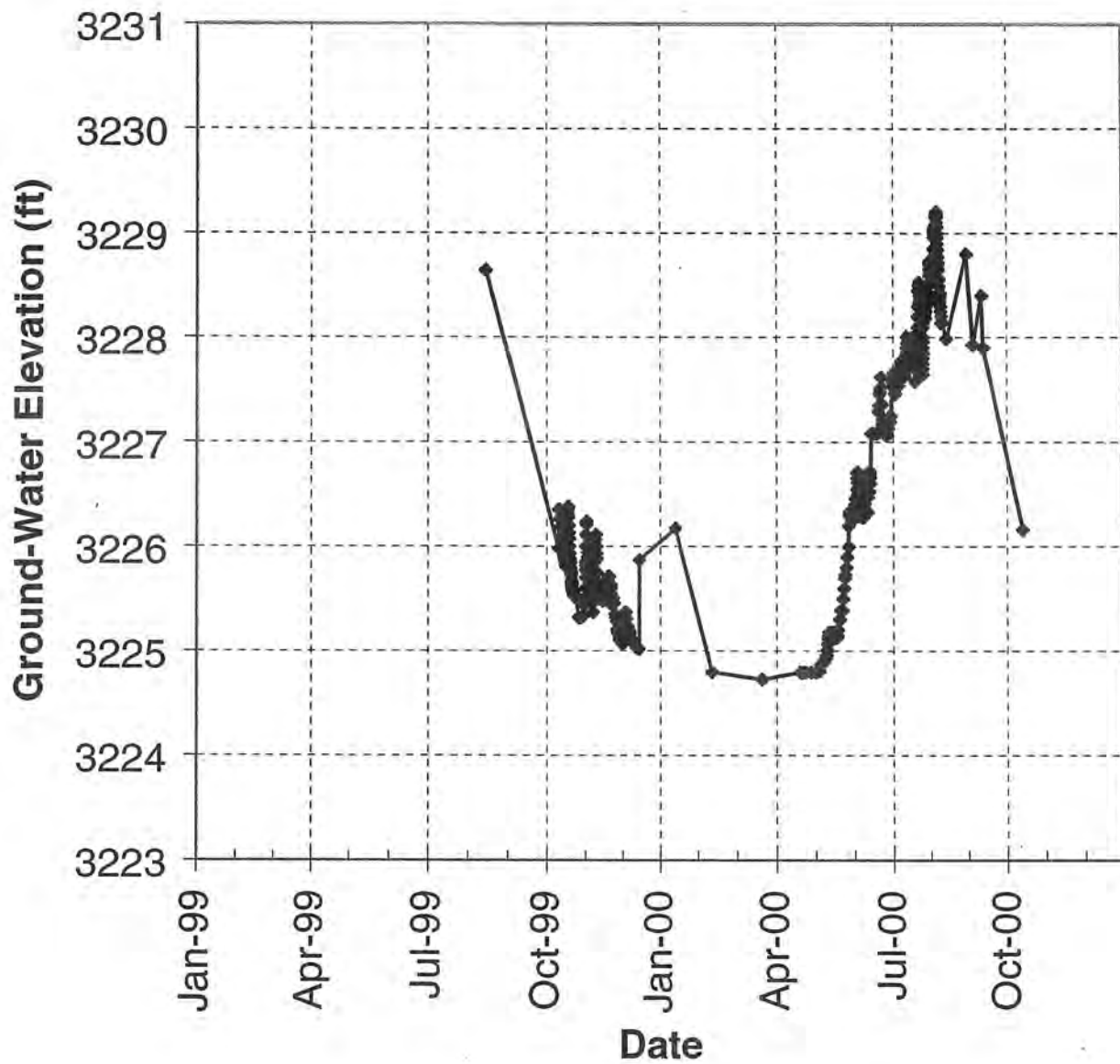
M:160920, YELLOWSTONE BAPTIST COL.
01S-25E-14-C
Alt=-- ft ,TD=21 ft



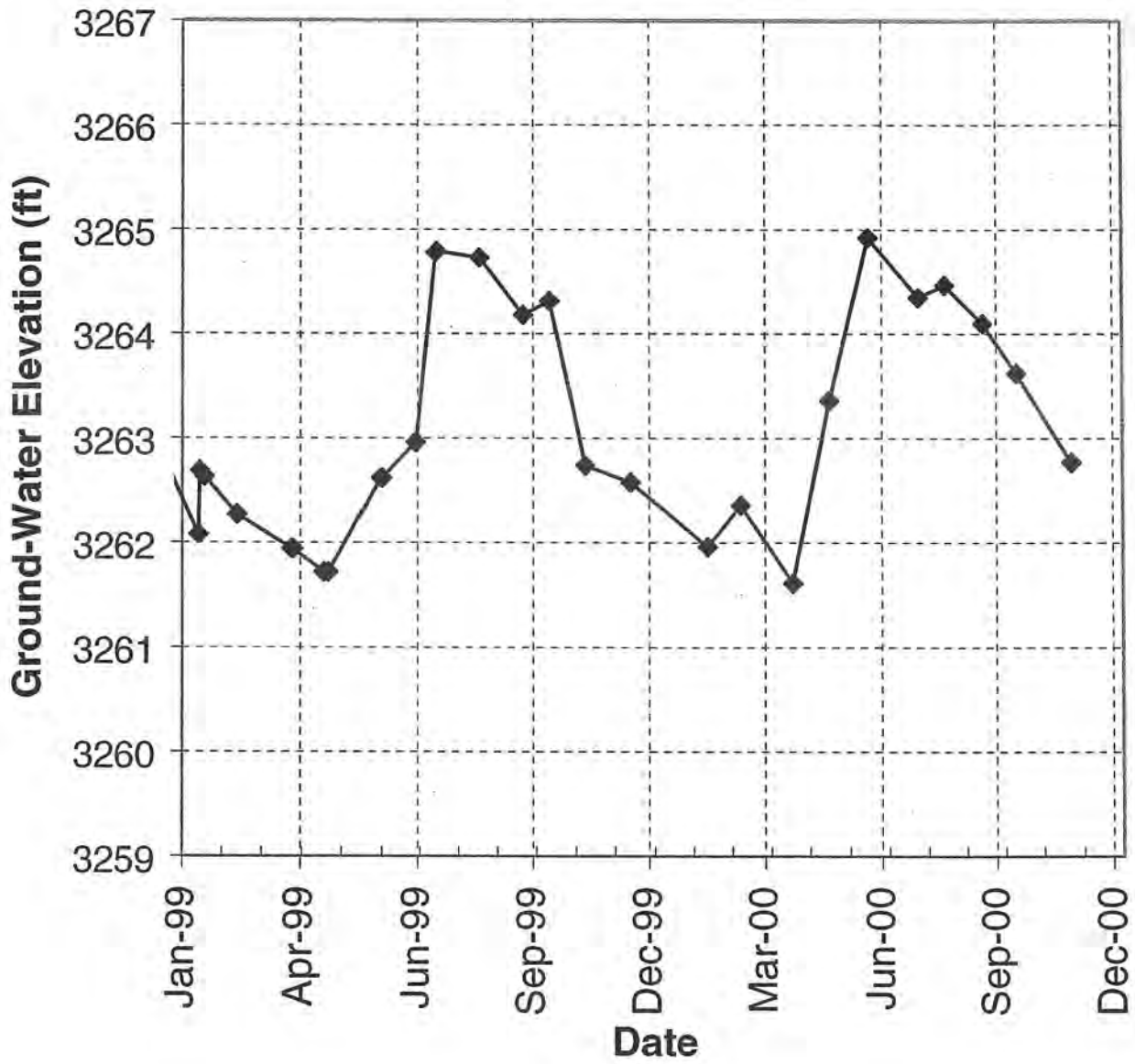
M:156654, MACDONALD GREGORY
01S-25E-14-ABCA
Alt=3237 ft ,TD=36 ft



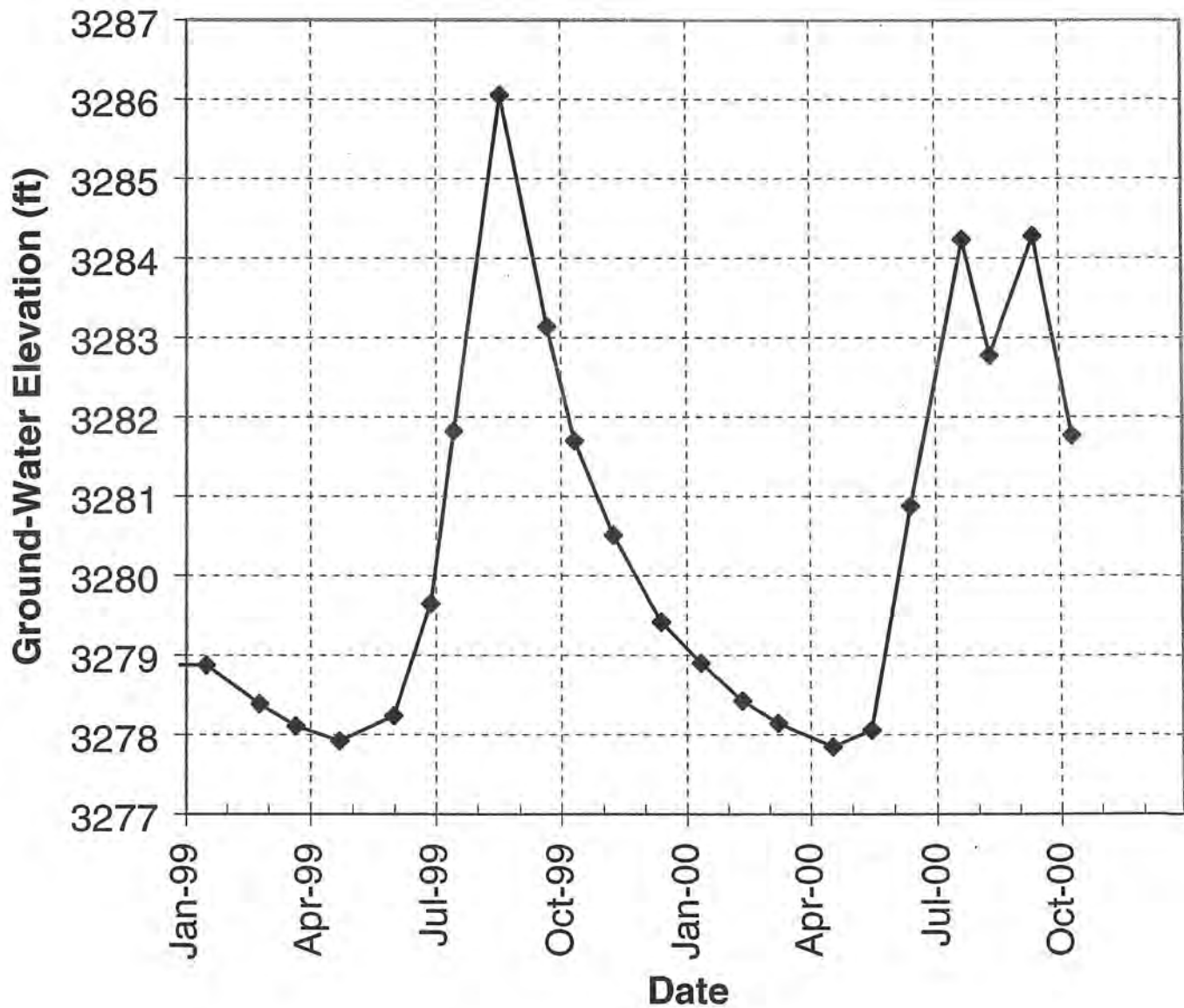
M:171243, SLOUGH-1
01S-25E-15-ACCC
Alt=3238 ft ,TD=25 ft



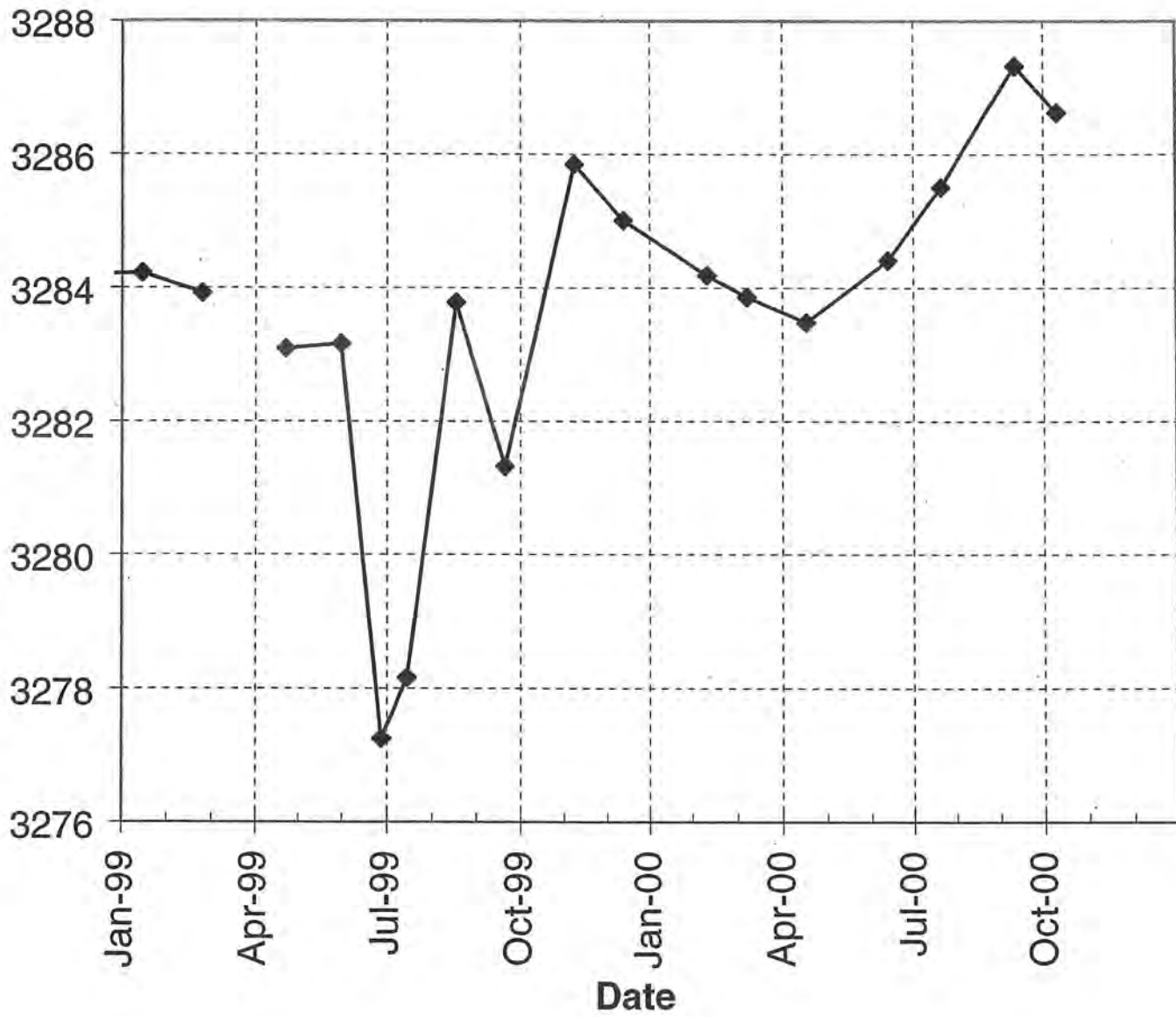
M:705291, USGS
01S-25E-17-AAAA
Alt=3269 ft ,TD=42 ft



M:93305, ELDERGROVE SCHOOL
01S-25E-18-DDDC
Alt=3290 ft ,TD=49 ft



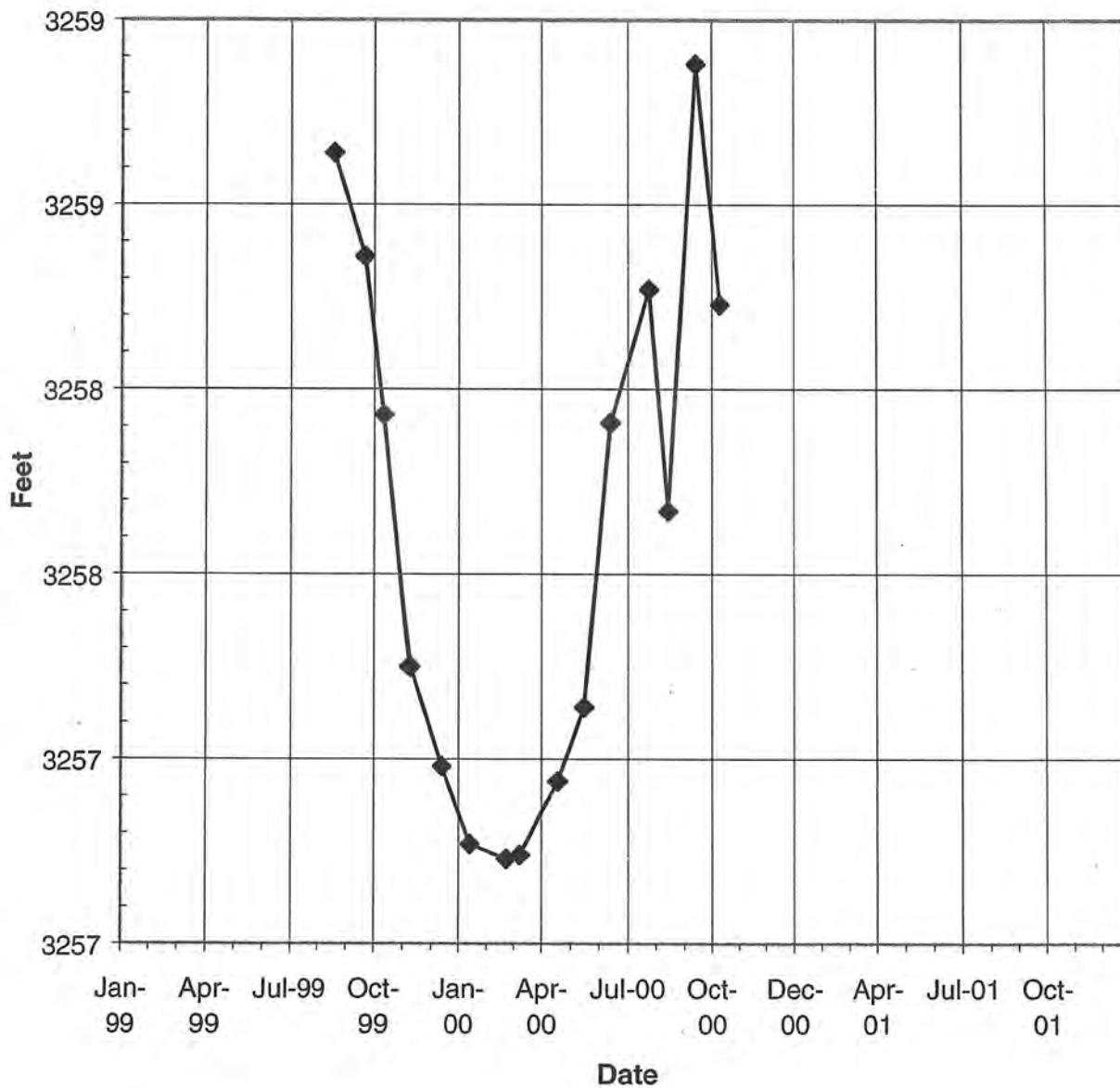
M:93316, YELLOWSTONE BOYS RANCH
01S-25E-19-BBAB
Alt=3305 ft ,TD=57 ft



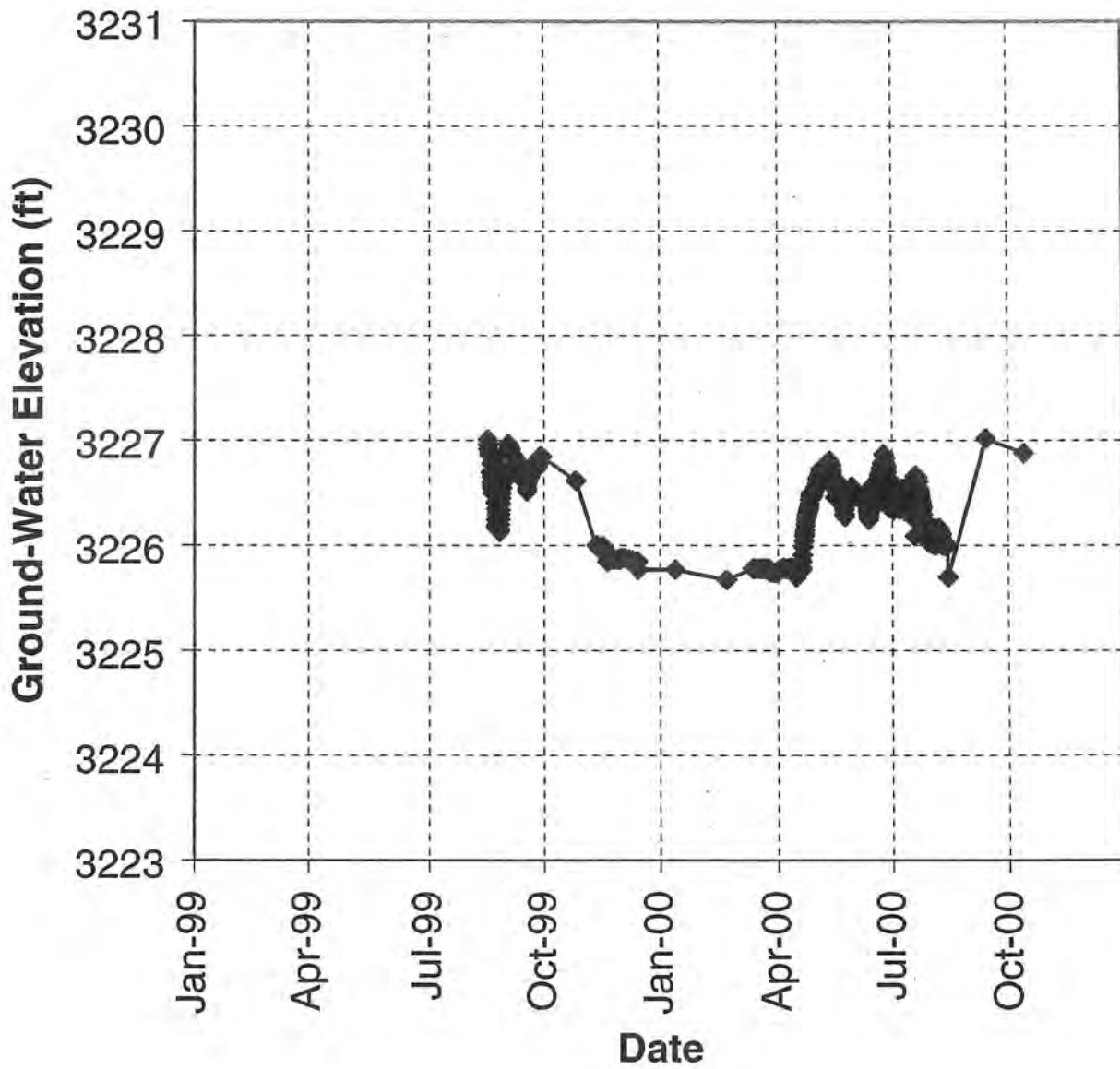
M:93329, LAMBRECHT GEORGE

01S-25E-20-A

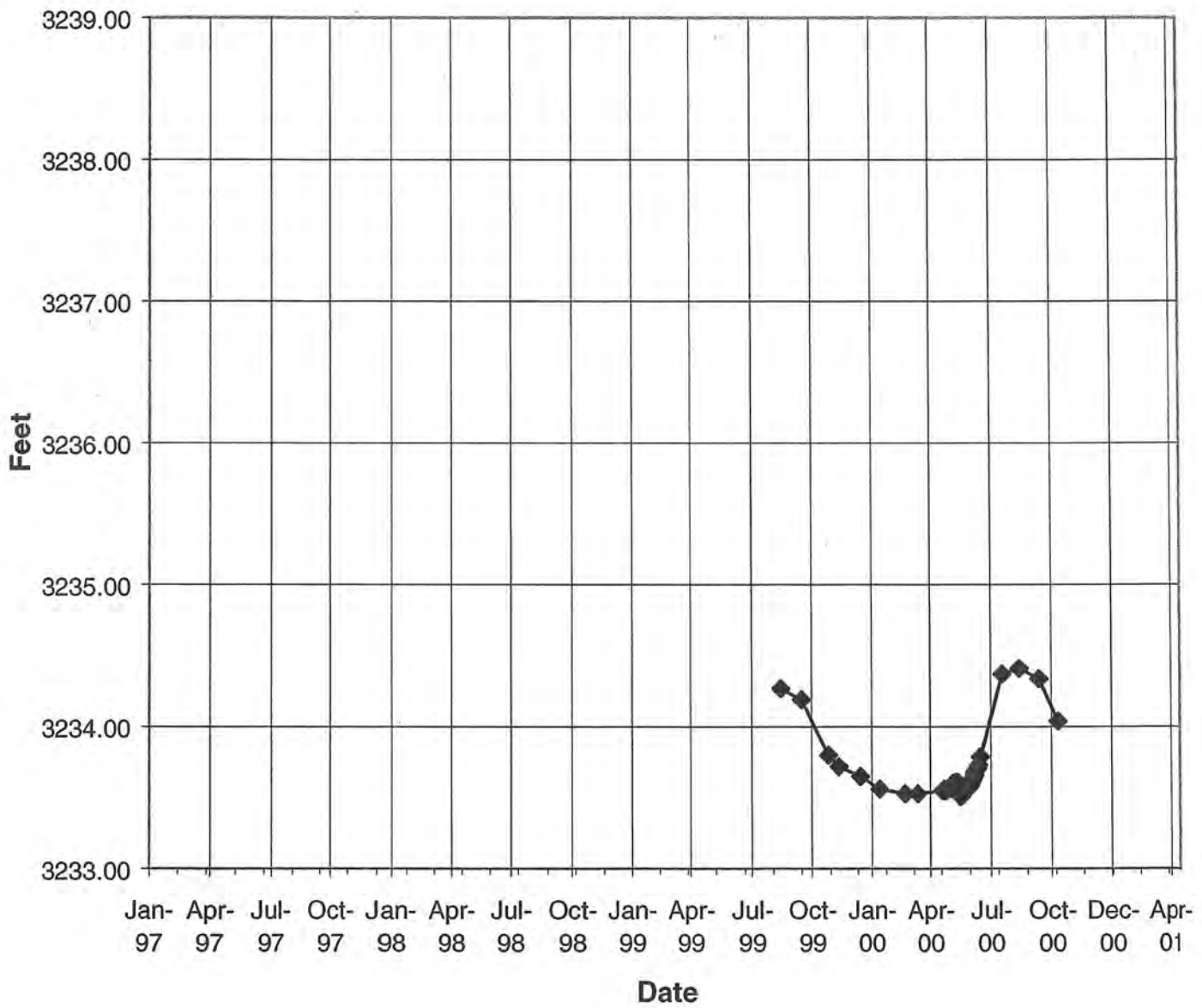
Alt=-- ft ,TD=38 ft



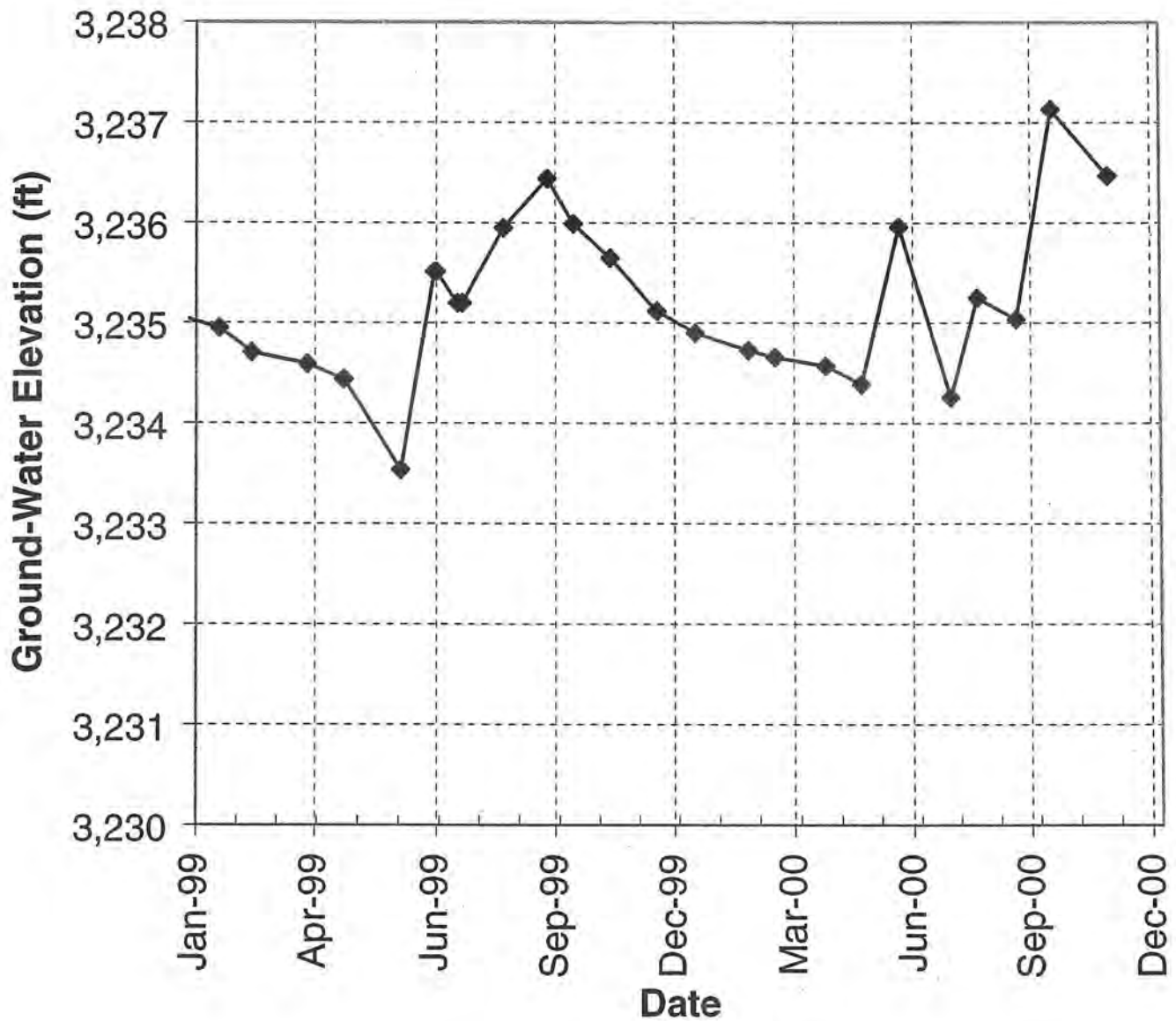
Alt=3235 ft ,TD=36.5 ft



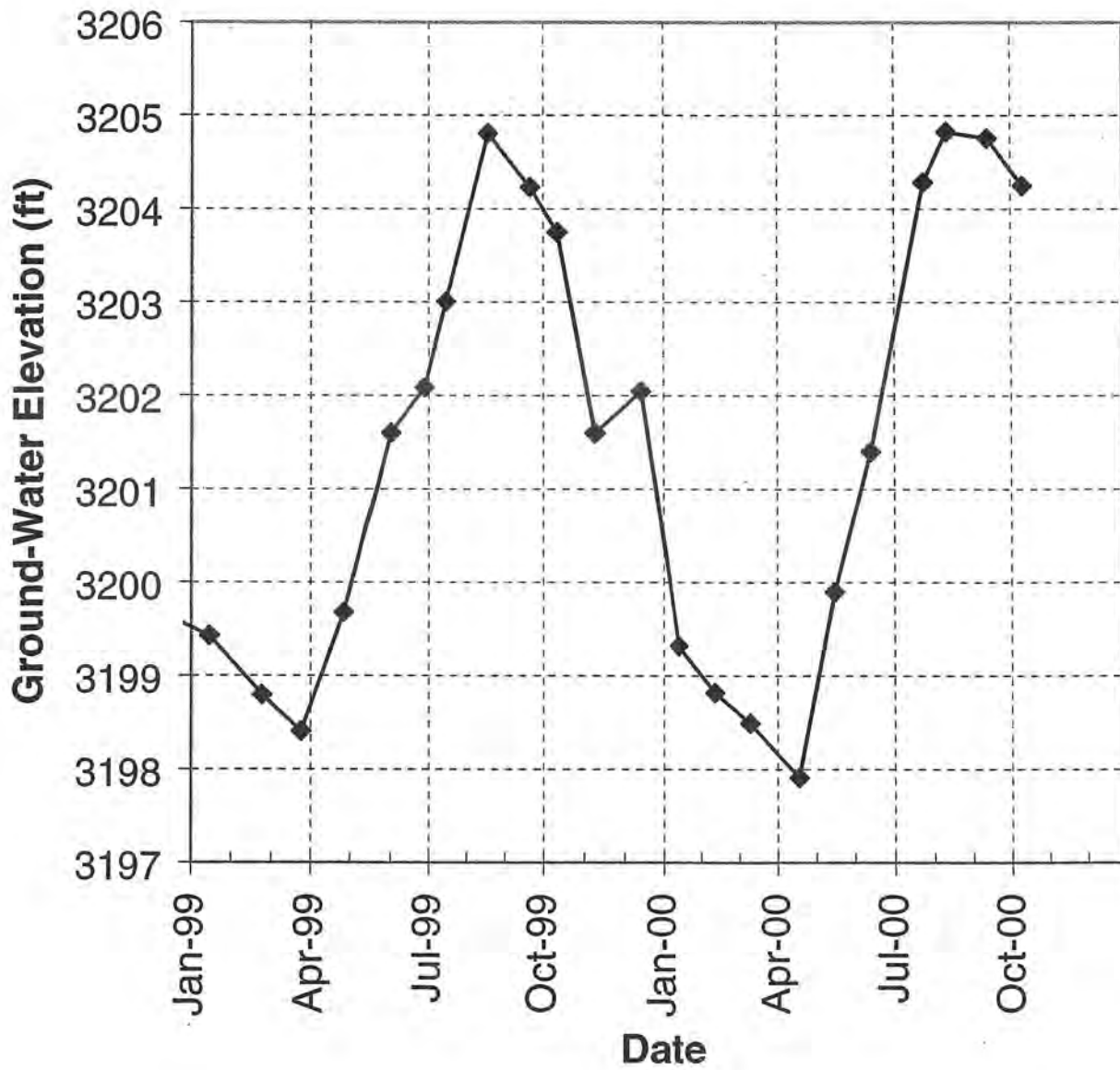
M:171250, JONES-2
01S-25E-21-DDAD
Alt=-- ft ,TD=31 ft



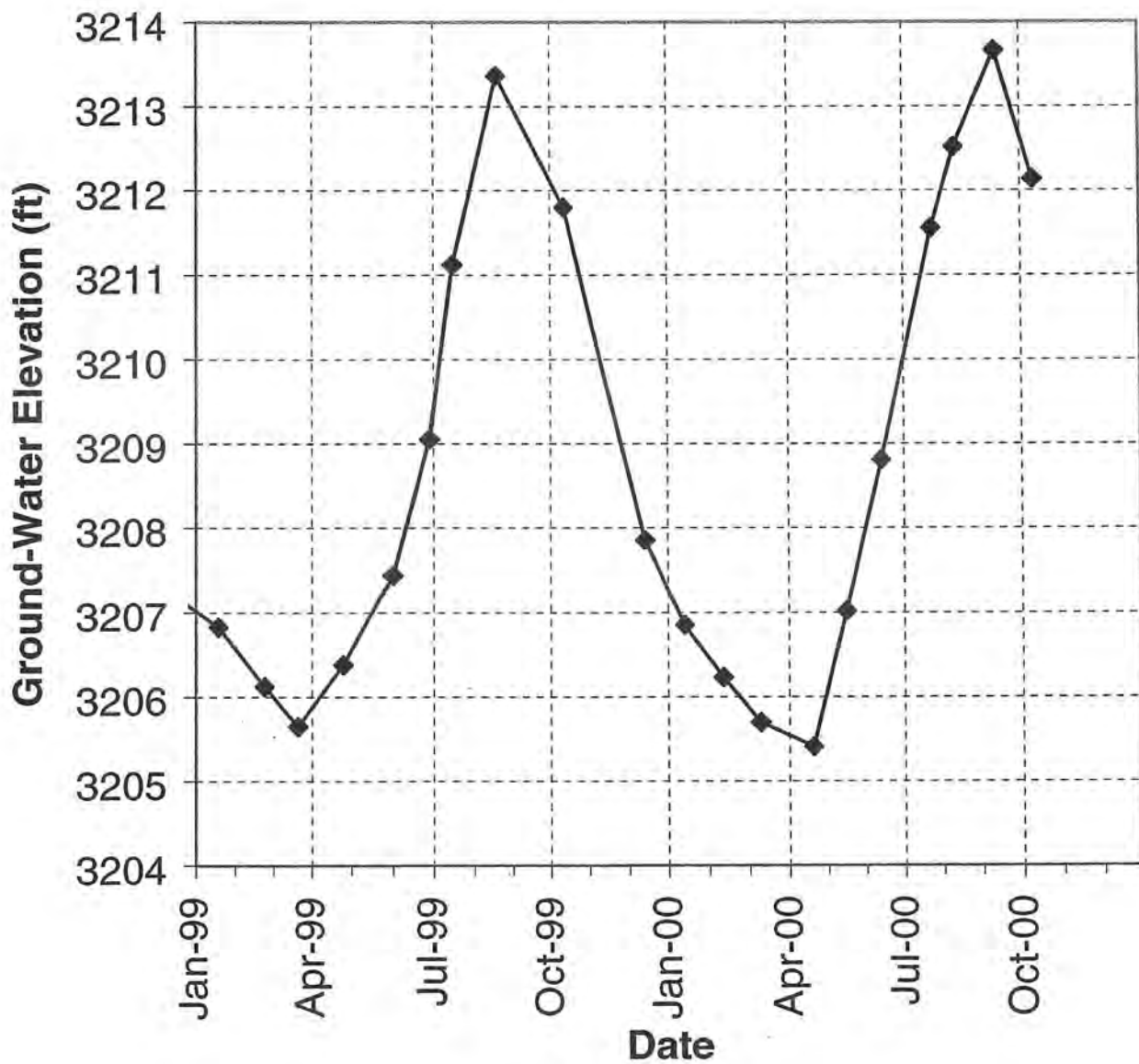
**M:93351, HUDIBURGH DALE
01S-25E-21-AADD
Alt=3255 ft ,TD=30 ft**



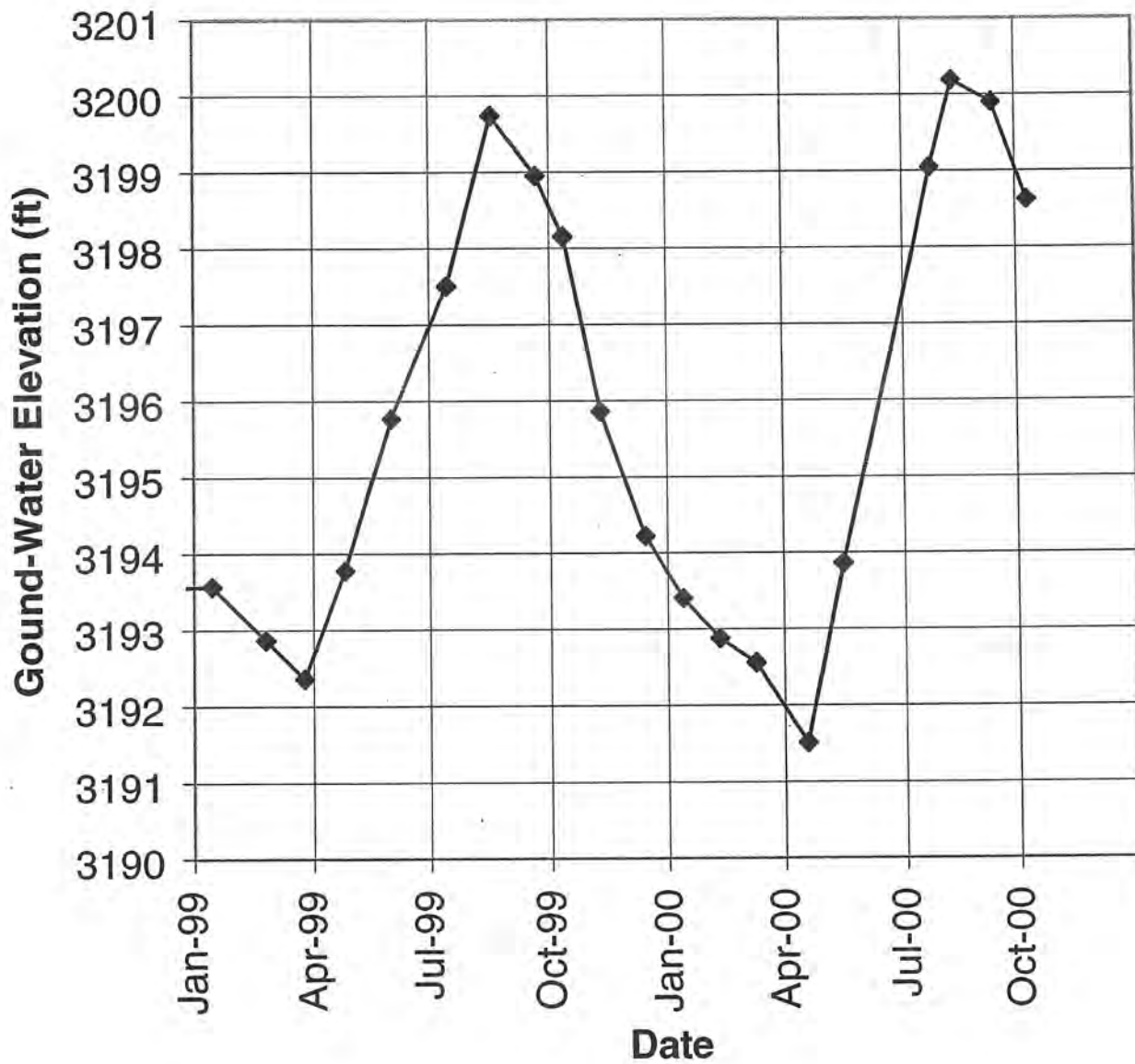
M:144832, ZOO MONTANA
01S-25E-22-DBAB
Alt=3225 ft ,TD=72 ft



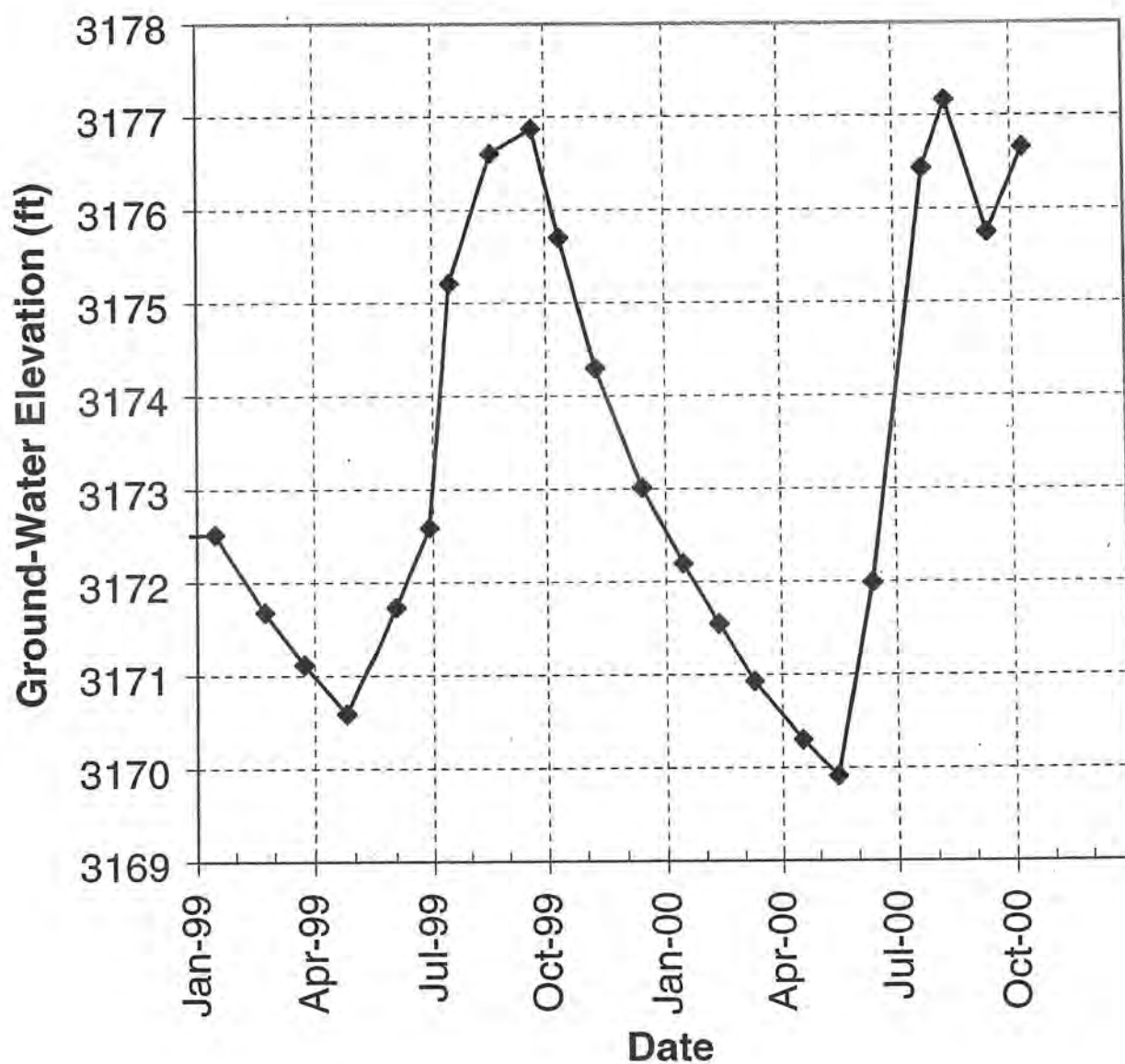
M:162747, FLOHR GARY
01S-25E-22-CDCD
Alt=3230 ft ,TD=35 ft



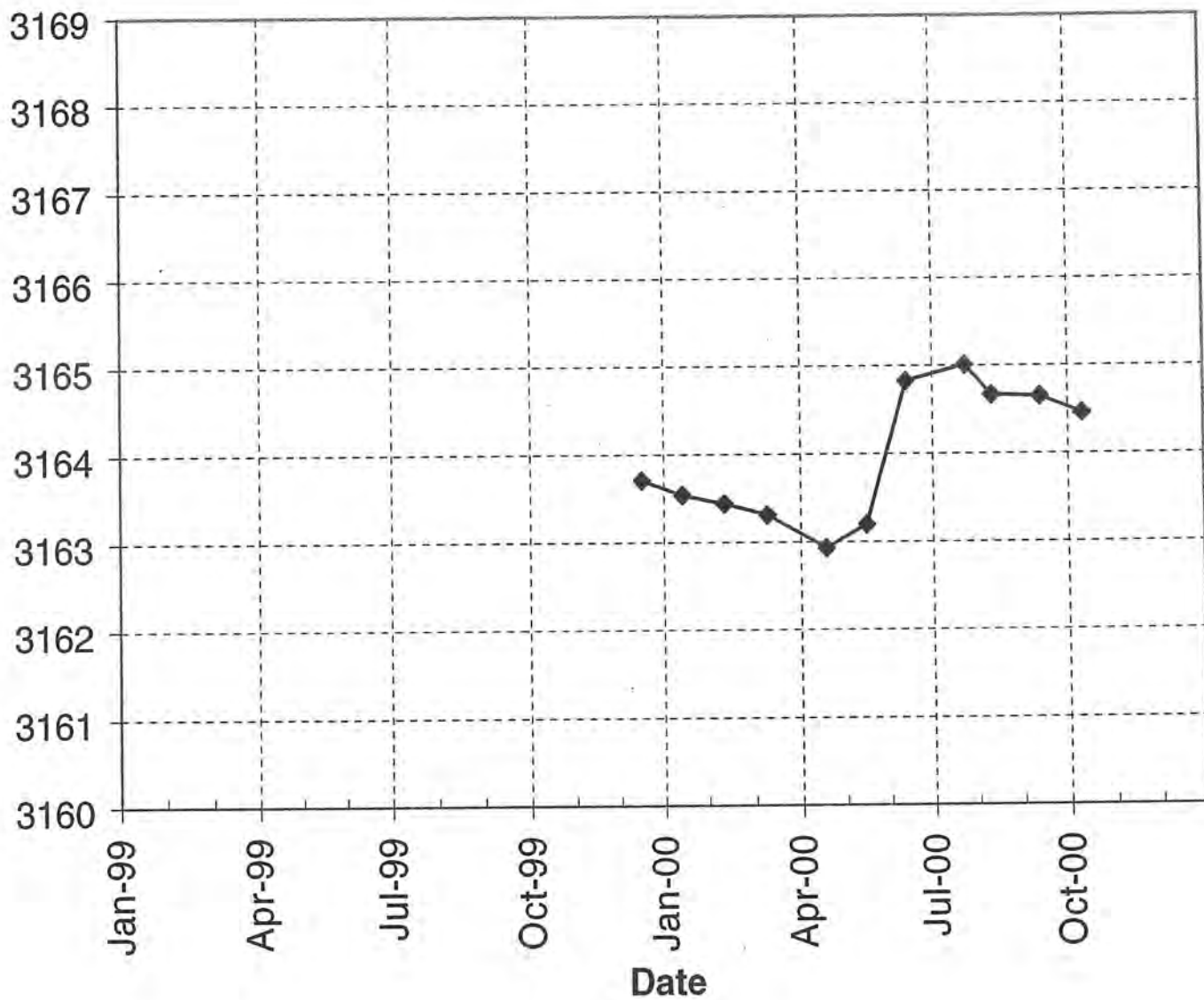
M:93417, ZOO MONTANA
01S-25E-22-DADA
Alt=3215 ft ,TD=45 ft



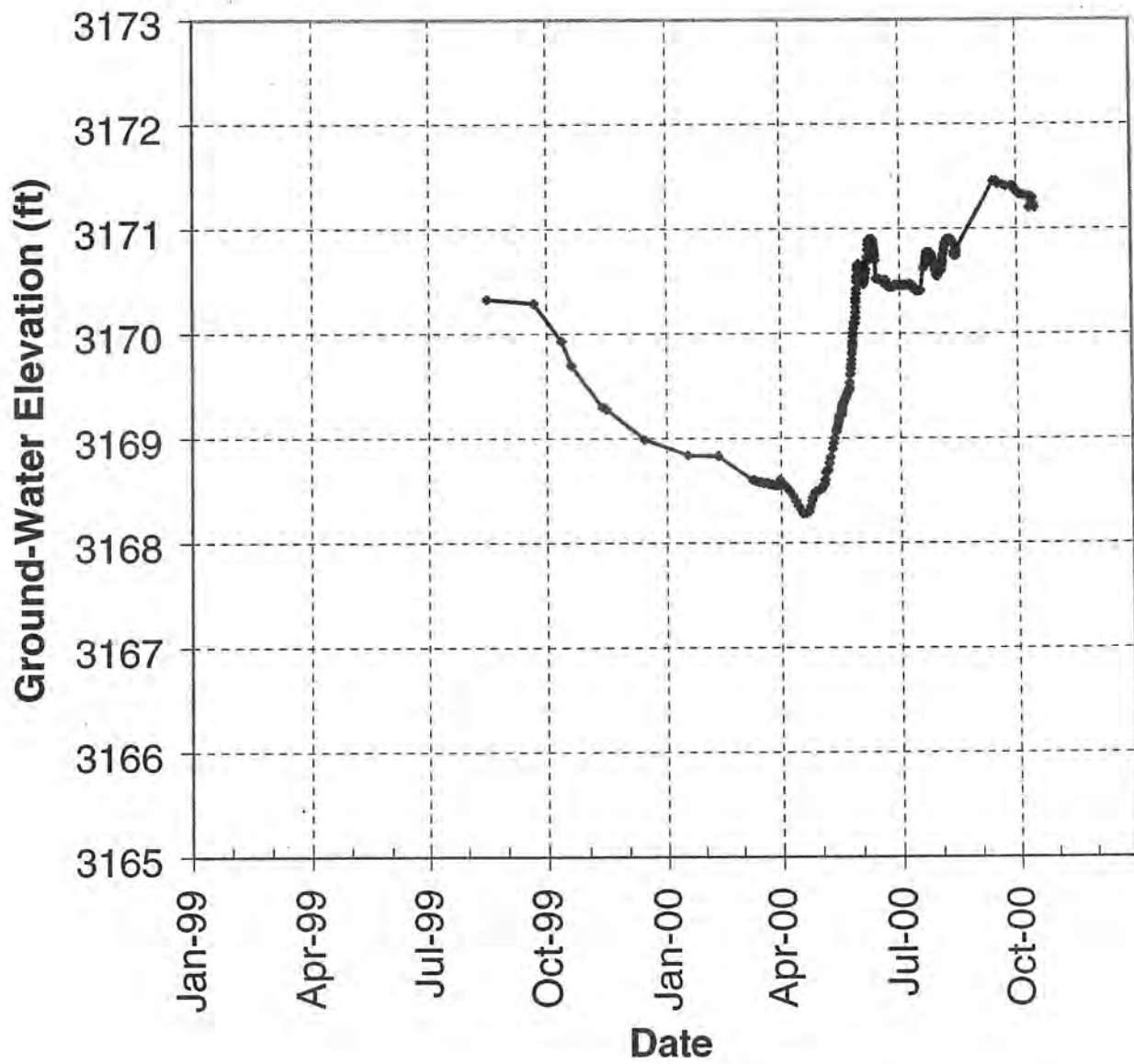
M:93432, ELYSIAN ELEMENTARY SCHOOL
01S-25E-24-AAAA
Alt=3190 ft ,TD=49 ft



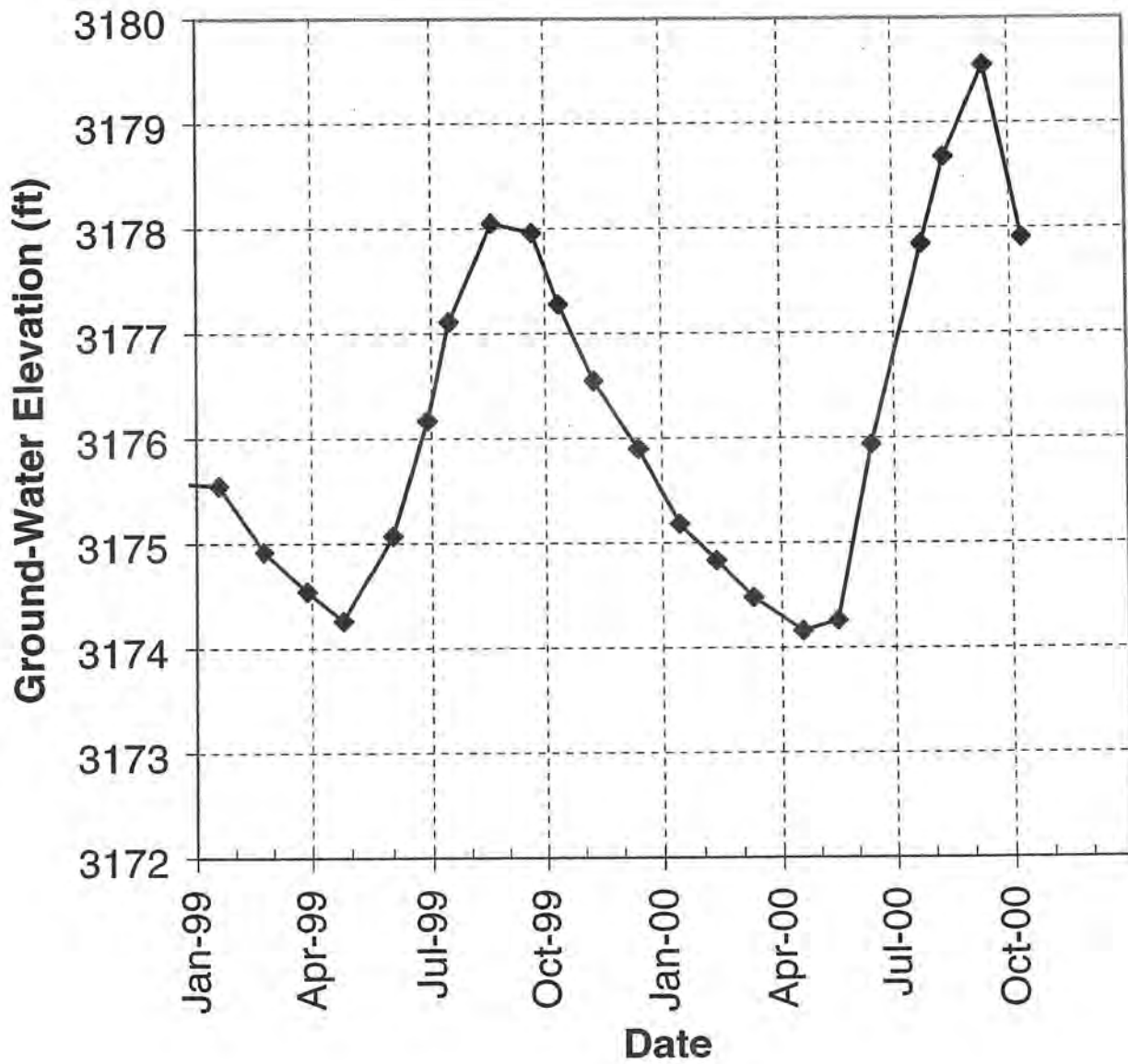
M:166073, ZEILER HAROLD
01S-25E-25-AABA
Alt=3170 ft ,TD=12.1 ft



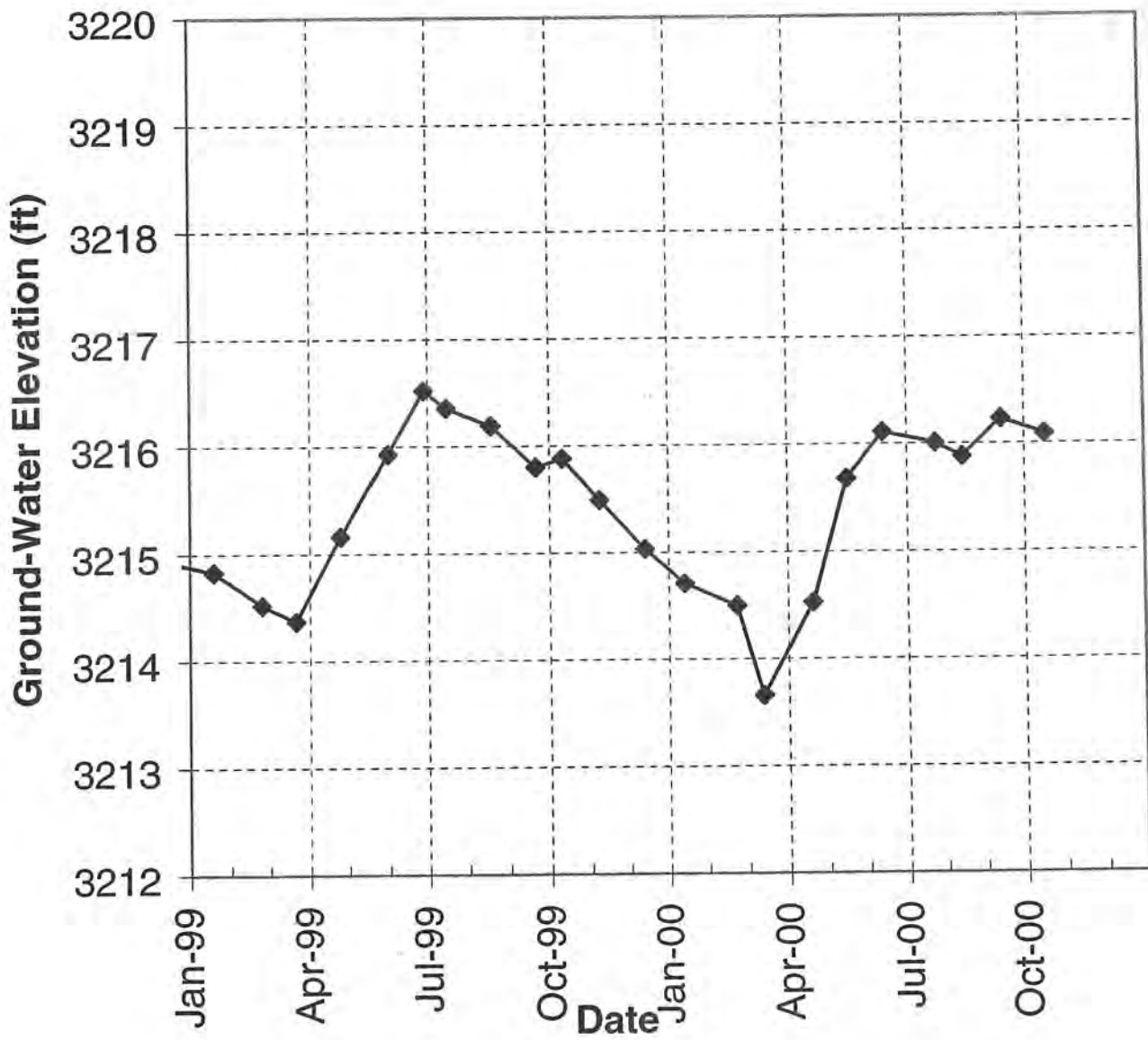
M:171258, GOODMAN-1
01S-25E-25-BCBC
Alt=3192 ft ,TD=25 ft



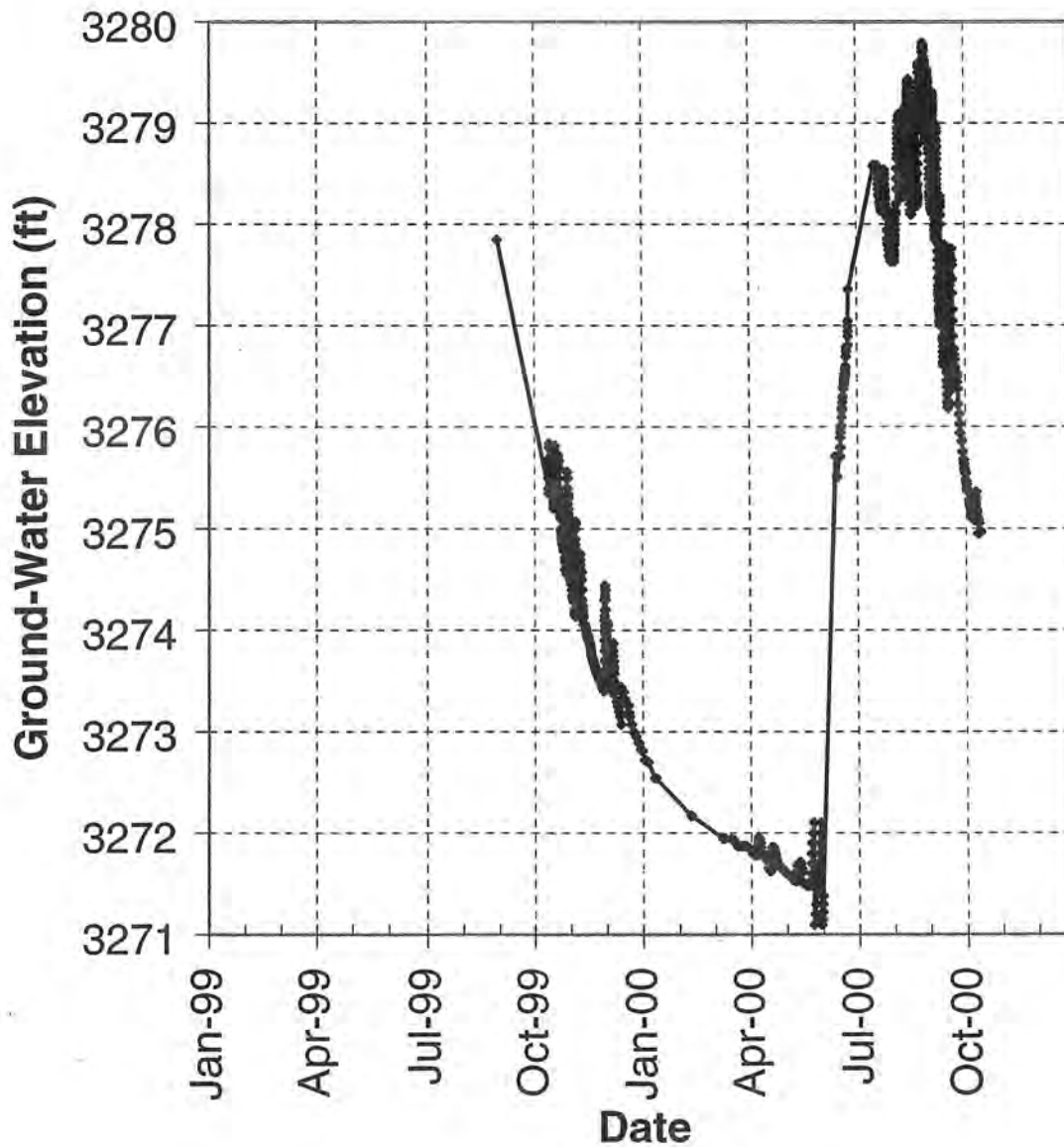
M:154210, GABEL EVERETT
01S-25E-26-AADD
Alt=3195 ft ,TD=38 ft



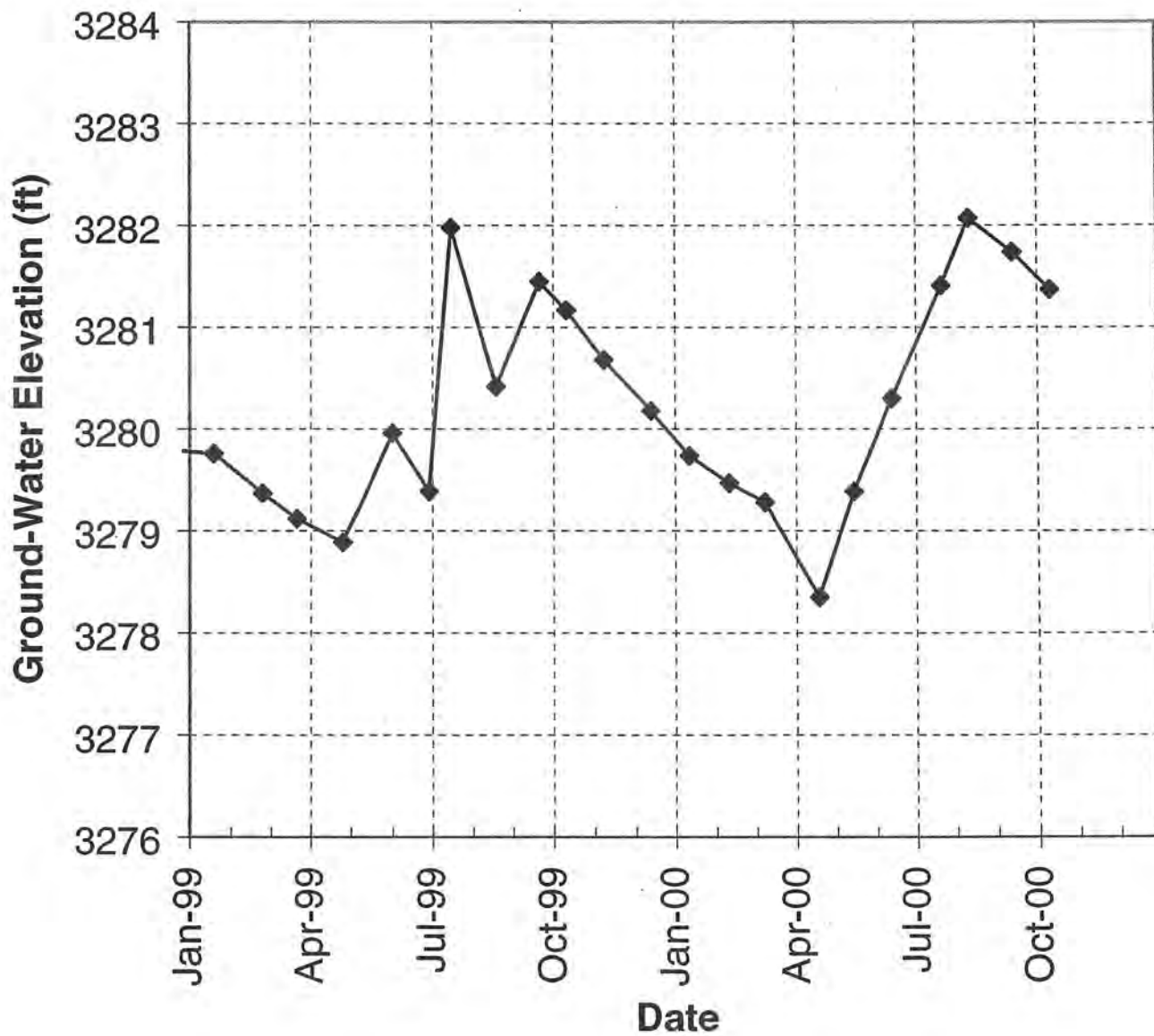
M:162752, JONES ELLEN
01S-25E-28-CDCD
Alt=3220 ft ,TD=30 ft



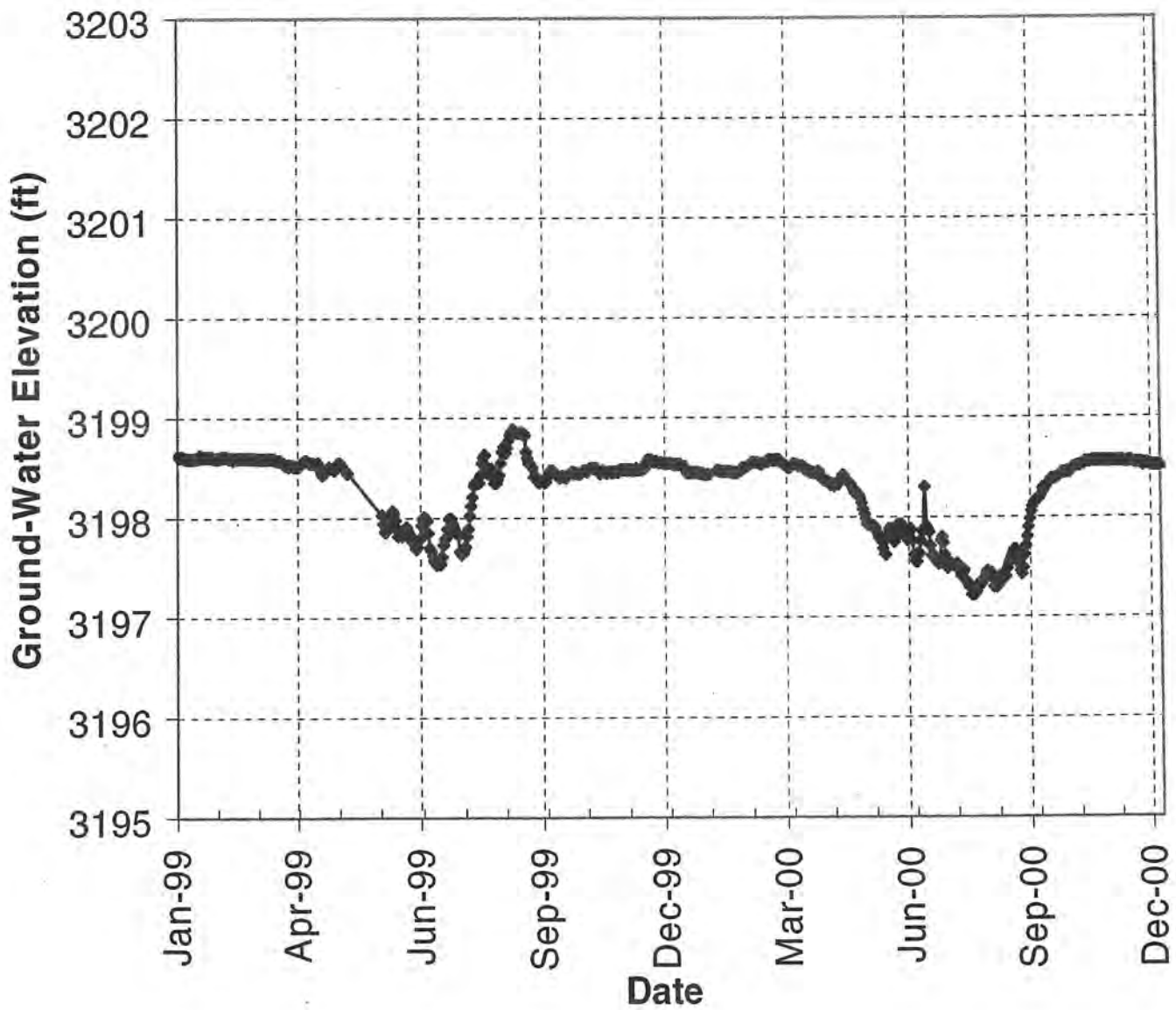
M:171248, THOMAS-1
01S-25E-29-BCCC
Alt=3283 ft ,TD=18.5 ft



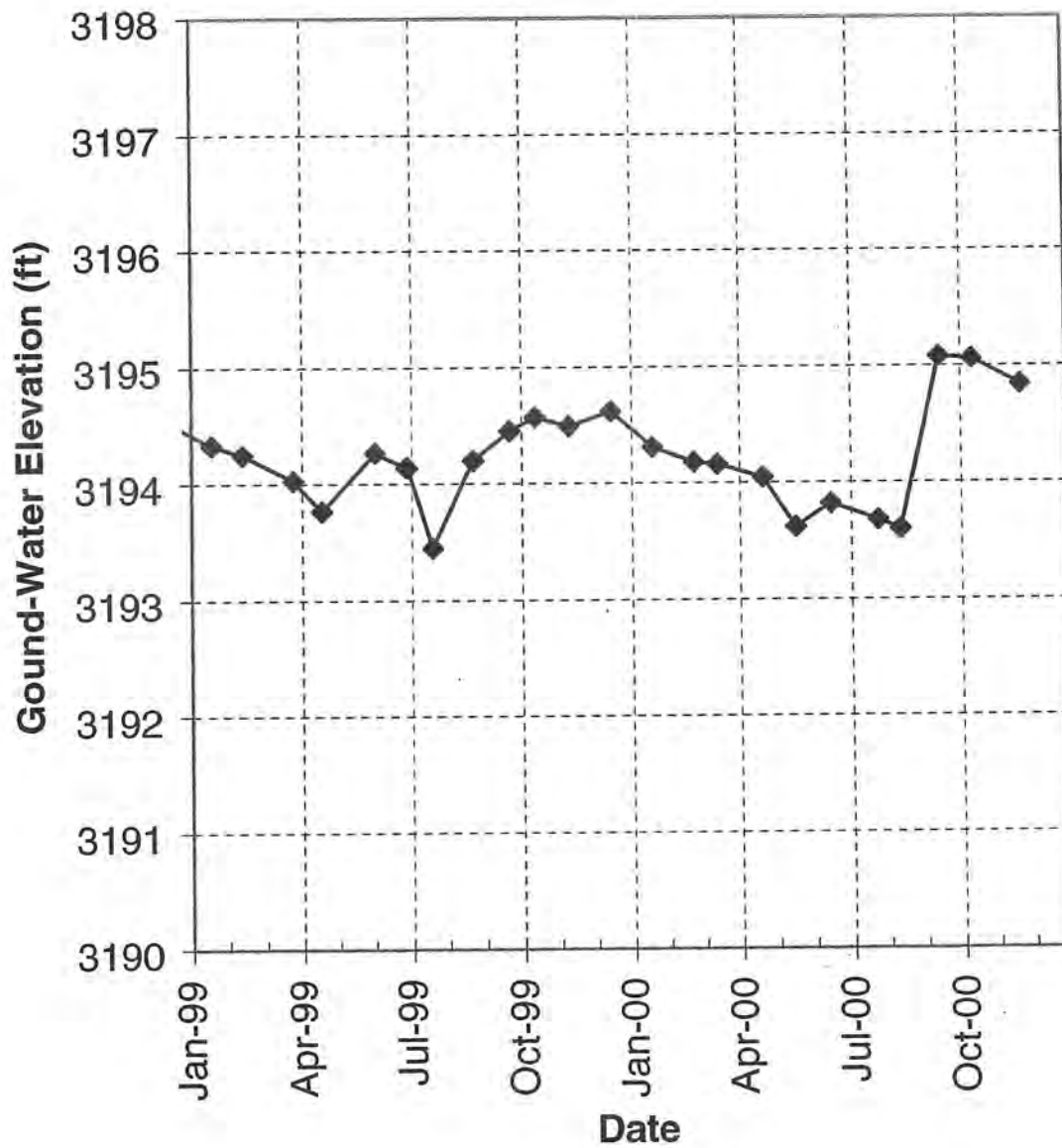
M:93528, SWANSON CLARENCE L.
01S-25E-30-DDDC
Alt=3285 ft ,TD=20 ft



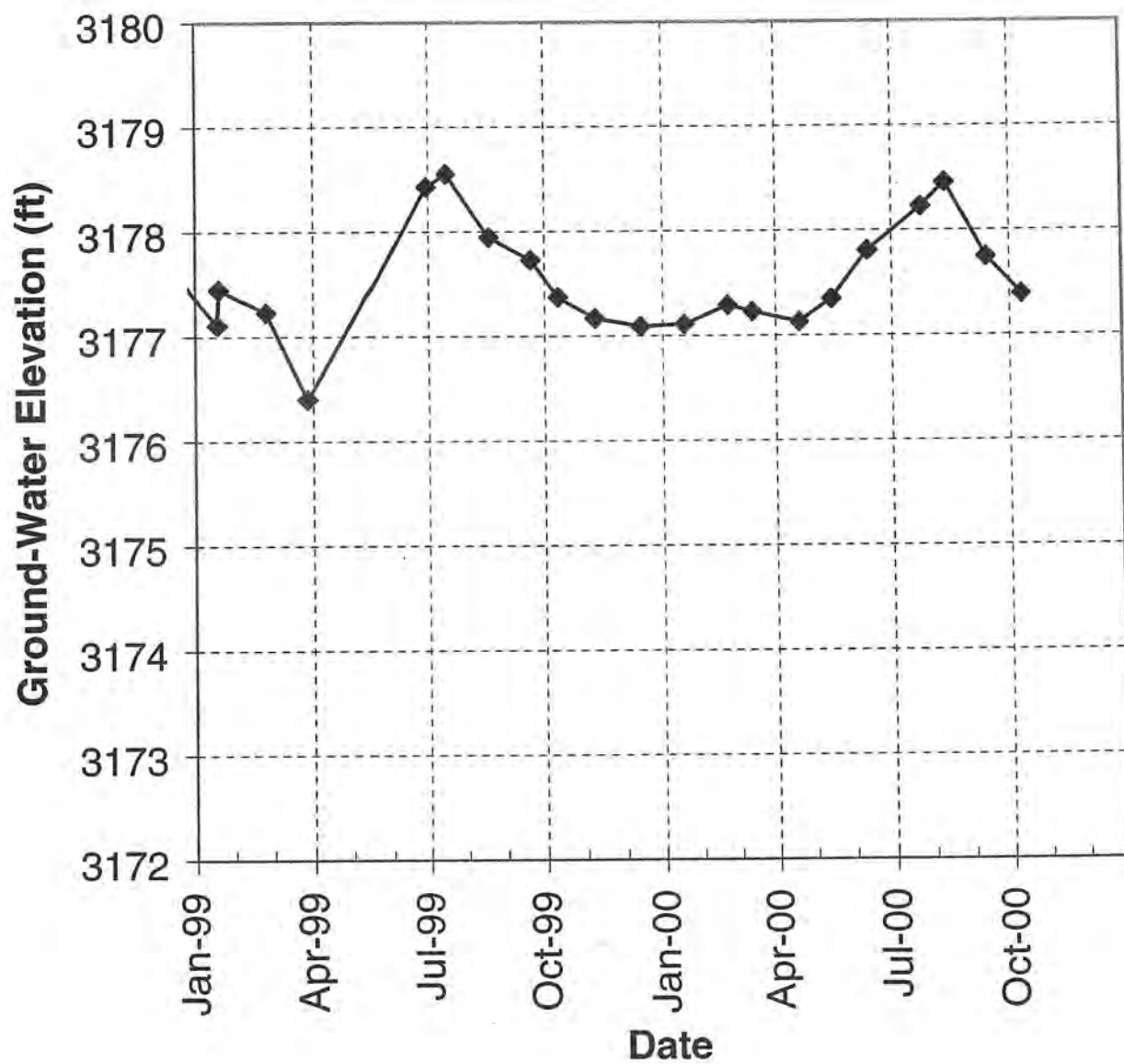
M:158589, WELLS DAN
01S-25E-33-ACDA
Alt=3208 ft ,TD=25 ft



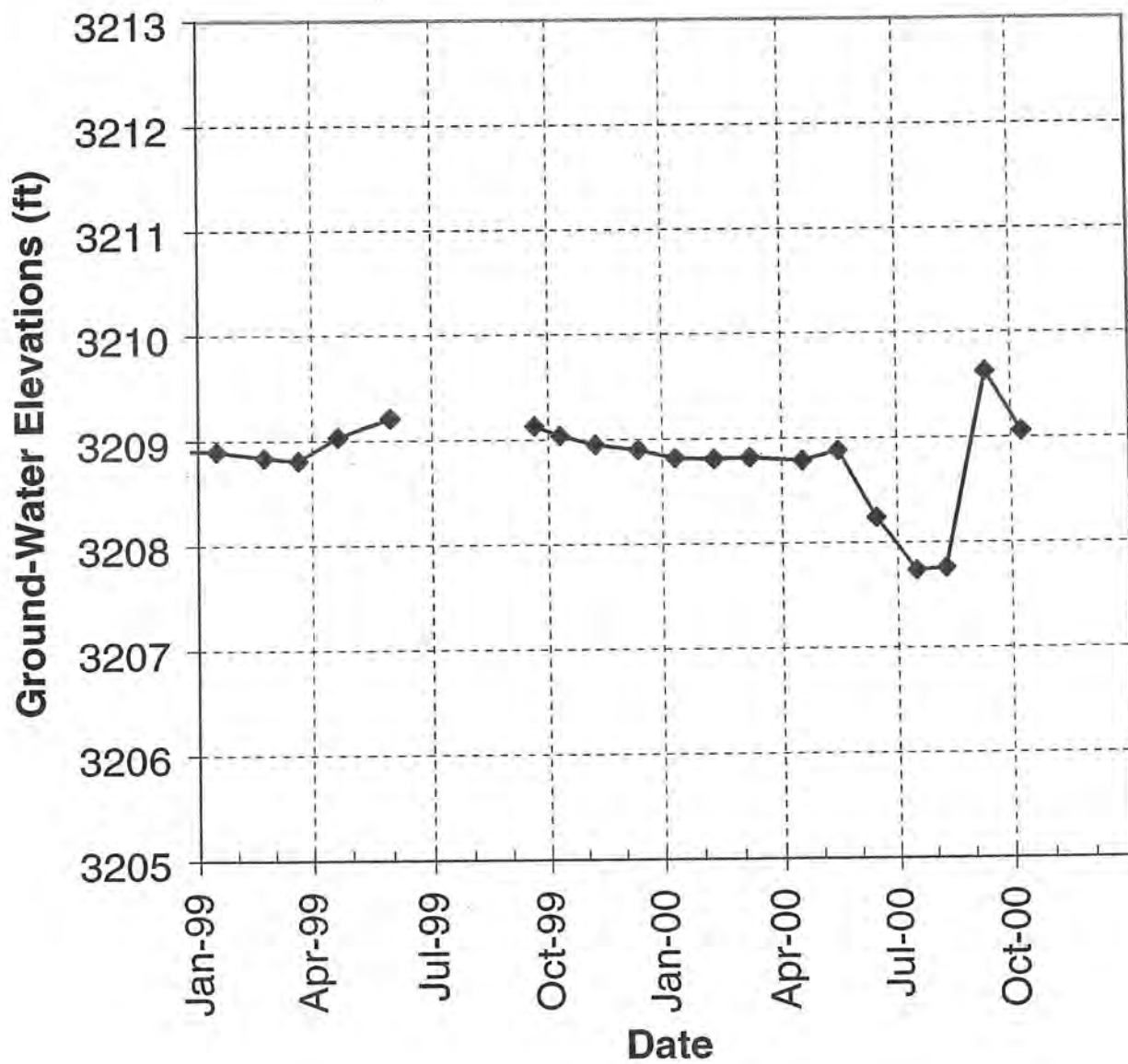
M:158946, REITEN PALMER
01S-25E-34-BBBB
Alt=3205 ft ,TD=23.5 ft



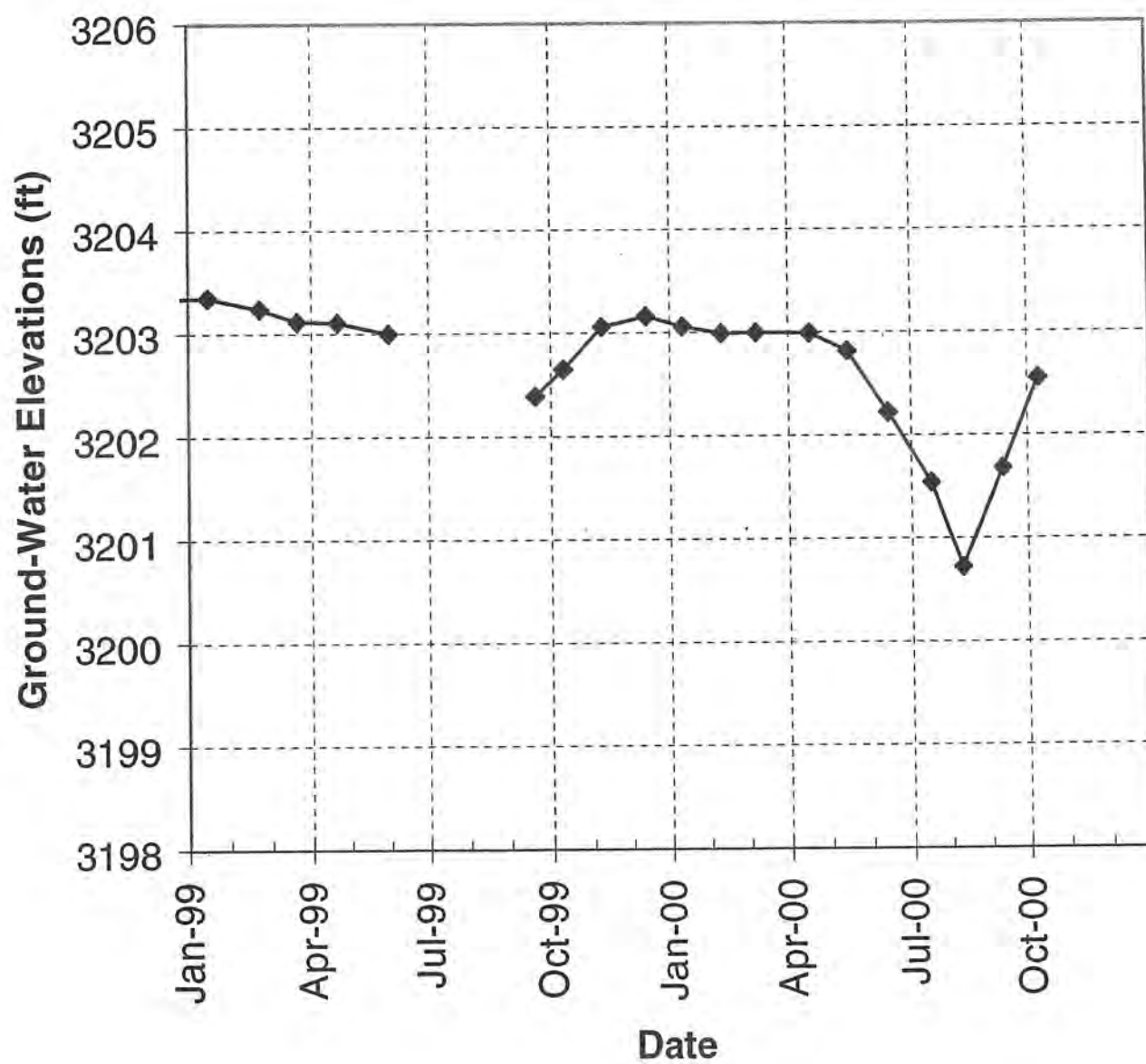
**M:162779, LIMPP RICK AND MARCIE
01S-25E-34-ADDD
Alt=3190 ft ,TD=10 ft**



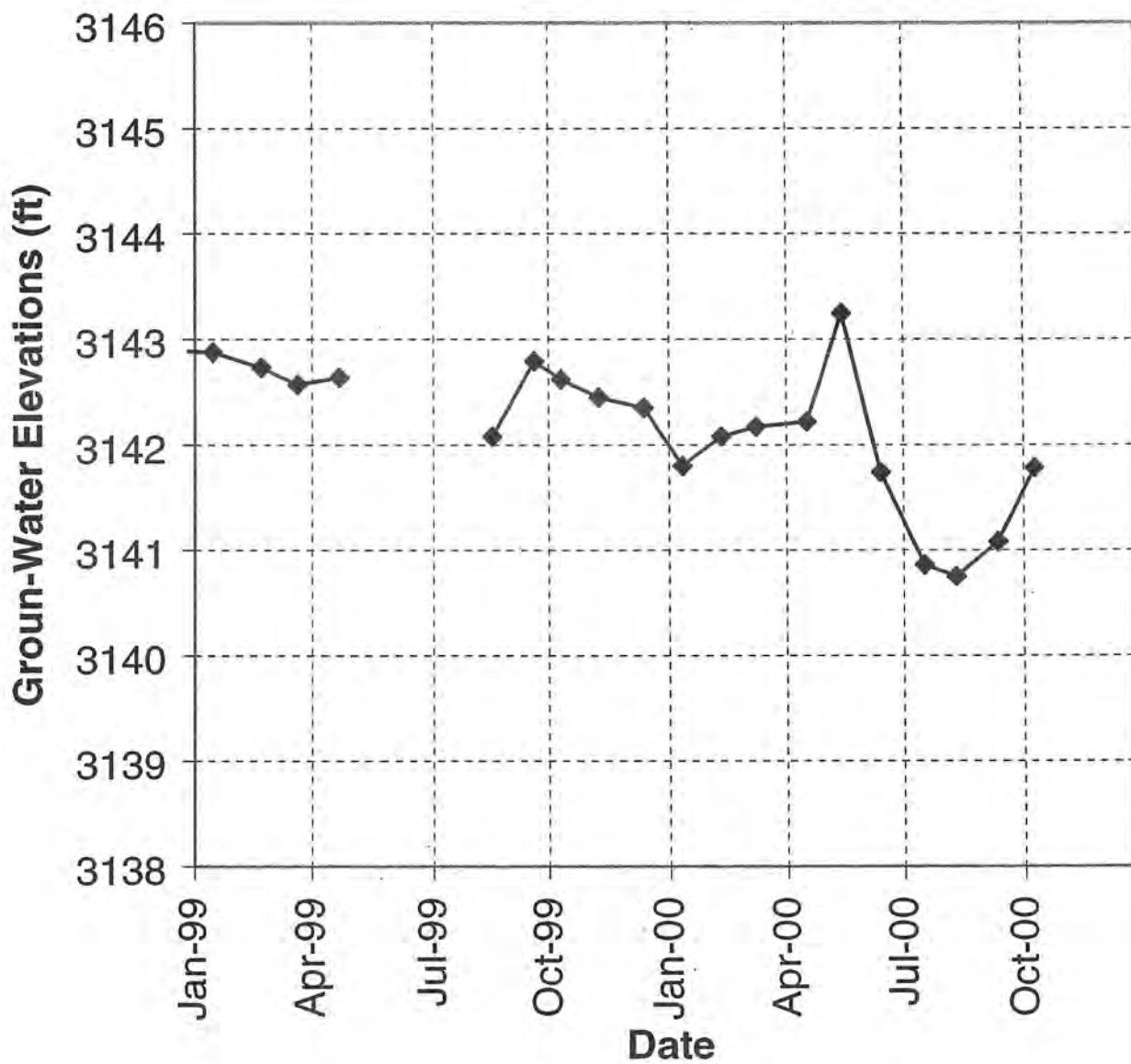
M:93844, BURLINGTON PARK
01S-26E-6-BACA
Alt=3220 ft ,TD=26 ft



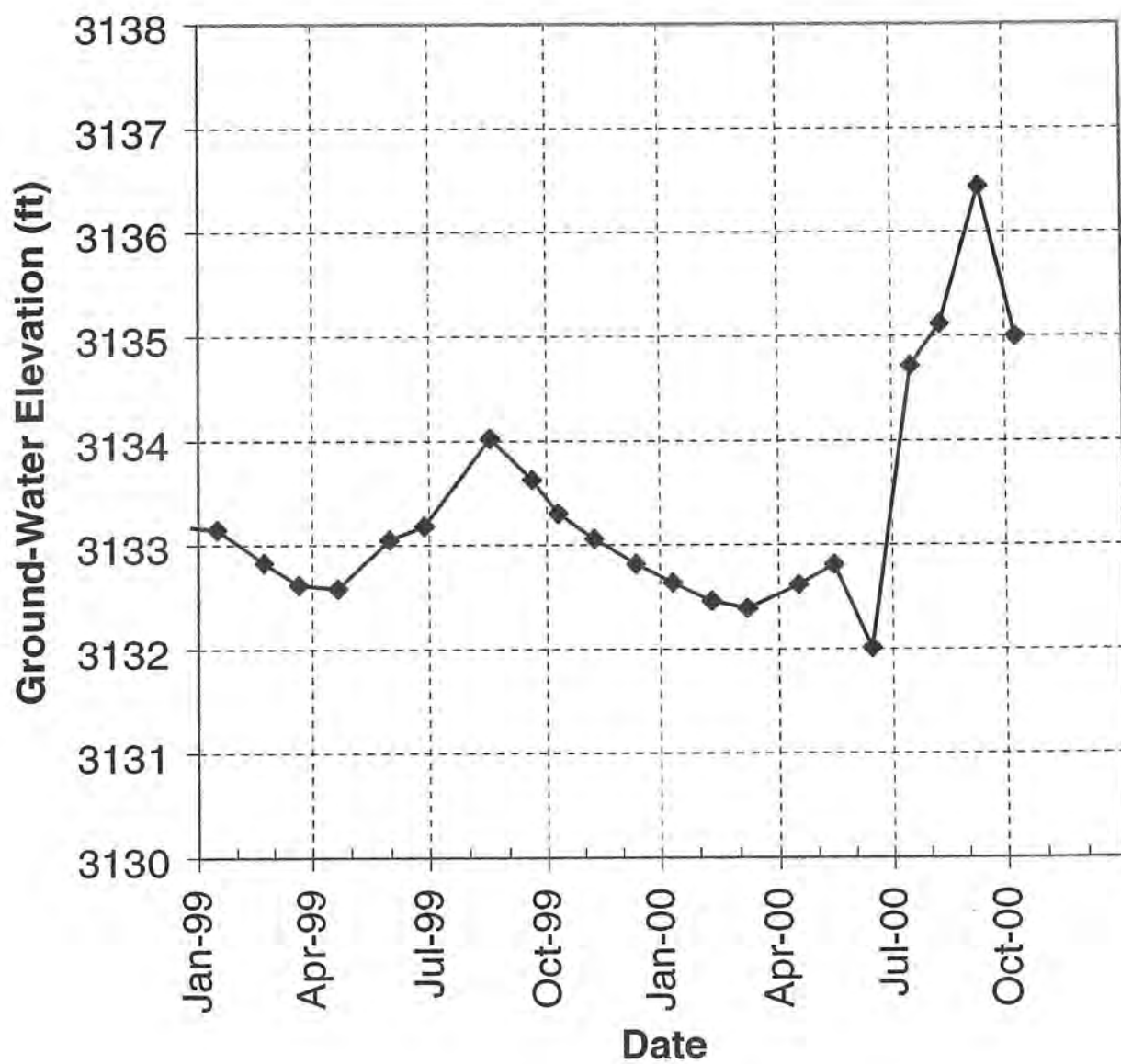
**M:93857, GORMAN PARK
01S-26E-6-CACA
Alt=3220 ft ,TD=25 ft**



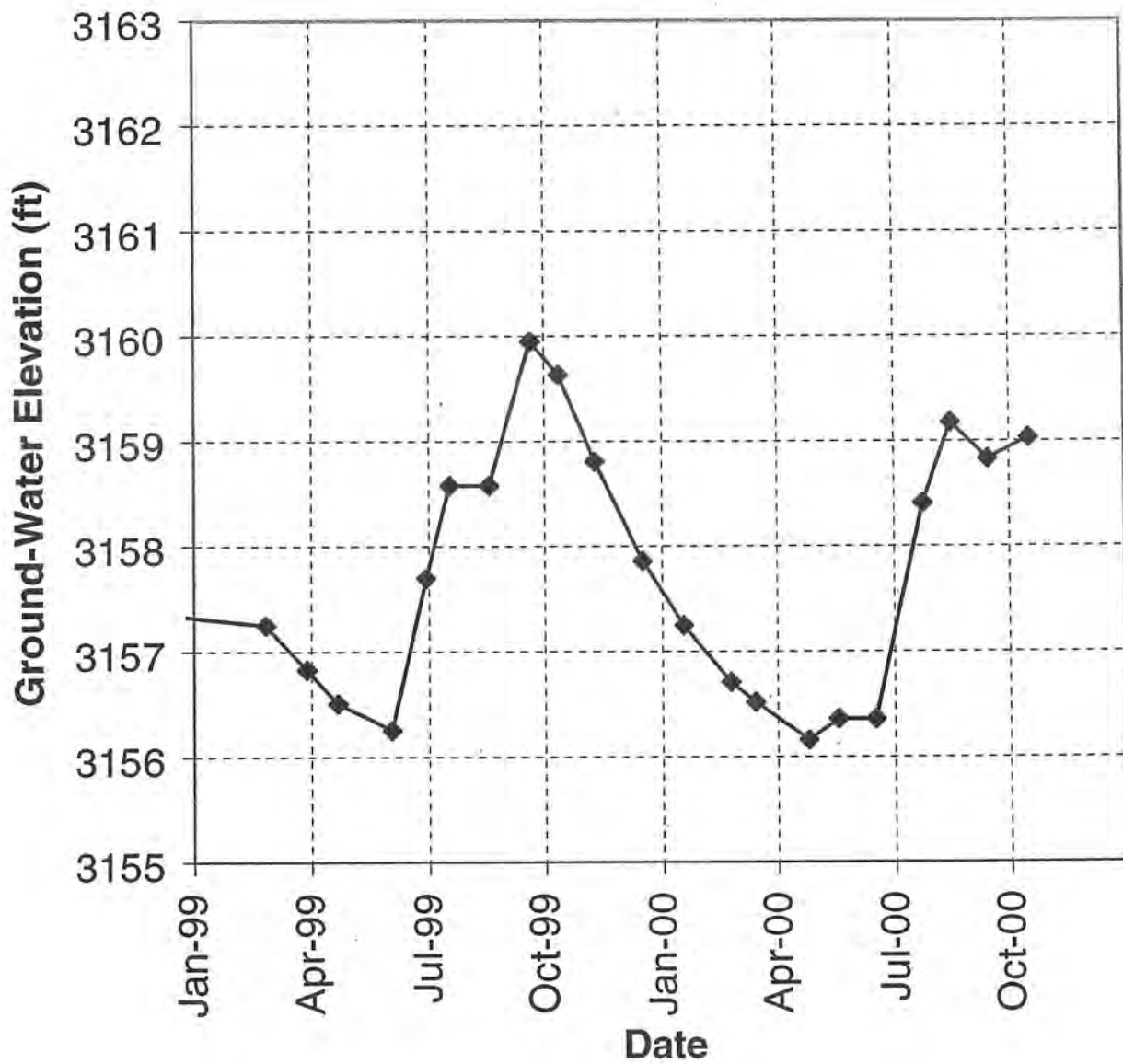
M:93939, COMANCHEE PARK
01S-26E-8-BDDA
Alt=3155 ft ,TD=31 ft



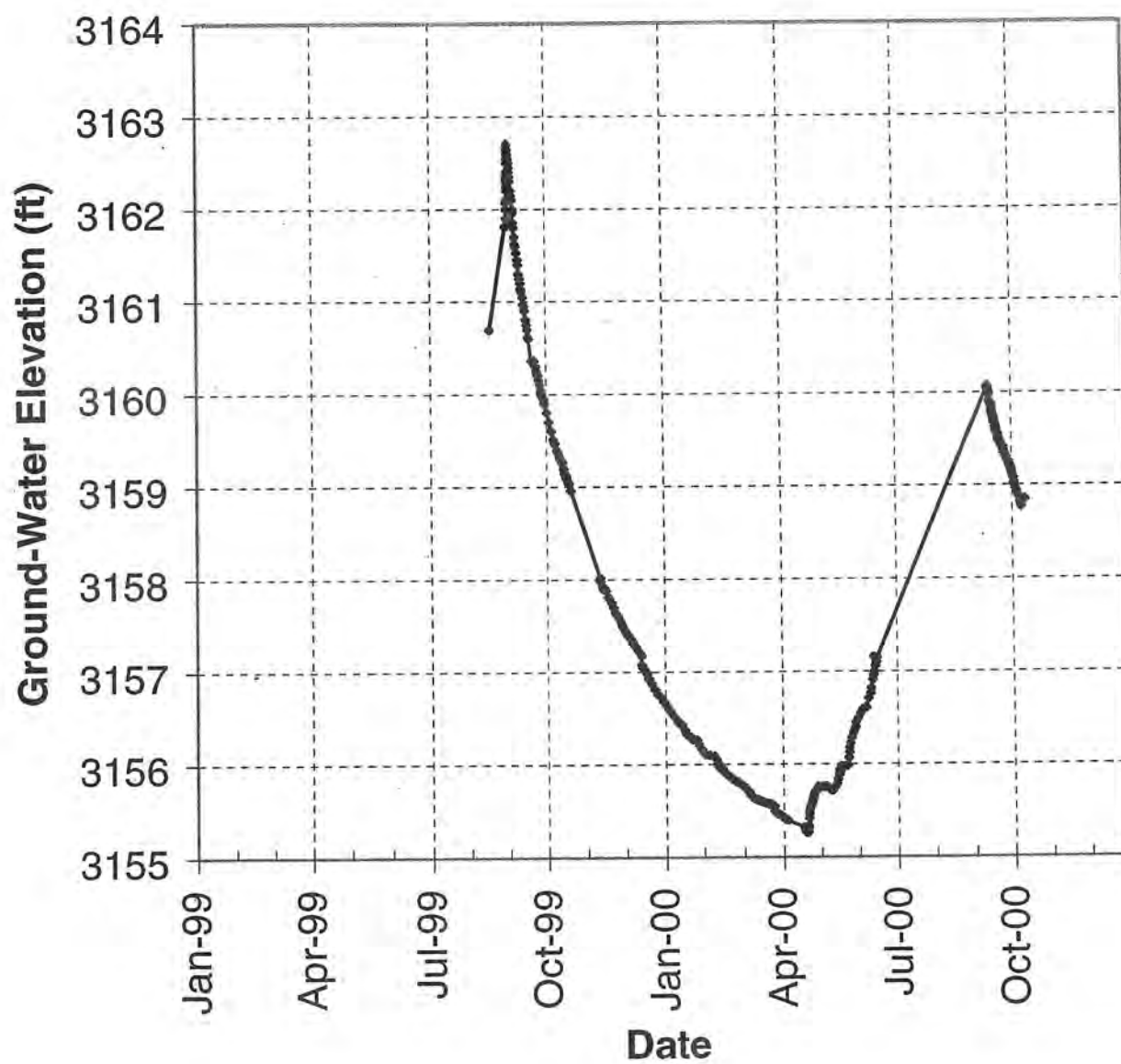
M:94118, CITY OF BILLINGS - PONDEROSA PARK
01S-26E-16-ABCB
Alt=3145 ft ,TD=26 ft



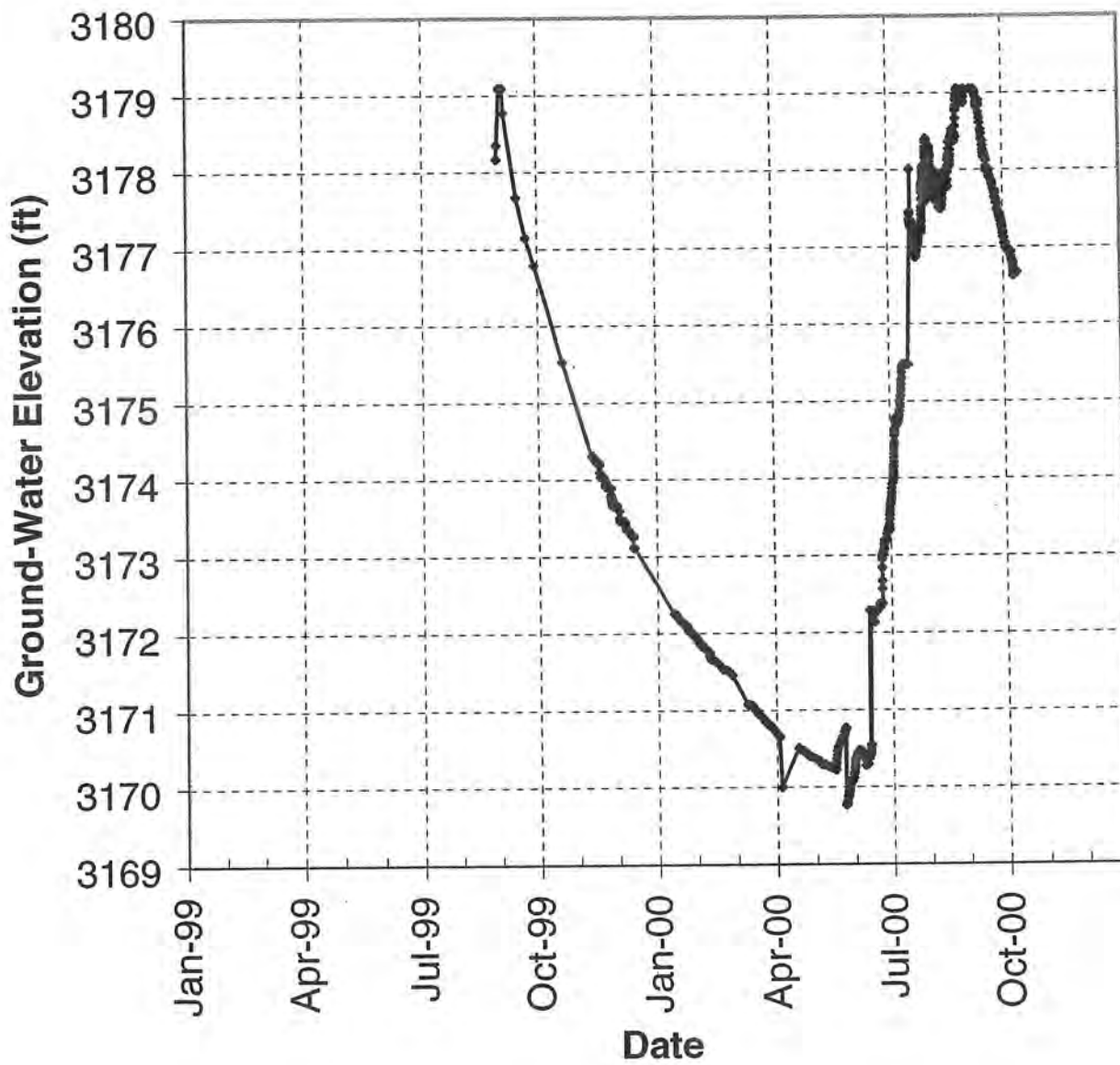
**M:145421, MT DEPT OF TRANSPORTATION
01S-26E-18-ADAC
Alt=3175 ft ,TD=47 ft**



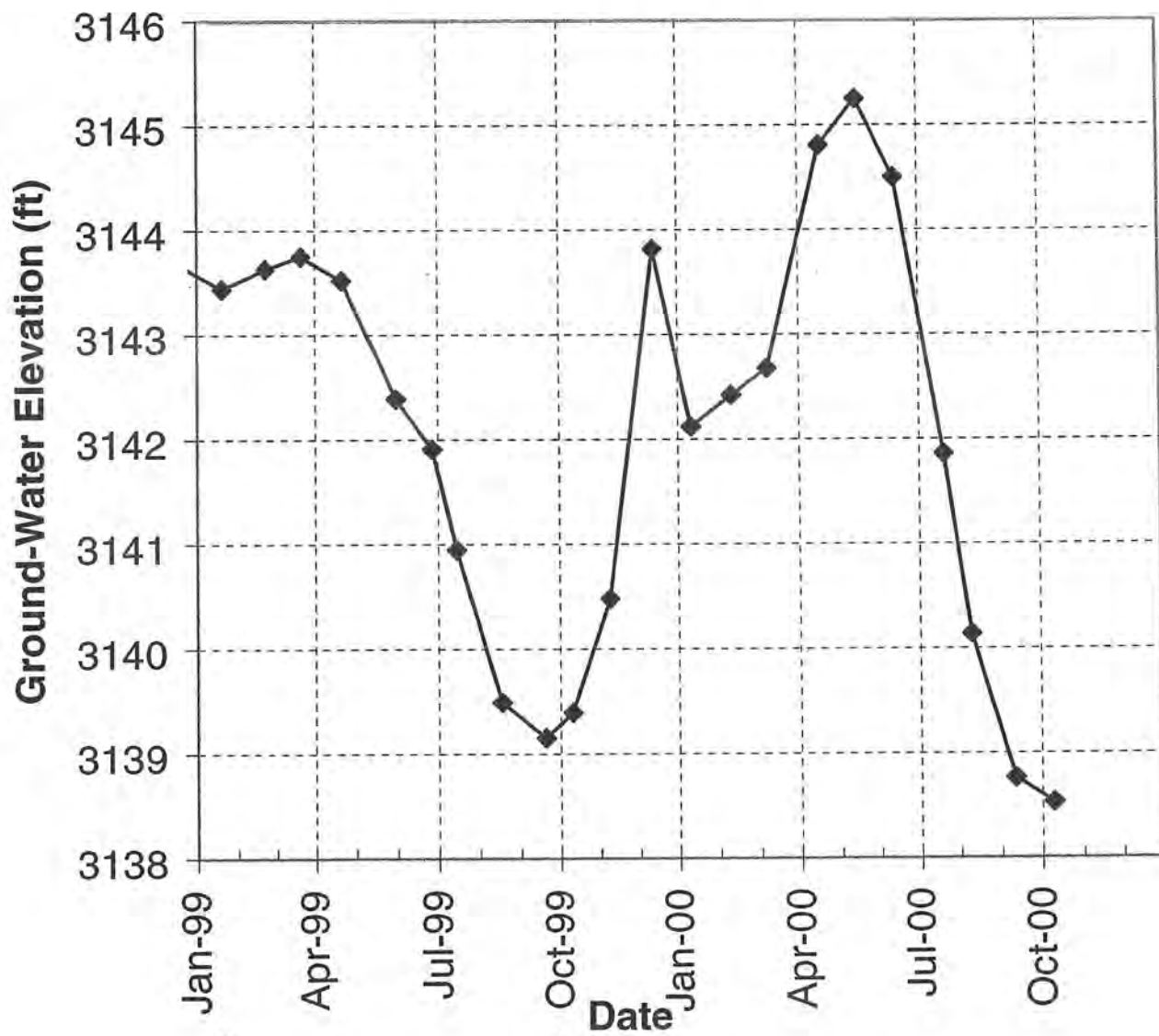
M:171256, WEBER-1
01S-26E-18-DDCC
Alt=3169 ft ,TD=19.5 ft



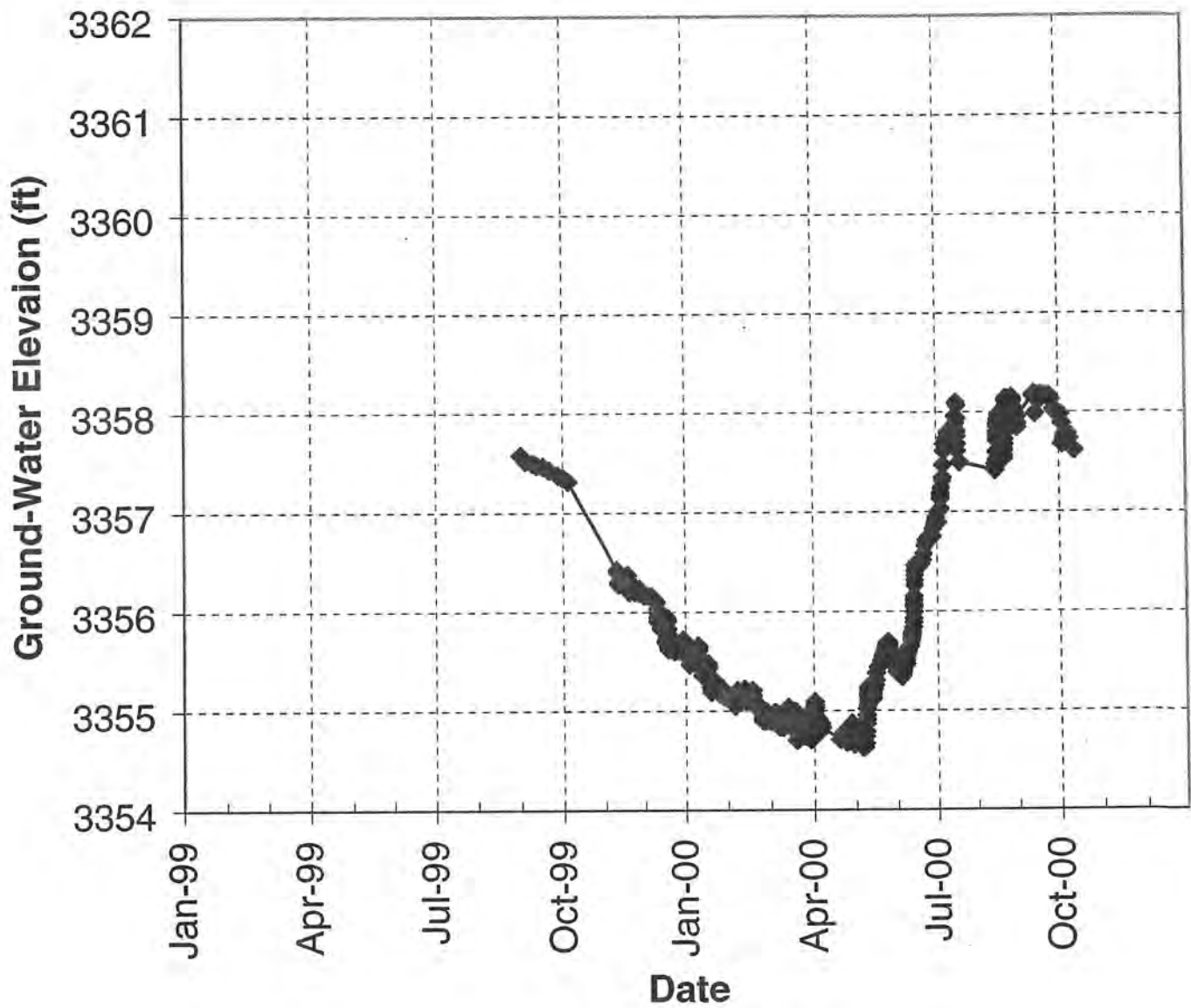
M:171257, ARMSTRONG-1
01S-26E-19-BBBD
Alt=3189 ft ,TD=20 ft



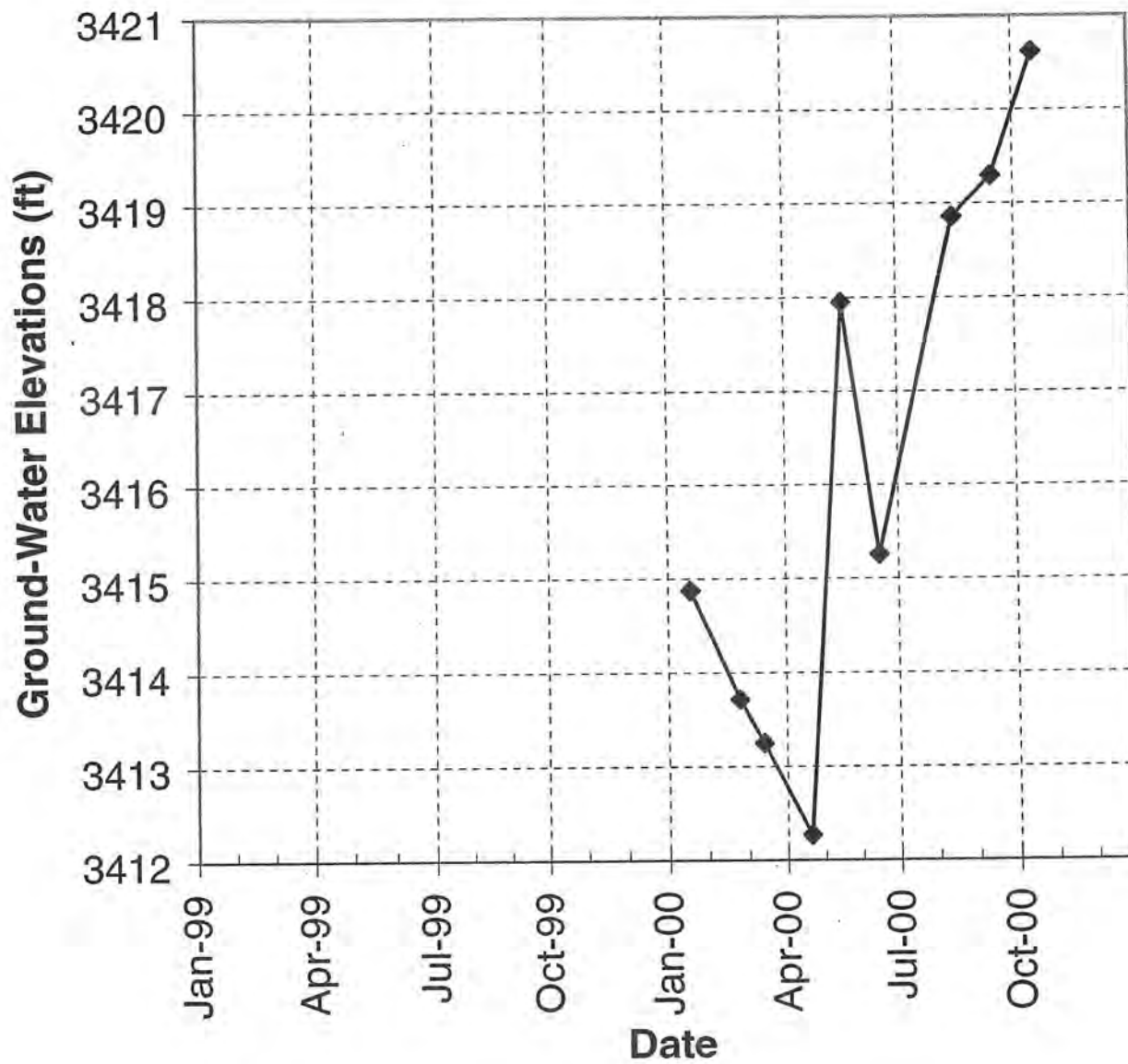
M:94162, RESTAD JAMES
01S-26E-20-DACA
Alt=3155 ft ,TD=36 ft



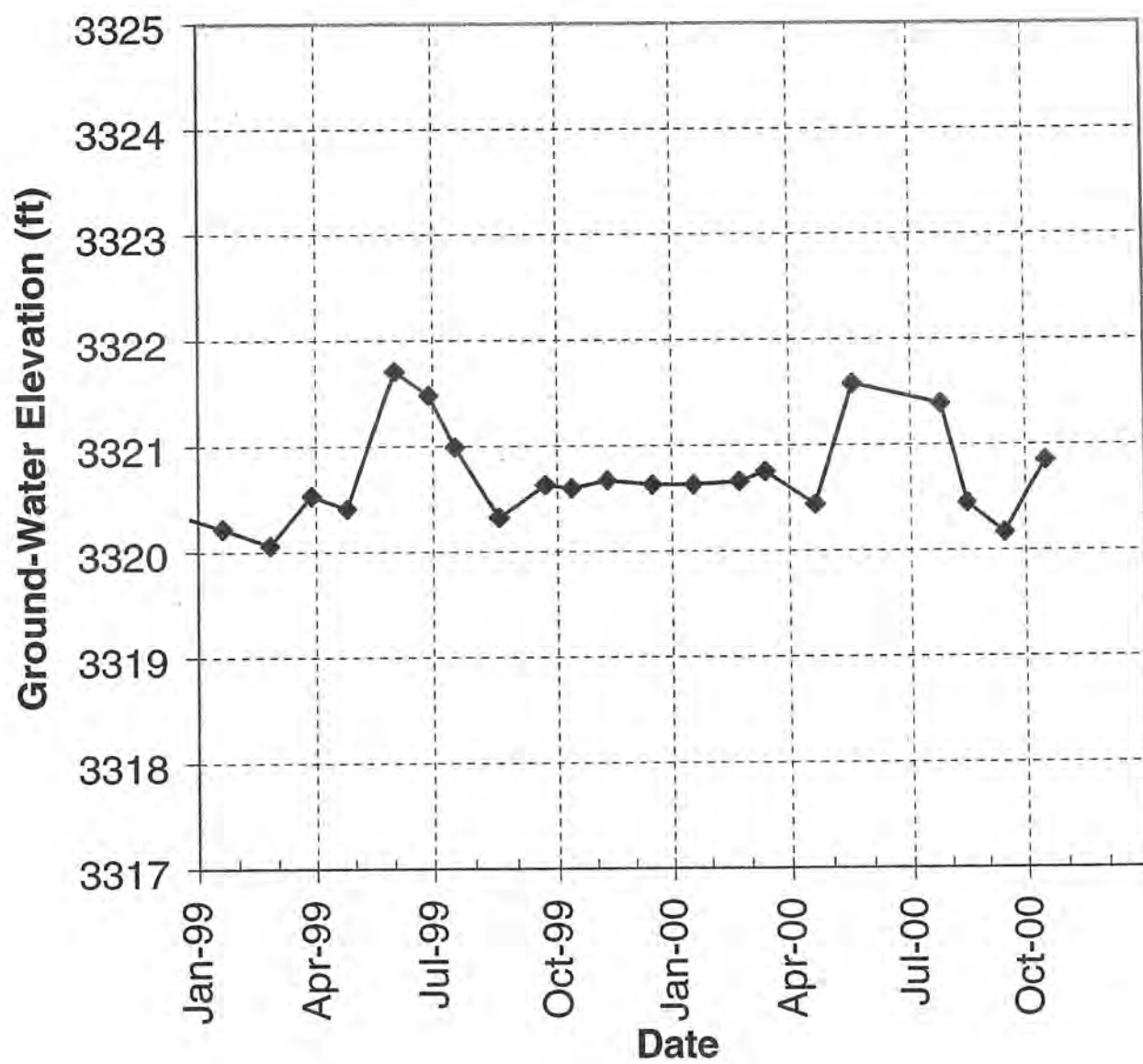
M:171264, SHAY-1
02S-23E-13-BBAB
Alt=3362 ft ,TD=31 ft



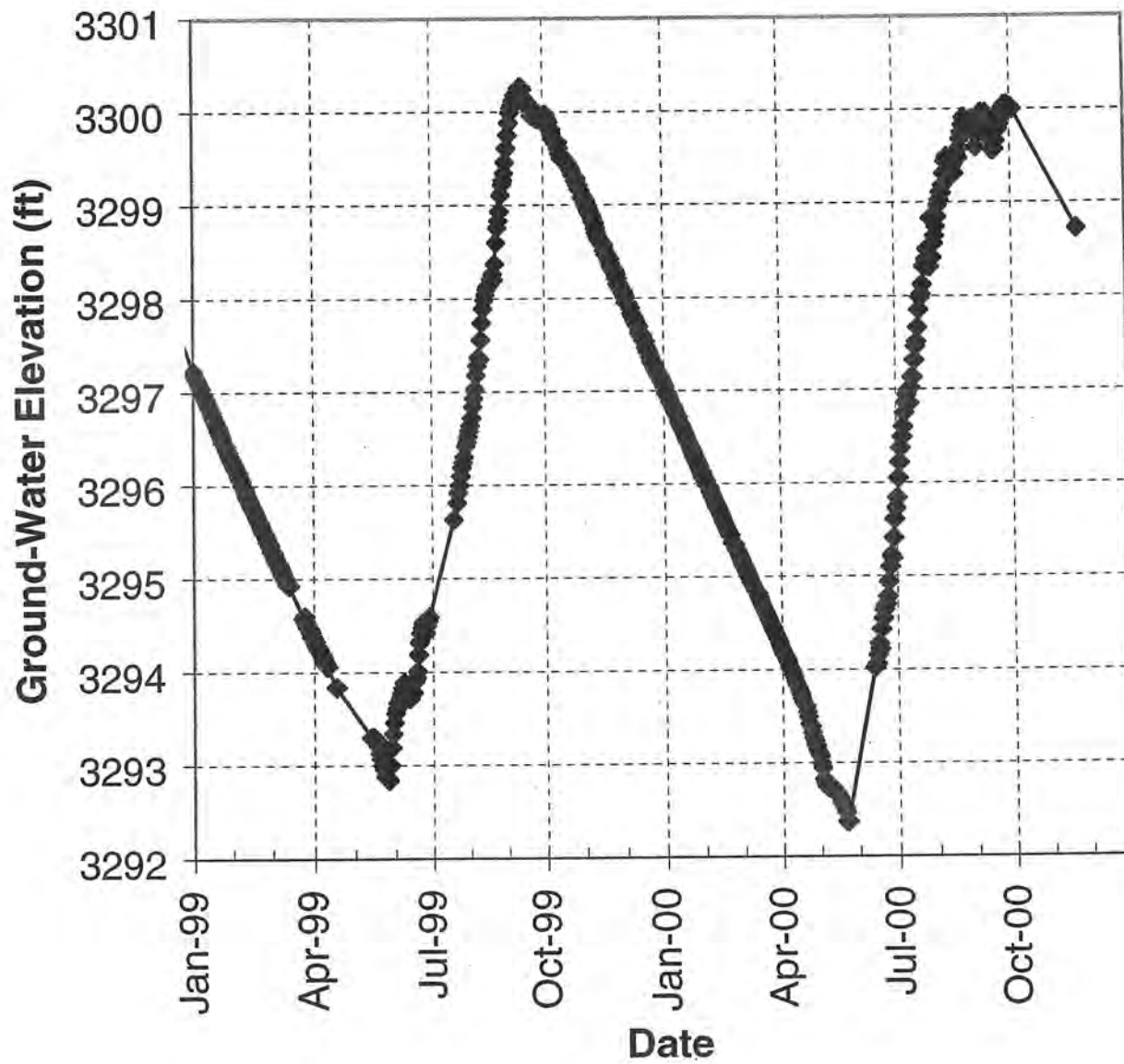
M:166072, RICHARDSON ALAN
02S-23E-15-BDDC
Alt=3430 ft ,TD=24.4 ft



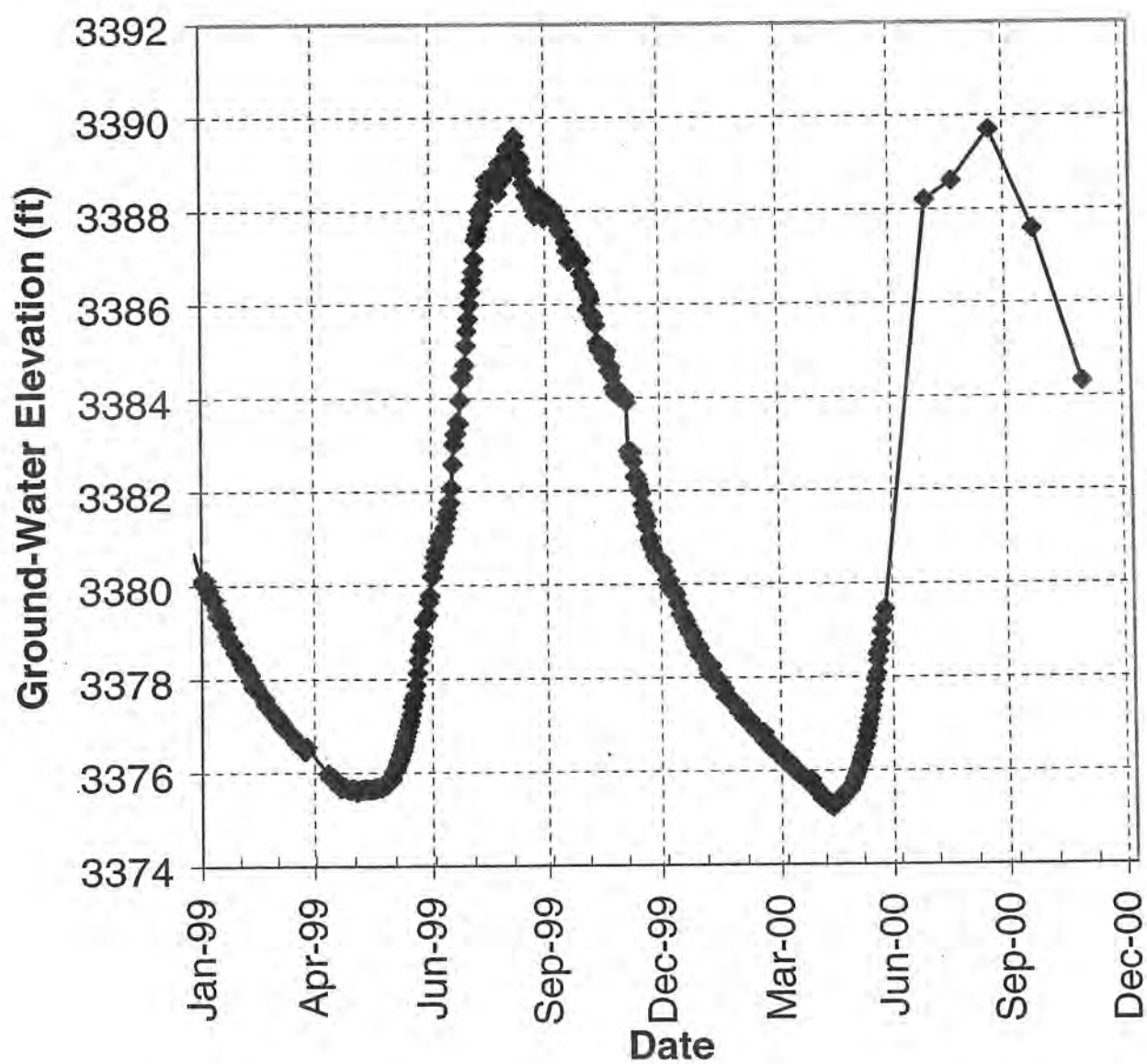
M:97745, TEBAY JANET
02S-23E-25-CABD
Alt=3330 ft ,TD=25 ft



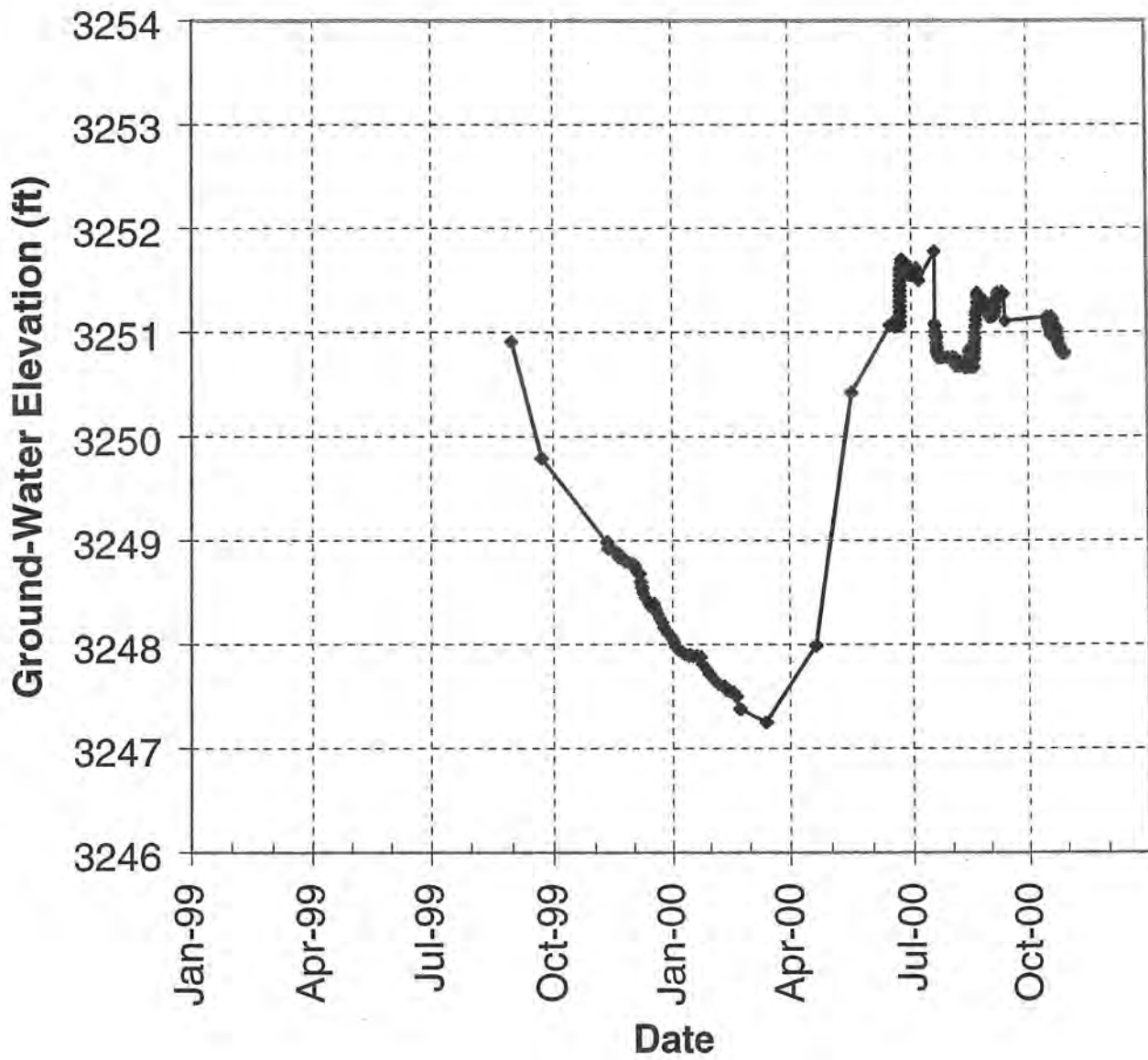
M:158606, HICKS AL
02S-24E-2-DCAA
Alt=3310 ft ,TD=33 ft



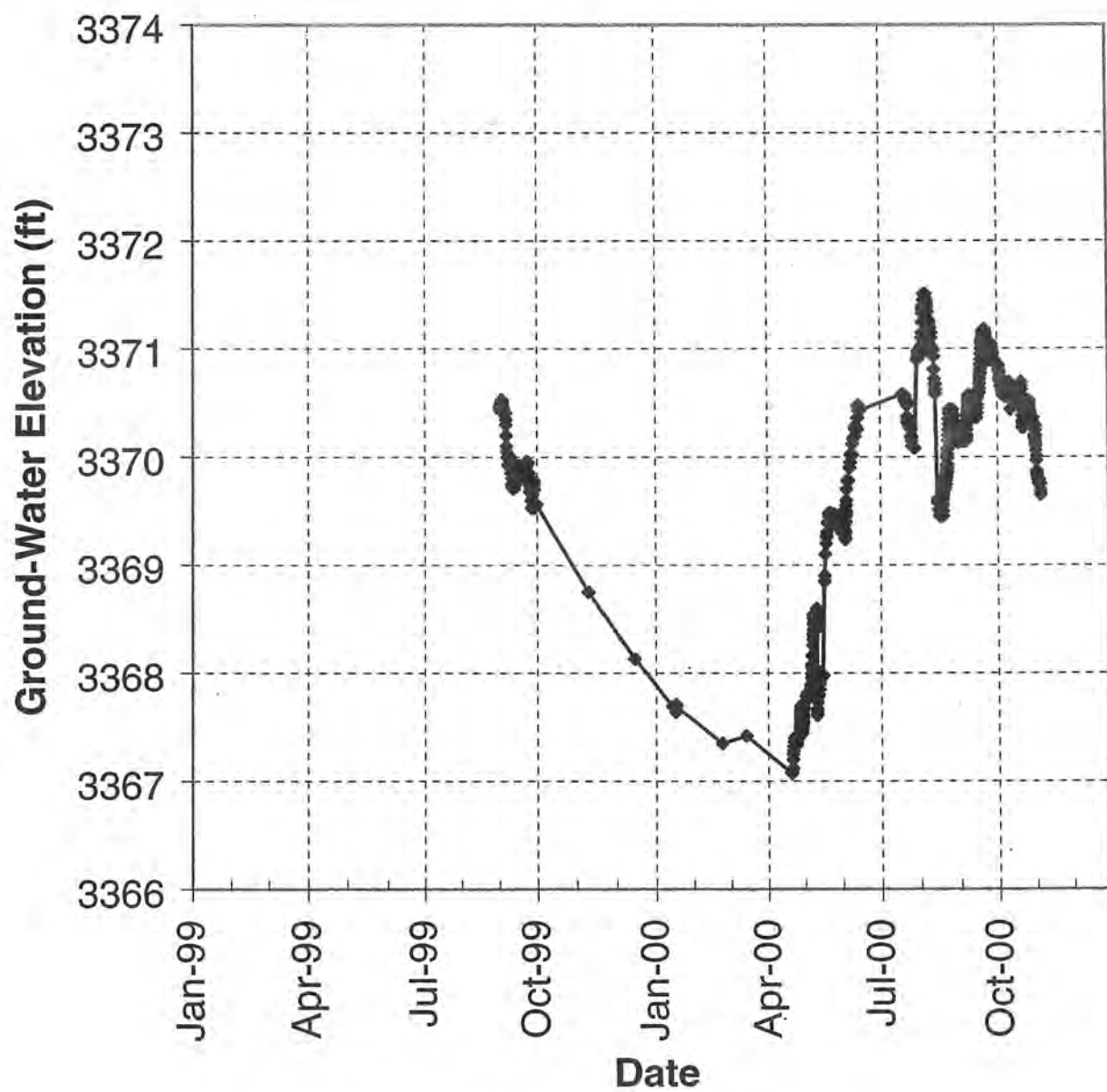
M:98056, BRIGGS ROGER
02S-24E-4-CBAB
Alt=3460 ft ,TD=94 ft



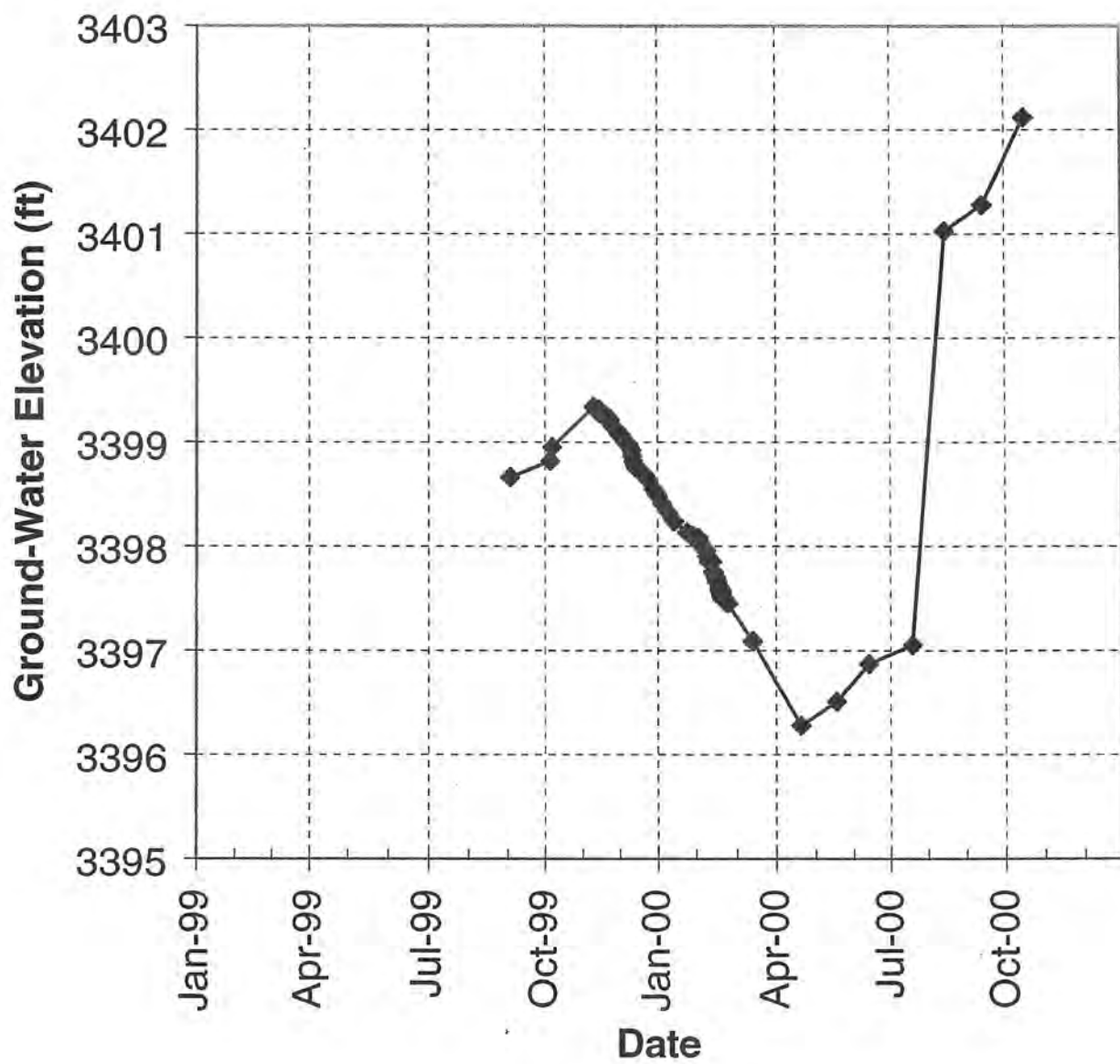
M:171259, DITCHFALLS-1
02S-24E-4-CDAA
Alt=3260 ft ,TD=20 ft



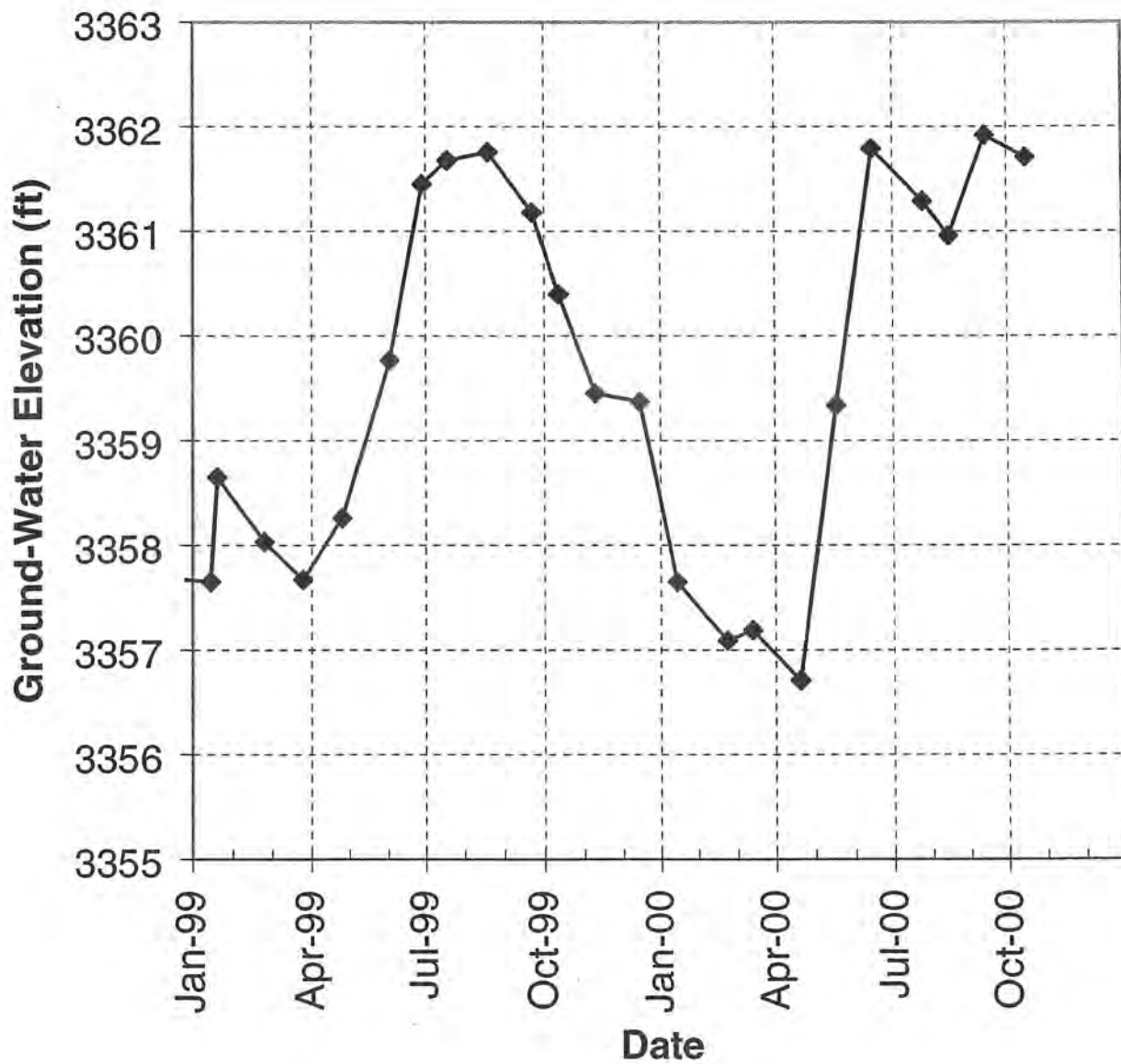
M:171261, GOLFEAST
02S-24E-7-DAAA
Alt=3375 ft ,TD=26 ft



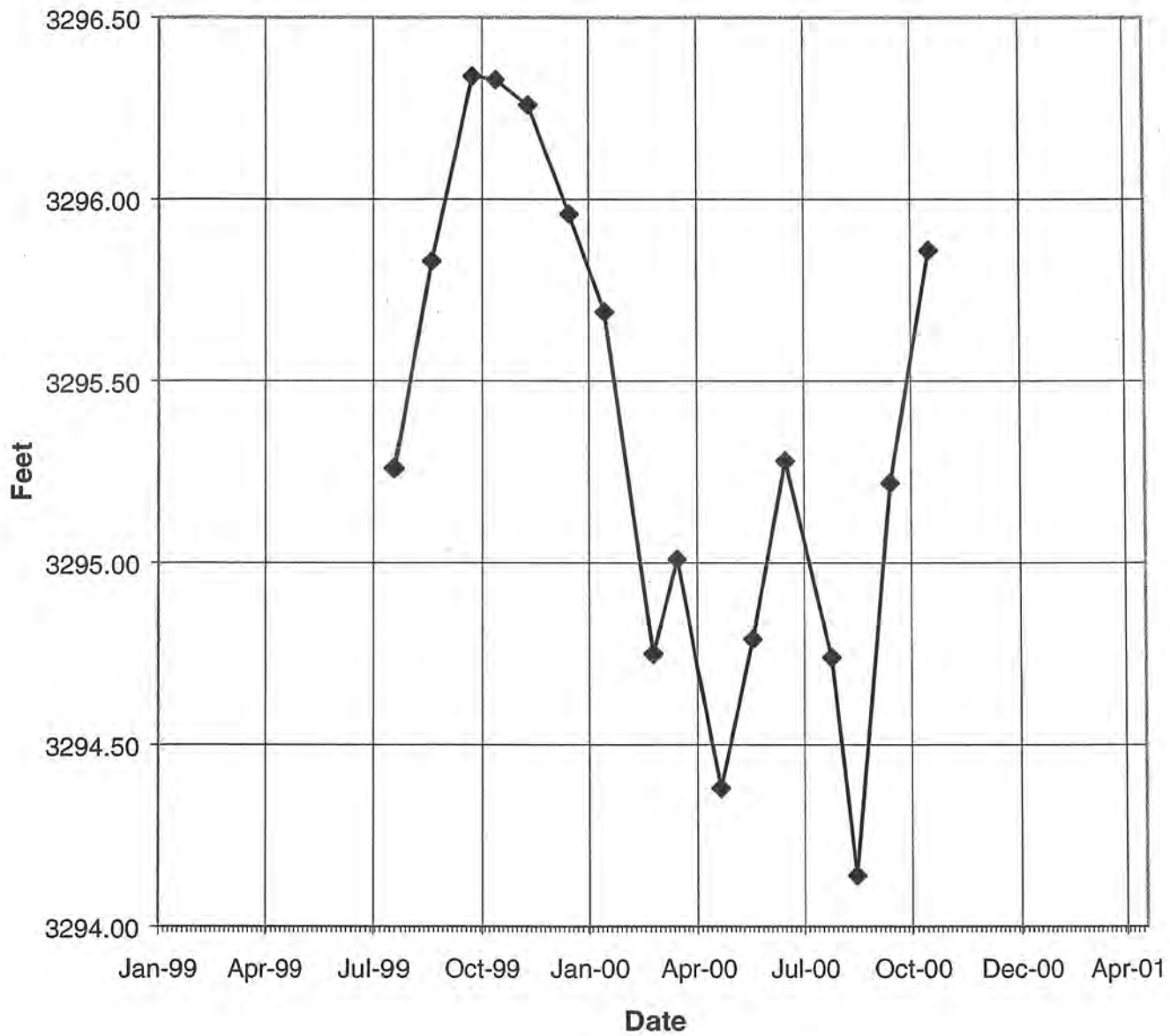
M:171262, GOLFWEST
02S-24E-7-BCBD
Alt=3418 ft ,TD=28 ft



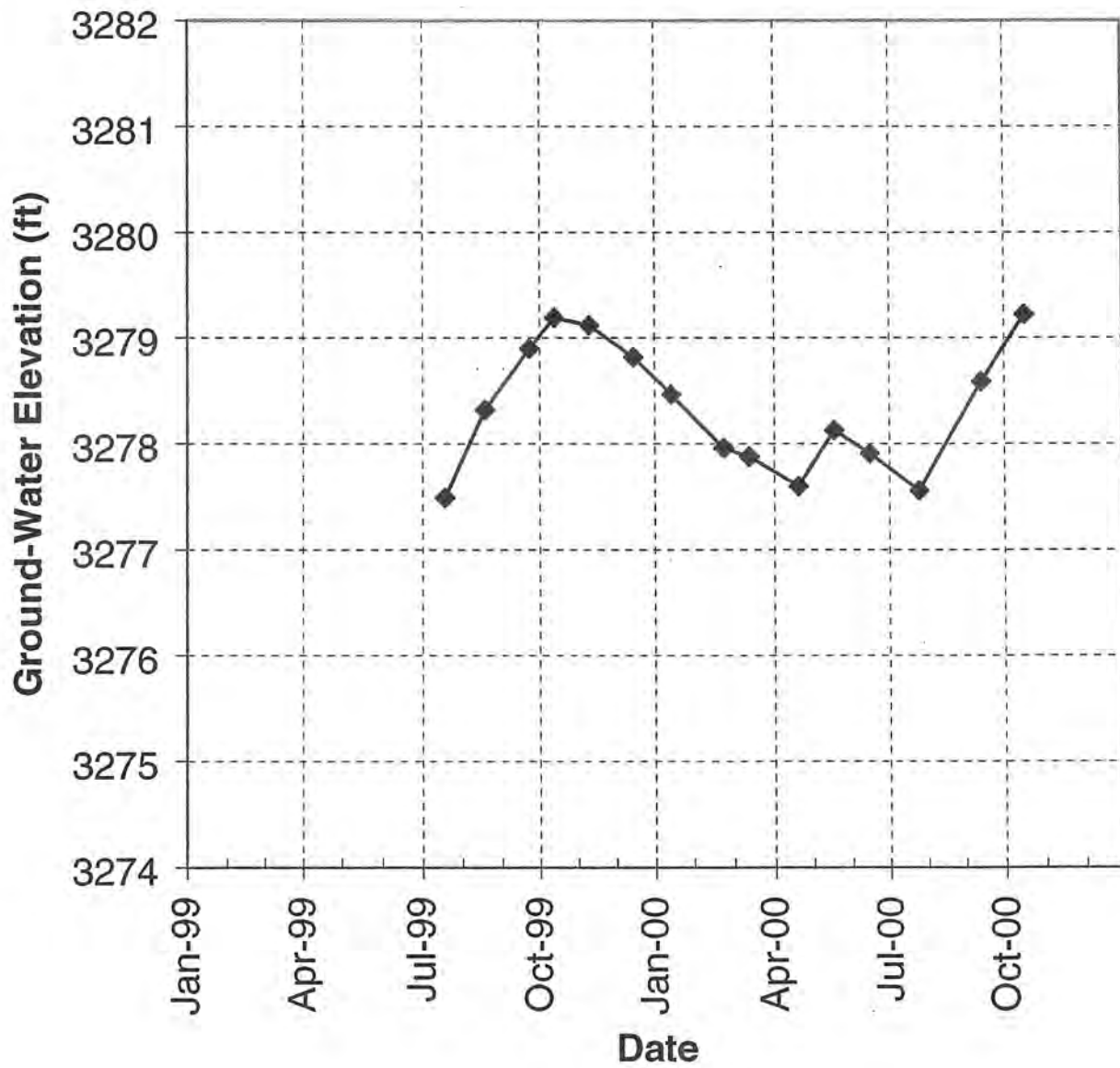
M:98111, CREECY JIM
02S-24E-8-BCCA
Alt=3370 ft ,TD=45 ft



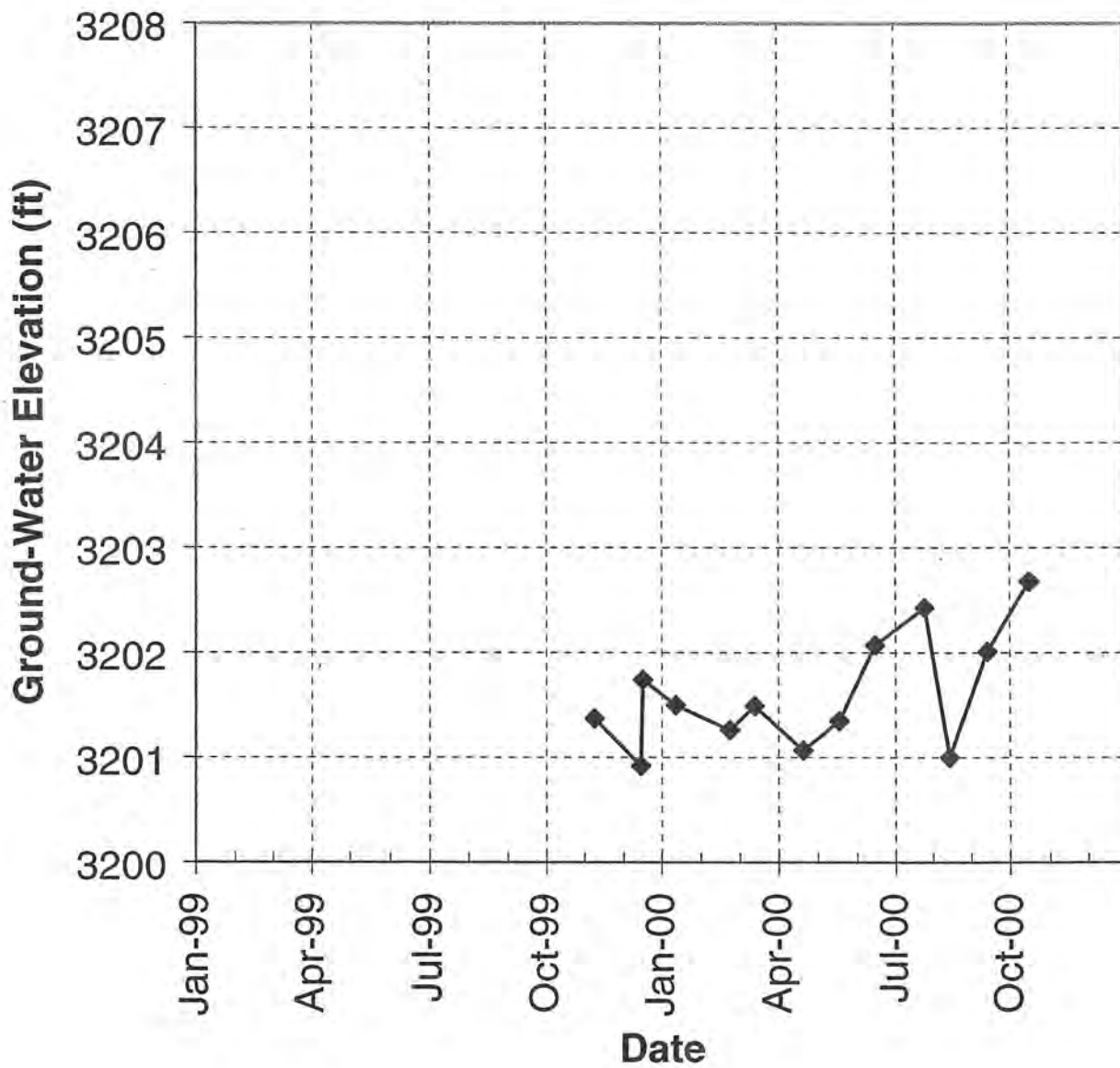
M:98118, LAUREL PUBLIC SCHOOL DIST #7
02S-24E-8-DA
Alt=-- ft ,TD=45 ft



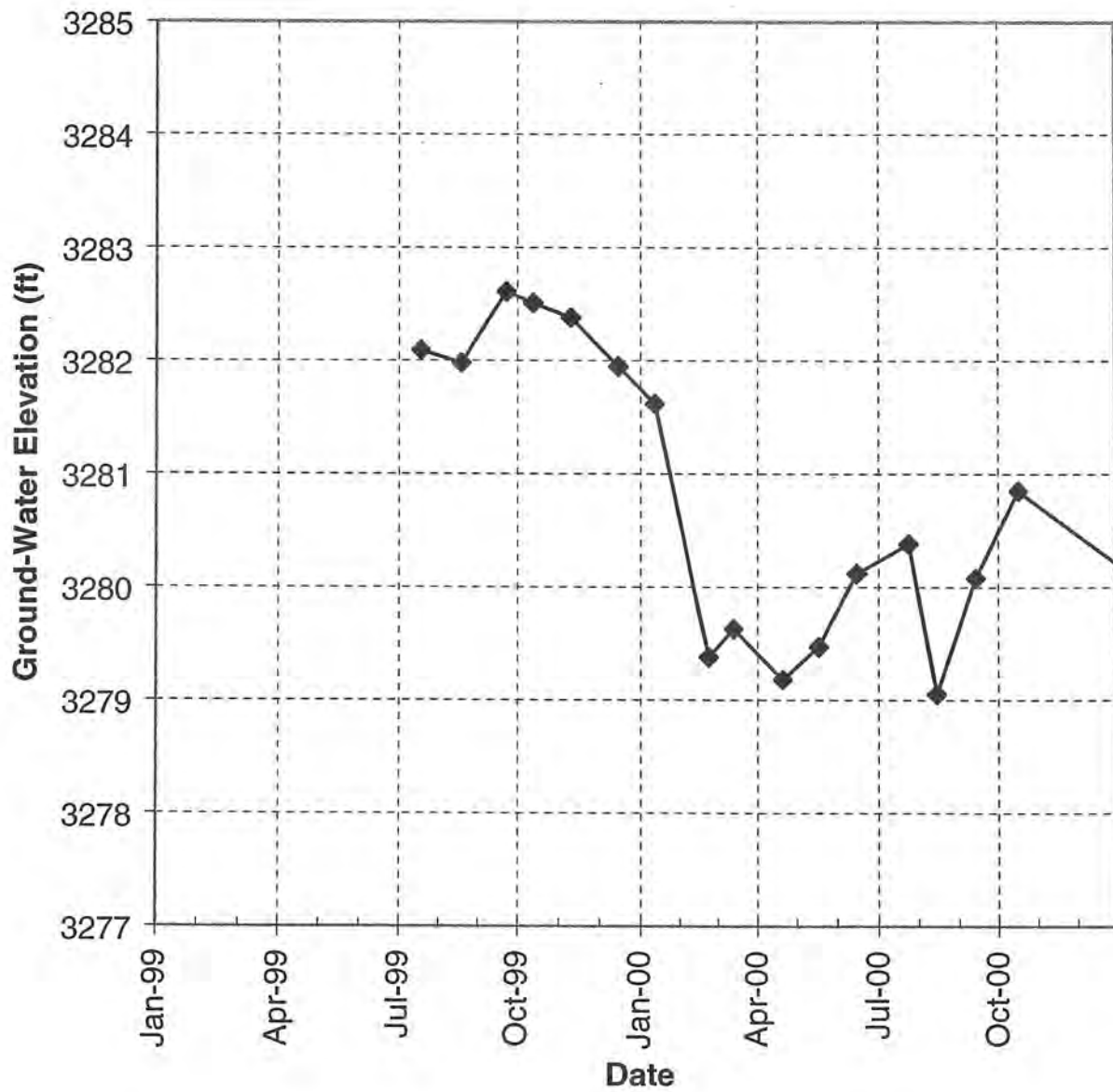
M:98128, LAUREL PUBLIC SCHOOL
02S-24E-9-
Alt=-- ft ,TD=57 ft



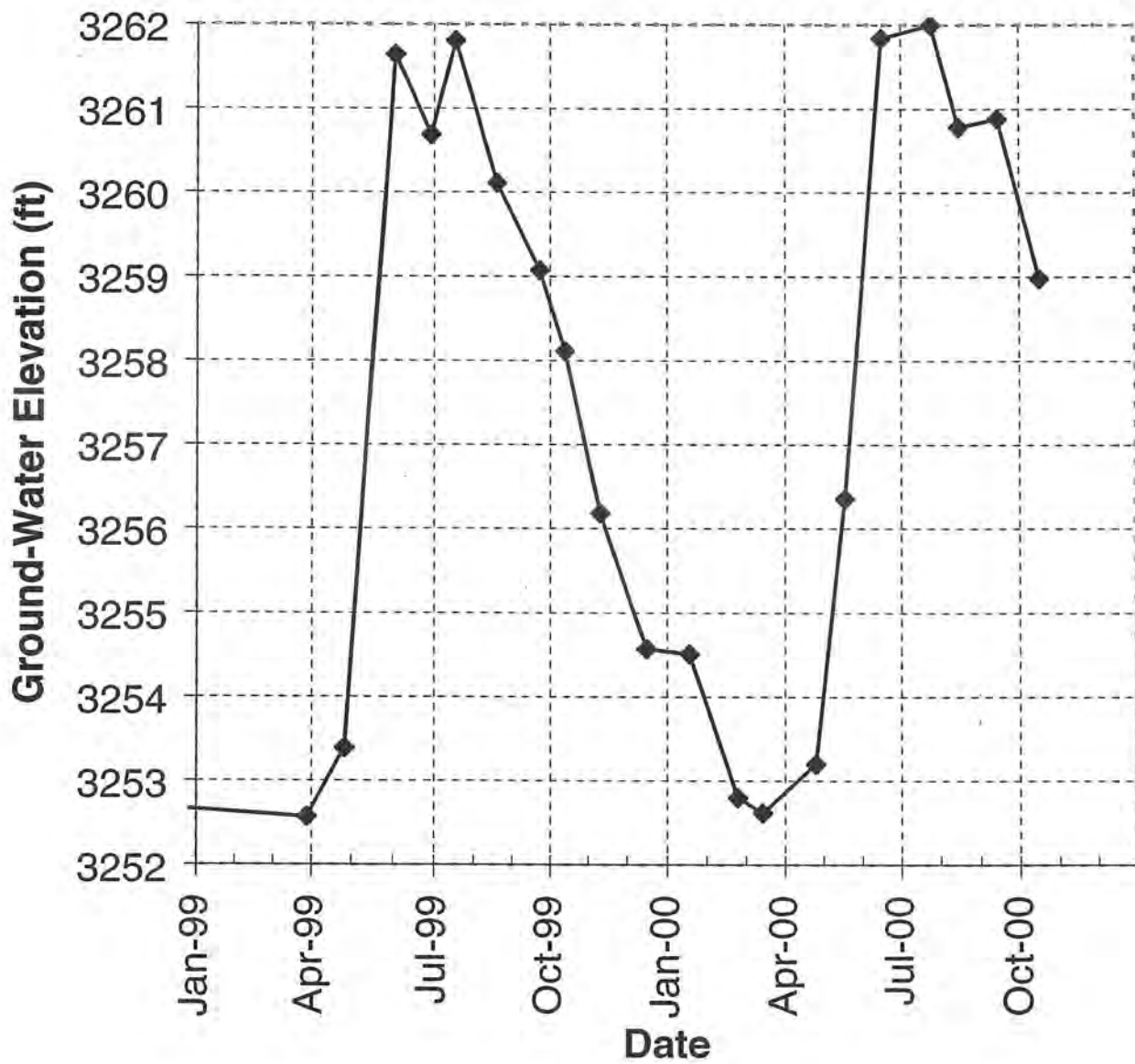
M:171265, FIRPARK-1
02S-24E-10-BACD
Alt=3205 ft ,TD=15 ft



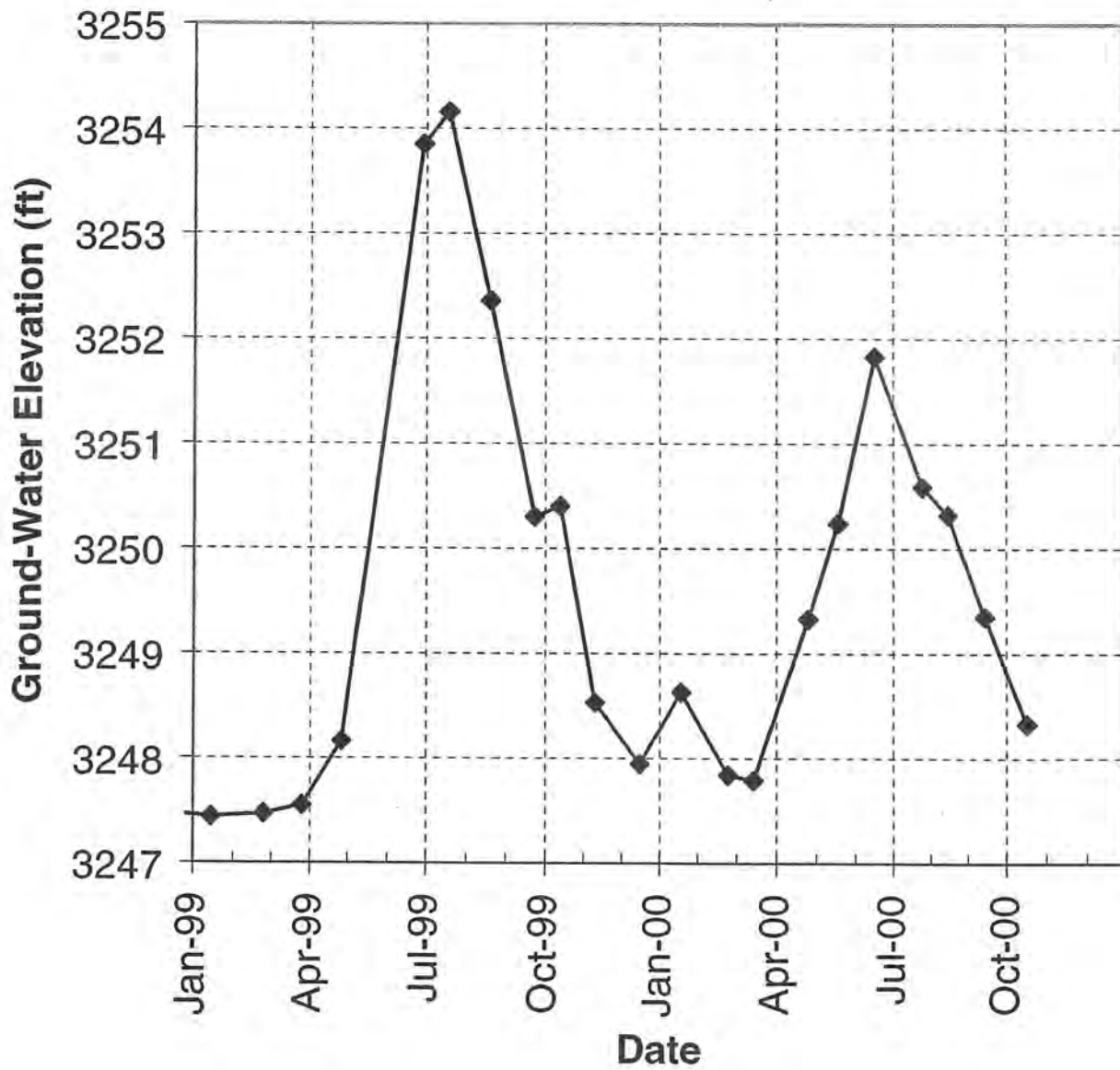
M:161047, LAUREL MENS SOFTBALL ASSOCIATION
02S-24E-10-BDB
Alt=-- ft ,TD=40.5 ft



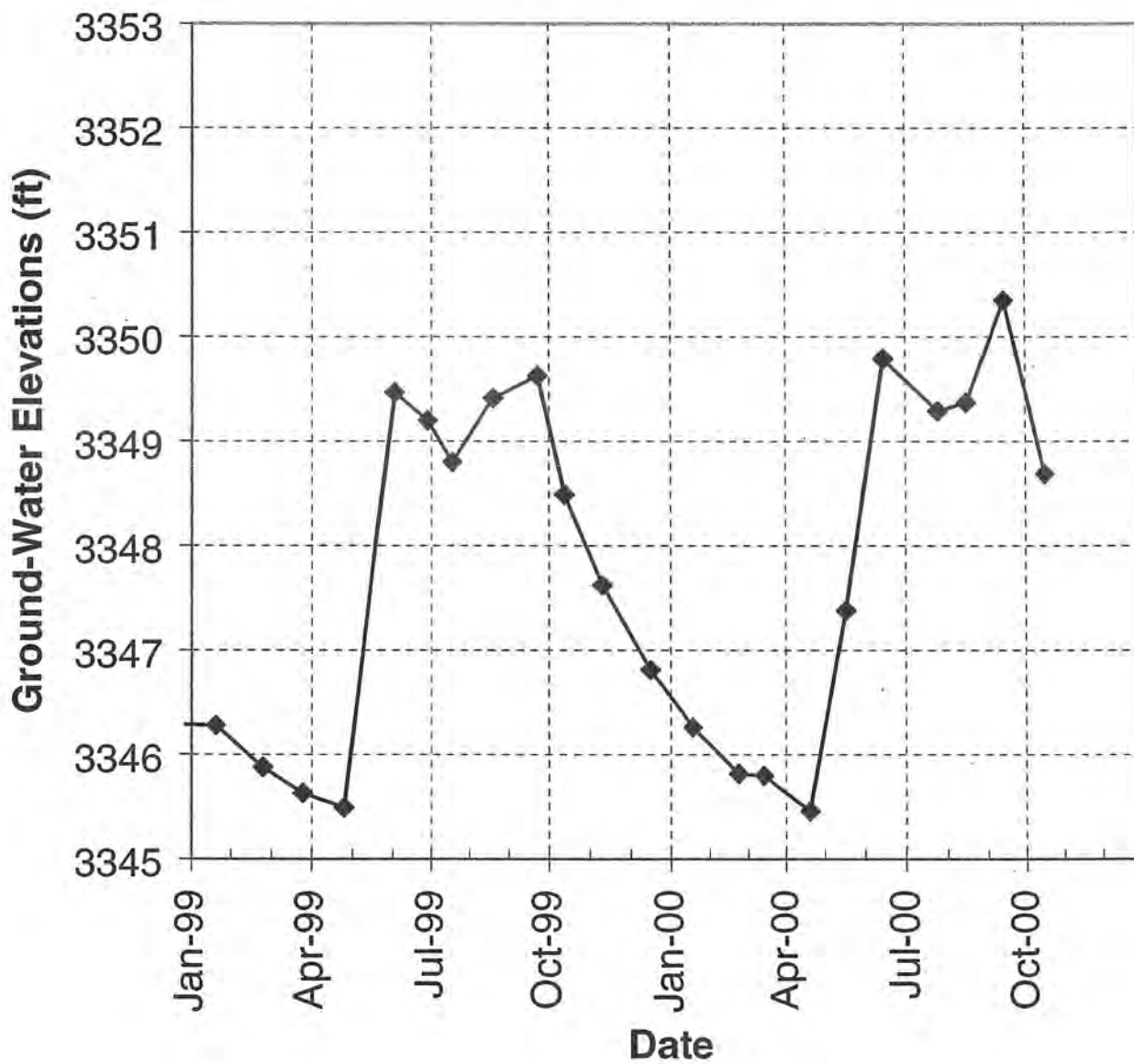
M:148540, CIRCLE LAND MANAGEMENT
02S-24E-14-ABBB
Alt=3265 ft ,TD=33 ft



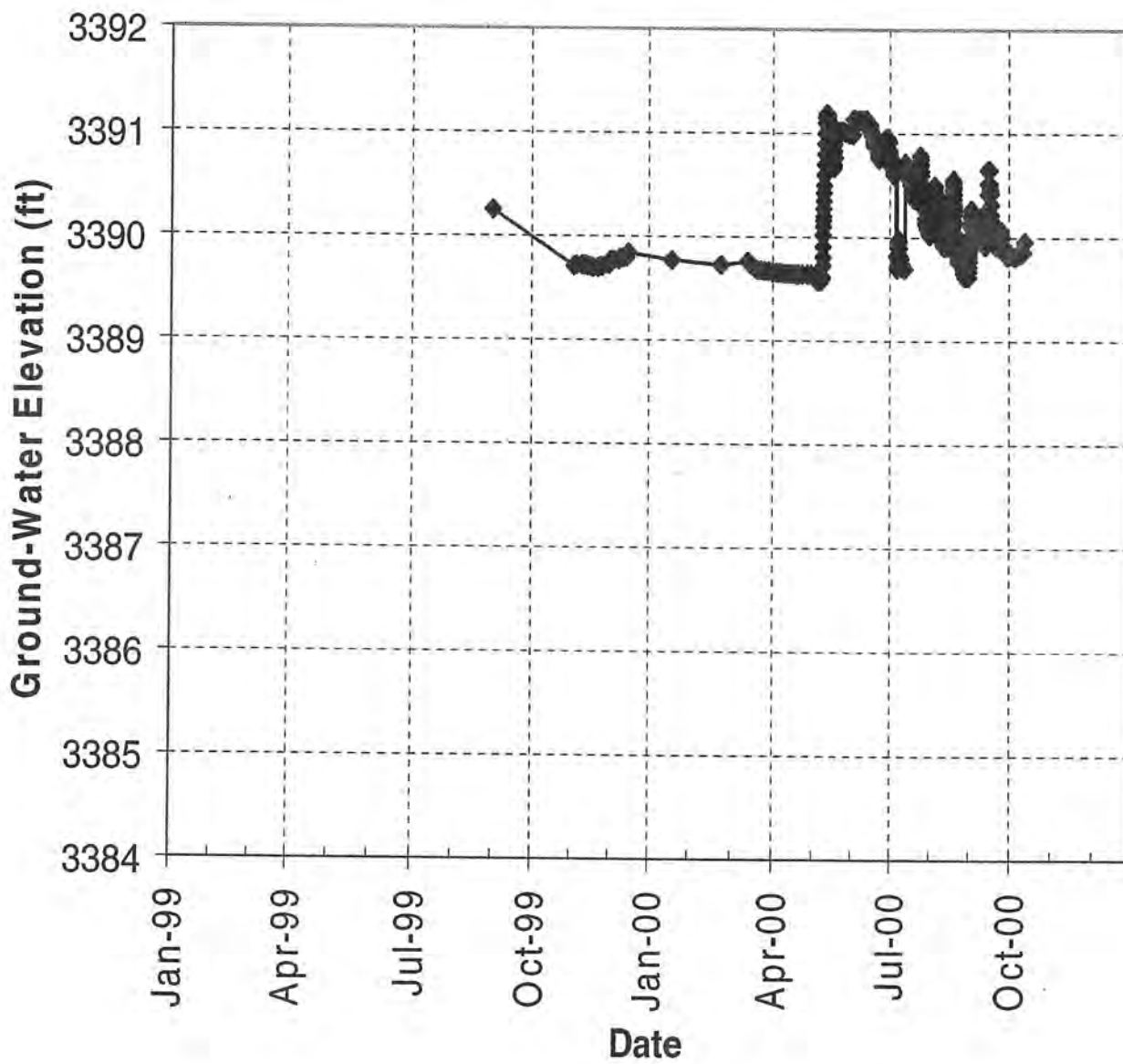
M:98208, STRAUCH MELVIN
02S-24E-15-DADD
Alt=3260 ft ,TD=30 ft



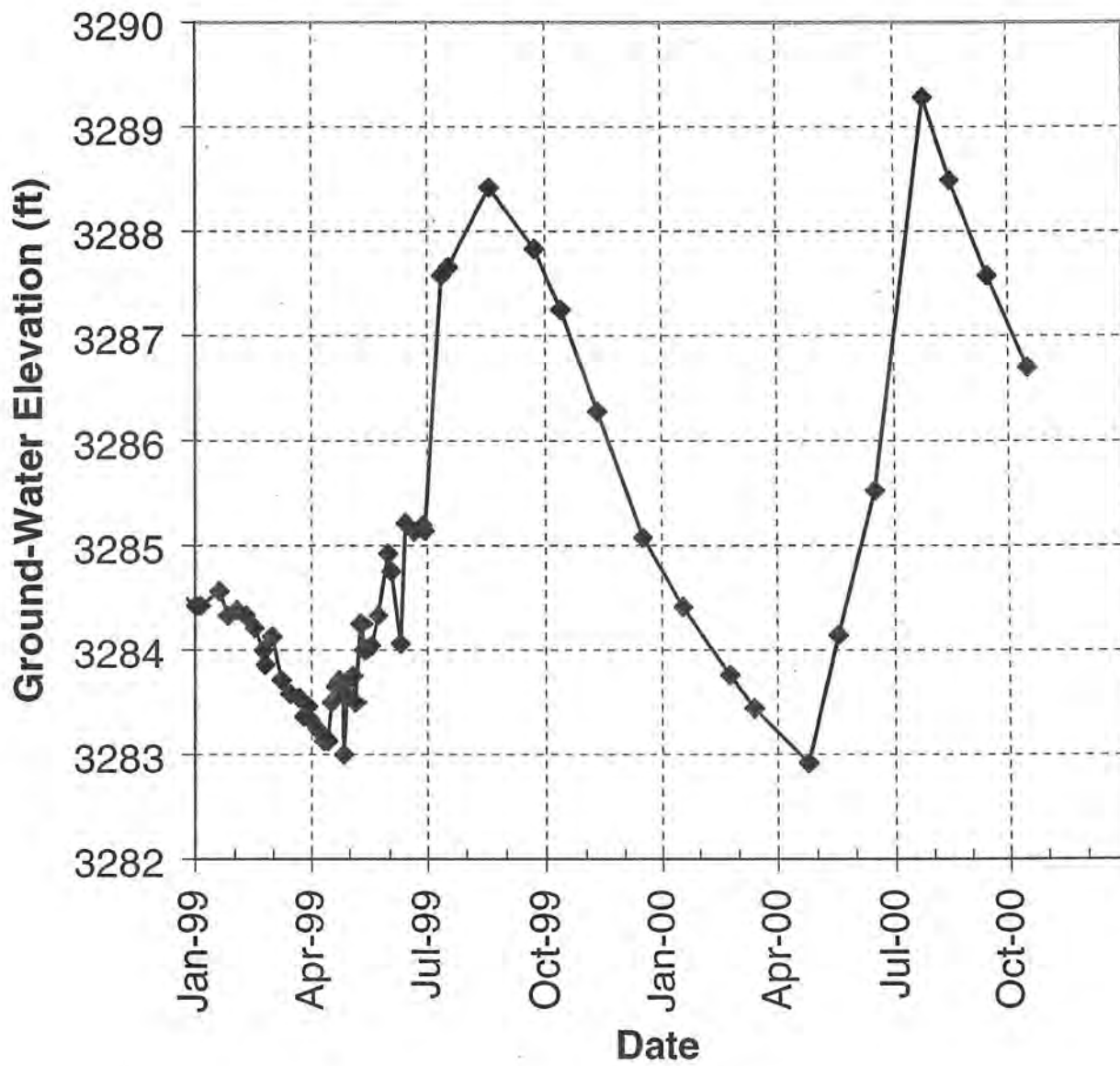
**M:98234, STRECK HERMAN G.
02S-24E-18-BCBD
Alt=3355 ft ,TD=28 ft**



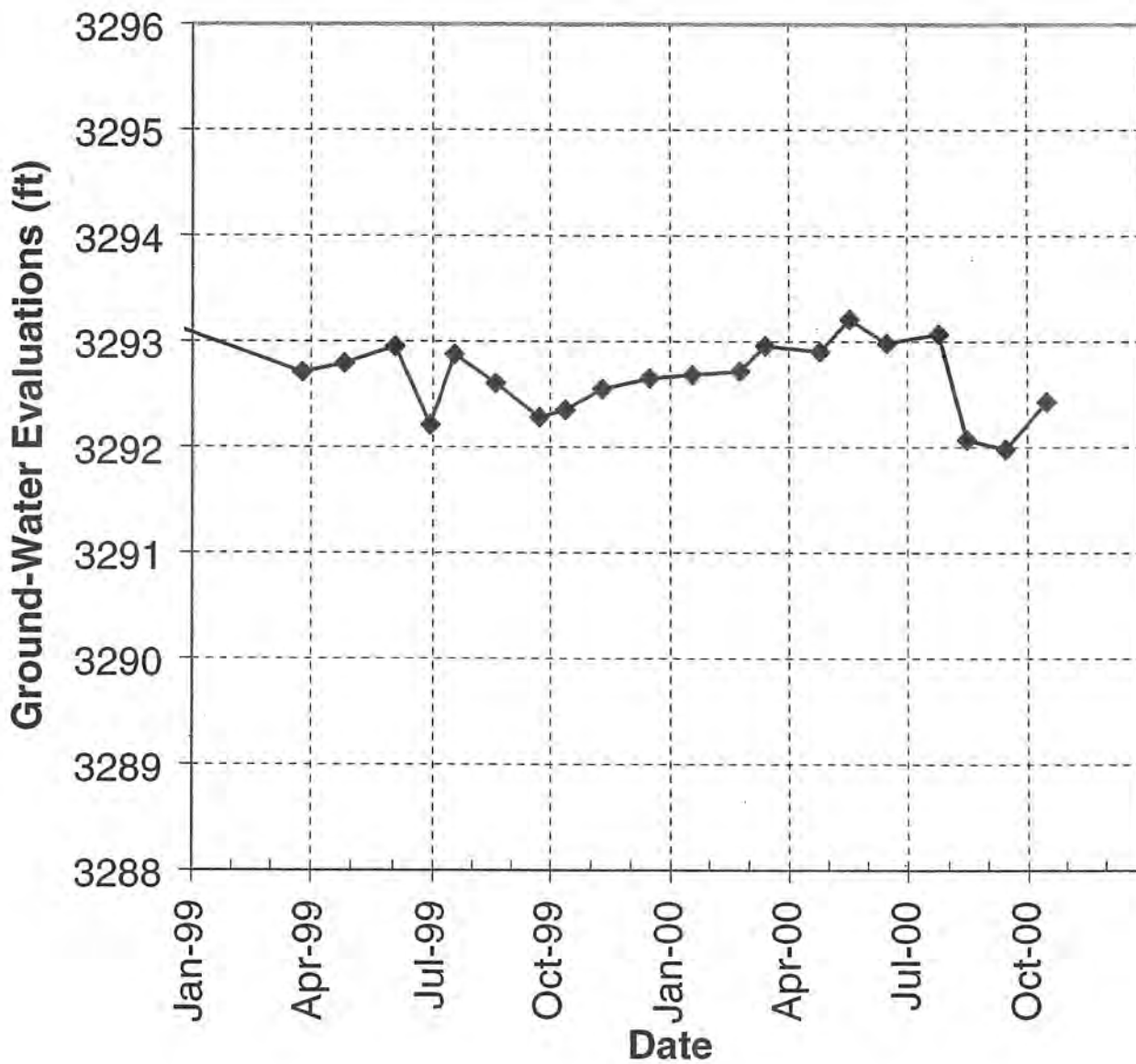
M:171263, STRECK-1
02S-24E-19-BCCC
Alt=3395 ft ,TD=20 ft



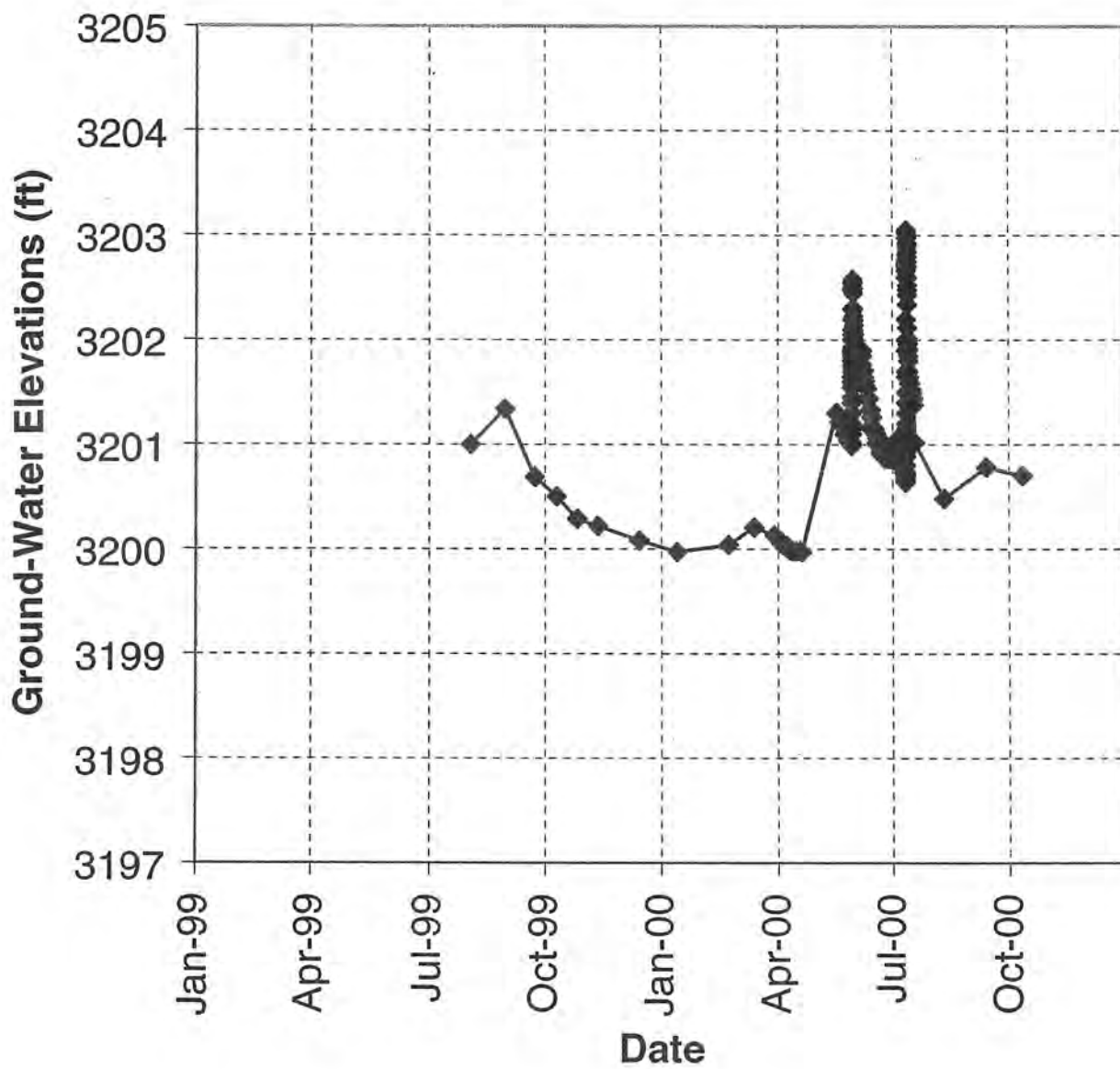
M:98264, THOM HOWARD L
02S-24E-22-CBCC
Alt=3300 ft ,TD=34 ft



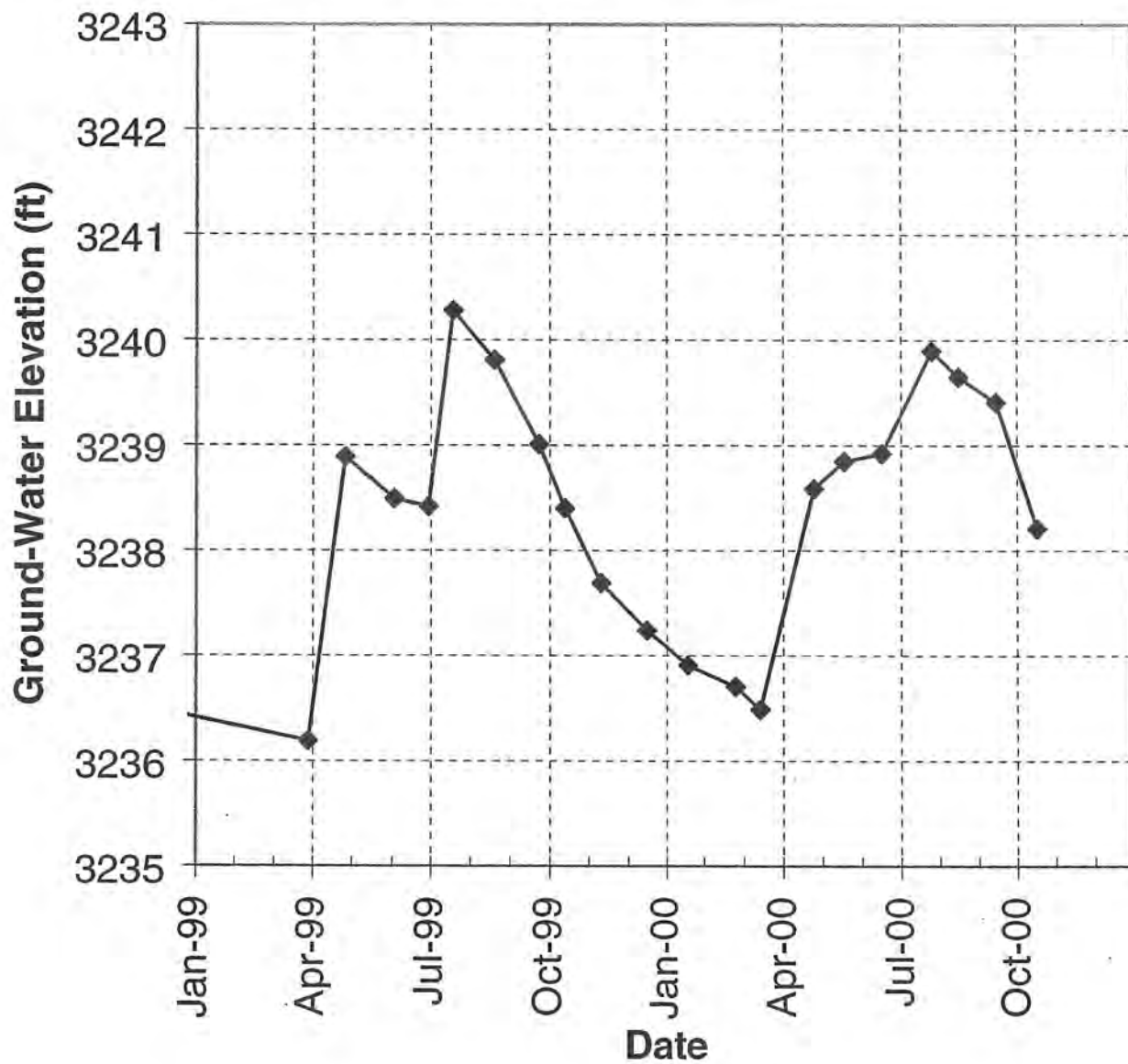
M:98337, LONESBERY STANLEY
02S-24E-33-BAAB
Alt=3300 ft ,TD=25 ft



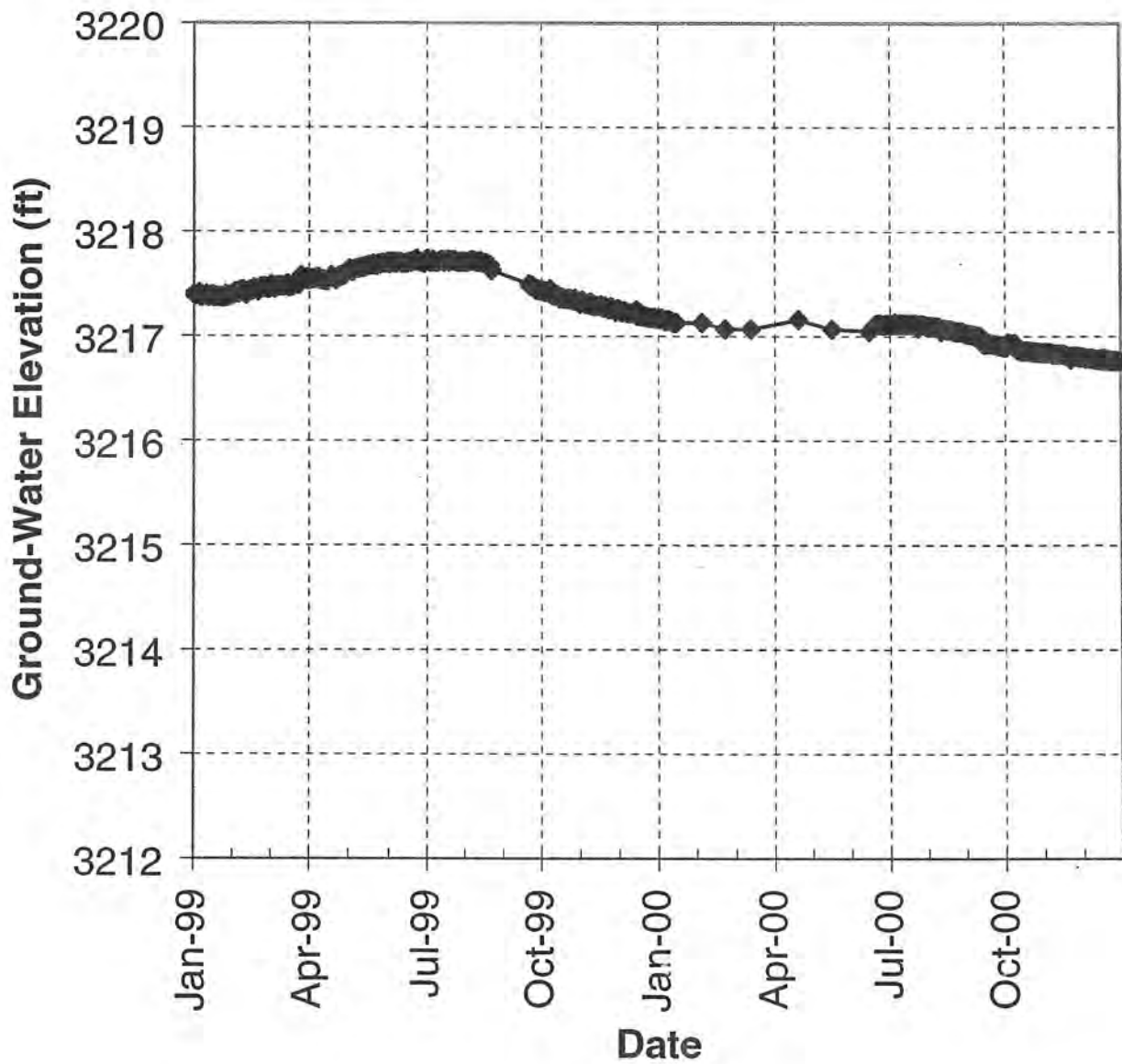
M:171253, BOND-1
02S-25E-4-BBAB
Alt=3205 ft ,TD=13 ft



M:705378, BURDETT GIL
02S-25E-7-BCBC
Alt=3245 ft ,TD=28 ft



**M:144916, LELFELDT O.G.
02S-25E-8-ADCB
Alt=3250 ft ,TD=44.3 ft**



SURFACE-WATER DATA

Surface-water sample analyses

Basic data

Mnumber	Site Name	Township	Range	Section	Tract	Sample Date and Time	Lab pH	Conductance (umhos)	Temperature °C
171392	CANYON CREEK * 80TH ST BRIDGE	01S	24E	14	AAAD	4/7/1999 15:10	8.15	5000	13.90
171393	KING AVE DRAIN * WASHINGTON ST BRIDGE	01S	26E	15	BBDA	4/6/1999 10:45	8.19	1660	8.50
171393	KING AVE DRAIN * WASHINGTON ST BRIDGE	01S	26E	15	BBDA	9/23/1999 14:20	8.70	622	15.50
171394	PIONEER CREEK * VIRGINIA LANE	01N	26E	32	CBBC	4/7/1999 10:00	7.91	999	9.50
171395	CANYON CREEK * 48TH ST WEST	01S	25E	21	ADDD	4/7/1999 16:00	8.21	2880	13.20
171395	CANYON CREEK * 48TH ST WEST	01S	25E	21	ADDD	9/21/1999 11:10	8.03	513	14.10
171396	HOGAN SLOUGH * ELYSIAN BRIDGE	01S	26E	18	DCCC	4/6/1999 12:00	8.20	2160	10.80
171396	HOGAN SLOUGH * ELYSIAN BRIDGE	01S	26E	18	DCCC	9/23/1999 13:20	7.93	558	--
171397	DANFORD DRAIN * CRYSTAL SPRINGS SUB	01S	25E	33	ABBD	4/6/1999 14:30	8.12	1213	14.90
171397	DANFORD DRAIN * CRYSTAL SPRINGS SUB	01S	25E	33	ABBD	9/23/1999 0:00	8.13	856	--
171398	CANYON CREEK * GOODMAN RD	01S	25E	25	BBCC	4/6/1999 14:00	8.29	2330	13.40
171398	CANYON CREEK * GOODMAN RD	01S	25E	25	BBCC	9/22/1999 9:30	7.91	449	13.70
171399	DANFORD DRAIN * 72ND ST	01S	25E	30	BCCC	4/7/1999 14:30	7.80	1469	14.30
172389	BBWC-SOUTH LAUREL	02S	24E	13	AAAB	9/19/1999 10:00	8.53	316	8.00

Surface-water sample analyses

Common Ion Constituents (mg/L)

Calcium	Chloride	Bicarbonate	Carbonate	Fluoride	Iron	Potassium	Magnesium	Manganese	Sodium	Nitrate (as N)	Nitrite (as N)	Total Phosphate	Ortho-Phosphate	Silicate	Sulfate
285.0	74.10	408.70	0.00	<2.5	<0.05	6.65	269.0	0.392	851.0	2.100	<2.5	<1	<2.5	5.25	3156.20
171.0	25.50	347.70	0.00	<5	<0.05	4.11	102.0	0.012	96.8	3.490	<5	<1	<5	19.50	702.10
60.8	9.33	157.14	12.48	<5	<0.1	3.40	27.3	0.004	37.5	0.760	<5	<2	<5	11.90	202.00
128.0	12.40	287.40	0.00	<5	0.054	2.71	50.1	0.015	40.3	0.790	<5	<1	<5	17.90	360.70
178.0	38.20	398.90	0.00	<1.0	<0.05	5.17	157.0	0.153	394.0	2.750	<1.0	<1	<1.0	9.07	1506.50
39.3	8.49	145.40	0.00	0.436	<0.1	3.53	18.0	0.014	42.1	<5	<5	<5	<0.5	12.90	140.80
164.0	30.70	392.80	0.00	0.640	<0.05	5.15	128.0	0.027	200.0	5.200	<5	<1	<5	16.00	989.60
41.2	9.36	167.90	0.00	0.467	<0.1	3.58	19.5	0.012	41.3	0.760	<5	<2	<0.5	11.70	146.20
139.0	13.00	281.80	0.00	<5	<0.05	3.70	74.7	0.043	54.8	3.060	<5	<1	<5	17.00	486.60
111.0	9.08	253.80	0.00	0.589	0.028	3.24	40.5	0.024	35.8	2.070	<5	<2	<5	16.00	295.80
146.0	33.00	358.70	0.00	0.750	<0.05	4.83	126.0	0.031	305.0	3.040	<5	<1	<5	8.67	1147.40
35.1	7.52	136.60	0.00	0.436	<0.1	3.35	14.6	0.005	32.5	0.560	<5	<2	<0.5	13.00	122.60
217.0	10.50	310.00	0.00	<5	<0.05	2.75	91.2	0.001	52.1	3.670	<5	<1	<5	22.80	730.90
28.9	6.72	125.40	3.84	0.449	0.118	3.09	10.3	0.013	19.1	<5	<5	<2	<0.5	15.00	45.21

Trace Constituents (ug/L)

84

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
CANYON CREEK Canyon Creek@Goodman Rd. T01S-R25E-SECTION26-TRACT DADA	01/14/99	12.02	6.9						
	02/12/99	12.06	4.6	2,250	9.9	8.58			
	03/17/99	12.08	3.5	2,610	9.9	8.36			
	04/06/99	12.07	4.0	2,340	13.4	8.65			
	05/21/99	11.16	134.0	366	18.0	7.76	71	260	2
	06/04/99	7.81		305	14.0	8.04			
	06/16/99	9.75			13.4				
	06/21/99	7.66		293	16.3	8.01	215	810	
	06/28/99	9.66		355	14.8	8.07	239	900	
	06/29/99	10.38	122.2		14.9	7.98	206	780	
	07/09/99	10.75		358	15.4	8.09			
	07/13/99	11.27	140.2	497	18.2	7.5			
	07/13/99	11.27	140.2	531	18.4	8.09	260	990	
	07/19/99	10.96	178.5	387	20.9	8.09	92	340	
	08/19/99	11.09	182.0	454	18.3	8.1	57	200	
	09/15/99	10.77	200.0	417	12.8	8.05			
	10/19/99	11.54	71.1	661	5.7	8.05			
	11/08/99	12.08	6.0	1,614	7.7	7.96			
	11/15/99	12.07	6.2						
	12/16/99	27.22	6.5						
	01/24/00	12.09	5.5						
	02/24/00	12.11	5.0	2,290	7.7	8.31			
	03/01/00	12.14	3.9						
	03/21/00	12.16	3.0	2,220	9.1	8.35		<10	<1
	04/05/00	12.20	3.0						
	04/17/00	12.10	5.0						
	04/19/00	12.12	4.5						
	05/26/00	9.90		302					
	05/31/00	9.63	32.0						
	06/06/00	9.85							
	06/12/00	10.79		310	17.0	8.52	110	410	<1
	06/12/00	11.10	161.8						
	06/14/00	10.63	294.8						
	07/07/00	10.94	102.0	438	19.8	7.79			
	08/02/00	11.38	101.0	638	21.4	8.52			
	09/25/00	10.84							
	09/25/00	10.84	230.2						
	10/08/00	11.05	174.0	534	7.0	7.36			
	04/04/01	11.72	19.0						
	04/17/01							<10	

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
Canyon Creek@48th T01S-R25E-SECTION21-TRACTDAAA	02/12/99			2,850	1.1	8.56			
	03/17/99								
	04/06/99	23.40	2.6						
	06/28/99	25.46							
	07/21/99	25.66							
	08/18/99	25.13							
	06/12/00			352	16.7	8.05	142	530	
	07/07/00	25.42			20.0	7.78			
Canyon Creek@56th T01S-R25E-SECTION20-TRACTADAA	01/14/99			3,020	2.5	8.15	6	10	
	04/06/99	14.21	2.2						
	06/17/99	13.75							
	06/21/99	12.63	176.8						
	06/28/99	13.29							
	07/21/99	13.48		527	18.7	7.91			1
	08/18/99	13.17							
	03/01/00	14.21	2.2						
	03/21/00	14.21		2,830	8.2	8.07			2
	05/08/00	12.83							
	05/26/00	13.42							
	06/12/00	13.08		362	16.7	8.07	204	770	<1
	07/07/00	13.42		535	20.0	7.86			
	08/02/00	13.75		1,030	21.6	7.97			
	04/17/01							<10	
Canyon Creek@72 T01S-R24E-SECTION24-TRACTAAAB	04/06/99		1.3						
	03/21/00			4,004	8.6	7.94			
	06/12/00			309	17.0	8.14	184	690	
	07/07/00	25.00		471	21.0	7.92			

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
Canyon Creek@Deaddog T01S-24E-SECTION14-TRACTAAAA	01/14/99	18.63	2.1	5,700	0.6	7.95	34	110	
	02/12/99	19.11	1.5	4,830	1.5	8.48			
	03/17/99	19.13	1.1	5,250	10.5	8.25			
	04/06/99	19.13	1.1						
	05/21/99	18.10	40.0	938	15.8	8.16			
	06/21/99	17.92	48.0						
	06/28/99	18.50	19						
	07/21/99	18.80	8						
	08/18/99	17.83	52						
	10/05/99	18.42	19.4	1,077	19.6	7.81			<1
	11/24/99	19.13	1						
	03/21/00		1.5	4,980	9.7	8.06			
	04/19/00	19.13	1						
	05/08/00	18.08	38						
	05/31/00	18.17	33						
	06/12/00	18.21	31	393	18.0	8.21	148	550	
	07/07/00	18.58	15	878	22.3	8.04			
	08/02/00	17.67	62	847	22.8	8.2			
	04/17/01							23	
Canyon Creek@88th St. T01S-R24E-SECTION11-TRACTCBCB	01/14/99	15.30		4,950	0.1	8.2	80	290	
	04/06/99		0.8						
	06/12/00			378	17.7	8.23	95	350	
	07/07/00	17.67		10	22.6	8.2			
Canyon Creek@Buffalo T01S-R23E-SECTION05-TRACTACD	01/14/99		0.2	5,700	0.6	7.95	35	120	
	04/06/99		0.1						
	06/14/99			3,400	22.5	8.06			
	06/21/99		2.8						
	10/05/99		0.1						
	03/21/00		0.1	3,640	12.3	7.91			
	05/31/00								
	06/12/00			3,560	20.6	8.04	28	90	<1
	07/07/00			3,440	24.4	7.99			
	08/02/00			3,240	21.6	7.86			
	04/17/01							18	

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
HOGAN SLOUGH Hogan Slough @Elysian Rd. T01S-R26E-SECTION19-TRACTBAAA	02/12/99	9.52	4.9	2,150	2.7	8.46			
	03/17/99	9.60	2.9	1,571	9.7	8.47			
	04/06/99	9.50	4.5	2,170	10.8	8.52			5
	04/06/99	9.50	4.5						
	04/23/99		20.0						
	05/20/99	8.30	44.8						
	05/21/99	8.30	47.2	476	16.0	8.11	135	500	
	06/14/99	7.56	93.1	386	16.3	8.09			
	07/09/99	7.13	126.9						
	07/19/99	7.16	127.0						
	07/23/99	7.38	107.0						
	08/18/99	7.66	86.1						
	08/31/99	7.82	75.4						
	09/15/99	7.70	83.4						
	10/19/99	9.10	14.1						
	11/08/99	9.38	7.2						
	11/15/99	9.38	7.2						
	11/24/99		6.7						
	12/06/99		6.4						
	12/17/99	9.47	5.3						
	01/14/00	5.85	5.1						
	02/02/00	9.49	4.9						
	02/24/00	9.54	4.9	1,958	9.7	8.44			
	03/21/00	9.50	4.7	1,580	10.1	8.38			2
	04/17/00	9.42	6.3						
	04/19/00	8.50	37.3						
	05/08/00	7.79	77.2	297	11.7	8.04			
	05/26/00	7.29	113.6	325					
	06/14/00	7.75	80.0						
	07/07/00	7.25	116.7						
	08/02/00	7.83	74.5						
	09/25/00	7.82	75.2						
	10/08/00	8.24	50.4						
	04/04/01	9.49	4.9						

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
Hogans Sloug @ 32nd	01/15/99		4.0						
T01S-R25E-SECTION13-TRACTCBBB	02/12/99		2.1	2,090	3.2	8.83			
Hogan Slough@Shilo Rd.	01/15/99	7.30							
T01S-R25E-SECTION14-TRACTCBBB	02/12/99			2,210	1.7	8.5			
	04/06/99		1.5						
	03/02/00	7.92							
	03/21/00	7.92		2,000	10.1	8.34			
	05/08/00	7.13							
	05/31/00	6.00							
Hogan Slough@29th St.	02/12/99			1,620	9.5	7.75			
T01S-R25E-SECTION13-TRACTBDDD	04/06/99	7.75	3.9	2,010	9.3	8.45			3
	05/20/99		30.0						
	06/16/99	7.76	56.7	470	16.7	7.67			
	07/21/99	8.16							
	08/18/99	8.00							
	03/21/00			2,250	10.1	8.34			
Hogan Sloug @ 56th	01/14/99		0.4	3,960	3.5	8.51	10		
T01S-R25E-SECTION8-TRACTADDA	02/12/99								
	04/06/99		0.4						
Hogan @ Central	04/06/99		0.3						
T01S-R25E-SECTION8-TRACTBAAB									
Hogan Sloug @ 64th	04/06/99		0.2						
T01S-R25E-SECTION5-TRACTCBBB									

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
DANFORD DRAIN Danford Drain@Wise Ln. T01S-R25E-SECTION35-TRACTBBBB	01/14/99	5.85	4.1	1,150	8.9	8.24			
	02/12/99	5.84	4.2	679	15.3	8.2			
	03/17/99	5.89	3.4						
	04/06/99	5.89	3.8						
	05/19/99	5.83	4.4						
	06/14/99	5.09	30.0						
	07/19/99	4.78	50.2						
	08/18/99	4.73	54.0						
	08/31/99	4.61	64.0						
	09/27/99	4.60	64.9						
	10/19/99	5.21	23.9						
	11/08/99	5.42	15.2						
	11/15/99	5.46	13.7						
	11/24/99	5.58	10.0						
	12/05/99	5.64	8.4						
	12/15/99	5.70	6.9						
	12/27/99	5.77	5.5						
	03/01/00	5.83	3.4	1,150	8.9	8.24			
	04/17/00	5.90	3.3						
	04/19/00	5.96	2.5						
	05/08/00	5.80	4.6						
	05/26/00	5.54	12.1	635					
	06/06/00	5.25	20.9						
	07/07/00	5.13	28.1						
	08/02/00	5.21	23.9						
	10/08/00	5.57	10.2						

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
Danford Drain at Crystal Springs T01S-R24E-SECTION33-TRACTABCC	01/14/99	4.00	4.1	1,271	5.4	8.47			
	02/12/99	4.08	4.3	1,268	2.8	8.47			
	03/17/99	4.10	2.9	917	9.1	8.31			
	04/06/99	4.10	3.3	1,230	14.9	8.79			
	05/19/99	3.95	4.7						
	05/21/99	3.42	13.1	1,006	14.2	8.16	22	70	
	06/14/99	3.38	114.0	657	17.7	7.9			
	07/19/99	3.10	21.6						
	07/23/99	3.13	20.1						
	08/18/99	3.00	23.2						
	08/31/99	2.88	26.4						
	10/19/99	3.16	19.2						
	11/08/99	3.42	13.5						
	11/15/99	3.50	11.9						
	11/24/99	3.59	10.1						
	12/05/99	3.70	8.3						
	12/15/99	3.78	7.0						
	12/27/99	3.88	5.6						
	01/15/00	3.72	4.0						
	02/02/00	4.08	3.1						
	02/24/00	4.06	3.3	1,337	10.4	8.69			
	03/01/00	4.10	2.9						
	03/21/00	4.10	2.9	1,140	10.8	8.36			
	04/17/00	4.12	2.7						
	05/08/00	4.02	4.1						
	05/26/00	3.83	6.5	662					

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
Danford Drain @ 51 St. T01S-R25E-SECTION33-TRACTAACD	04/07/99		2.8	1,105	14.3	8.6			3
	05/20/99	1.60	1.5	1,369	16.3	8.31	43	150	
	06/14/99	3.25		239	16.7	8.08			
	06/21/99	1.10							
Danford Drain @ 64th St. T01S-R25E-SECTION30-TRACTCBCC	02/12/99			1,477	6.1	8.23			
	04/06/99		1.9						
Danford Drain @ 72nd St. drain T01S-R25E-SECTION30-TRACTCBBB	01/14/99			1,510	9.2	7.94			3
	03/17/99			1,200	12.9	7.47			
	04/06/99		0.34						
CITY-COUNTY DRAIN									
City-County Drain @ McDougal	03/17/99	4.50	5.5						
	04/06/99	4.51	5.3						
	05/20/99	3.90	29.4						
	06/17/99	3.58	45.2						
	08/18/99	3.58	44.9						
	10/19/99	4.00	25.2						
City County Drain @ BLM T01S-R26E-SECTION17-TRACTAAB	04/06/99	7.10	4.9	1,480	10.4	8.08			3
	05/20/99	6.75	28.0						
	07/09/99	6.75	30.6						
	07/19/99	6.50	47.0						
	10/19/99	6.95	15.0						
	11/24/99	7.08	5.6						
	02/02/00	7.09	5.3						
	02/24/00	7.10	4.8						
	03/01/00	7.13	3.8						
	03/21/00	7.14	3.5	1,694	11.9	8.16			2
	04/17/00	7.08	5.7						
	05/08/00	6.63	45.5	630	12.1	8.04			<1
	05/26/00	6.83	22.5	570					
	06/14/00	6.71	35.4						
	07/07/00	6.75	30.6						
	08/02/00	6.80	25.4						
	10/08/00	6.88	18.1						

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
NUTTING DRAIN									
Nutting Drain @ Yard Office Rd (culvert) T2S-R24E-SECTION 10 TRACTAADA	03/17/99	3.42	1.7	1,260	6.2	7.45	10	20	2
Nutting Drian@Shannon St. T2S-R24E-SECTION12-TRACTBAAD	04/07/99	1.50	2.6	1,105	14.3	8.6			
	05/17/99	0.80	6.3						
	06/04/99	0.80	7.7						
	07/19/99	0.00	24.8						
	10/19/99	0.75	8.3						
	11/24/99	1.00	5.7						
	03/01/00	1.29	3.7	1,118	12.3	8.51			
	03/21/00	1.44	3.0	991	11.6	8.28			
	04/17/00	1.45	2.9						
	04/19/00	1.40	3.2						
	05/08/00	1.29	3.7	9	17.0	8.37			
	05/21/00	1.67	2.1	1,122					
	05/26/00	0.88	6.9	115					
	06/14/00	0.58	10.7						
Nutting North of Fir Park T02S-24E-SECTION10-TRACTBDBA	05/26/00	1.10							
	06/14/00	1.02							
OTHER DRAINS									
Interstate Drain@56th St. T01S-R25E-SECTION33-TRACTBCCB	03/17/99		0.3						
	04/07/99	2.42	0.7	713	13.2	8.55			1
	05/20/99	2.30	2.0						
	06/21/99	0.08							
29th St. Drain T01S-R25E-SECTION13-TRACTDBAD	04/07/99		3.5						
	05/20/99		26.3						
72nd St Drain T01S-R25E-SECTION30-TRACTBCCC	04/07/99		0.4						

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
BIG DITCH Big Ditch@Trewin T02S-R23E-SECTION14-TRACT-BBBC Big Ditch@Golf East T02S-R24E-SECTION7-TRACTADCA Big Ditch at Laurel Airport Road T02S-R24E-SECTION02-TRACTBAAA	05/23/00			135	17.7	7.89			
	05/18/99	7.29	339.9						
	06/17/99	7.33	329.6						
	08/18/99	7.66							
	04/17/00	7.42							
	06/14/00	3.63							
	04/26/99	7.36	37.0						
	05/18/99	4.58	125.0						
	05/18/99	6.83	91.7						
	06/15/99	6.08	163.7						
	07/09/99	5.63	240.0						
	07/19/99	5.66	256.1						
	07/23/99	5.71	227.0						
	08/19/99	5.88	202.0						
	09/27/99	6.42	105.8						
	09/27/99	6.42	115.5						
	10/12/99	7.00	67.0						
	10/15/99	8.20	0.0						
	11/08/99	8.88	0.0						
	11/24/99	9.27	0.0						
	04/19/00	7.38	36.0						
	05/08/00	6.50	120.0						
	05/23/00	6.74	74.0	153	19.4	8.18			
	05/26/00	6.08	173.0	116					
	06/14/00	6.00	185.0						
	07/07/00	5.83	209.0	172	20.6	8.14			
	08/02/00	5.92	196.0						
	09/25/00	6.25	151.0						
	10/08/00	6.96	71.0						
	10/15/00		0.0						

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
Big Ditch@Hesper T01S-R24E-SECTION24-TRACTABCA	05/18/99	3.63	85.0						
	05/18/99	6.13	86						
	05/23/99	6.00	89.0	173	19.5	8.23			
	05/26/99	5.82	93						
	06/04/99	5.82	93						
	06/14/99	5.16	113.0	164	17.0	8.12			
	06/14/99	5.15	113						
	06/28/99	5.35	107						
	06/28/99	5.38	106						
	07/21/99	5.35	107						
	08/18/99	5.38	106						
	04/19/00	7.63	56						
	05/08/00	6.00	89						
	06/12/00	5.50	102	144	16.4	8.25	81	290	
	07/07/00	5.42	105	190	21.1	7.96			
	08/02/00	7.83	53						
Big Ditch@King Ave. T01S-R24E-SECTION18-TRACTBBBA	05/18/99	5.46	38.2						
	05/18/99	5.46	38.2						
	06/14/99	7.83	49.7	164	17.0	8.12			
	06/28/99	5.88							
	08/18/99	6.83							
	06/12/00	7.23		141	16.9	8.08	90	330	
	07/07/00	6.42		176	21.9	8.05			

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
HIGH DITCH High Ditch@LA T02S-R24E-SECTION03-TRACTAABB	04/20/99								
	05/18/99	6.71	29.7						
	06/15/99	5.00	100.8						
	07/09/99	5.42	238.8						
	07/19/99	5.33	100.0						
	08/18/99	5.79	266.8						
	09/27/99	6.61	0.0						
	10/15/99		0.0						
	11/24/99	8.40	0.0						
	05/08/00	6.50		123	13.7	8.32			
	05/23/00			145	19.9	8.14			
	05/26/00			118					
	06/14/00	4.79							
	07/07/00	4.75		155	20.7	8.11			
High Ditch@80th T01S-R23E-SECTION24-TRACTBBBB	05/18/99	4.75	29.5						
	06/04/99	2.83							
	06/14/99	2.46	73.7						
	06/28/99	3.29							
	11/24/99	0.00	dry						
	05/08/00	4.29							
	05/23/00			167	20.3	8.22			
	05/26/00	5.06							
	06/12/00			115	16.9	8.2	62	220	
	06/12/00	2.38							
	07/07/00	2.67		167	21.6	7.97			
High Ditch@88th St. T01S-R24E-SECTION11-TRACTCBCC	06/12/00	2.38		207	17.5	8.31	72	260	
	05/18/99	4.88	5.2						
	06/28/99	4.94							

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
COVE DITCH Cove Ditch@Laurel Airport Rd. T02S-R24E-SECTION03-TRACTBBAB	05/19/99	4.21	13.0						
	06/15/99	2.25	48.3						
	07/19/99	1.97	19.3						
	08/18/99	1.96	19.1						
	09/27/99	1.91	60.0						
	10/14/99		48.0						
	10/17/99		0.0						
	05/08/00	3.63		140	13.9	8.32			
	05/26/00	2.67		189					
	06/14/00	5.00							
Cove Ditch@Hesper T01S-24E-SECTION26-TRACTBBBA	06/12/00								
	07/07/00			159	22.5	7.99			
	05/20/99		0.6						
Cove Ditch@88 T01S-R24E-SECTION01-TRACTBAAA	07/10/99	2.21		190	22.3	8.08			
	06/12/00								
	05/18/99		dry						
	06/14/99	1.58	24.3						

Surface water field measurements

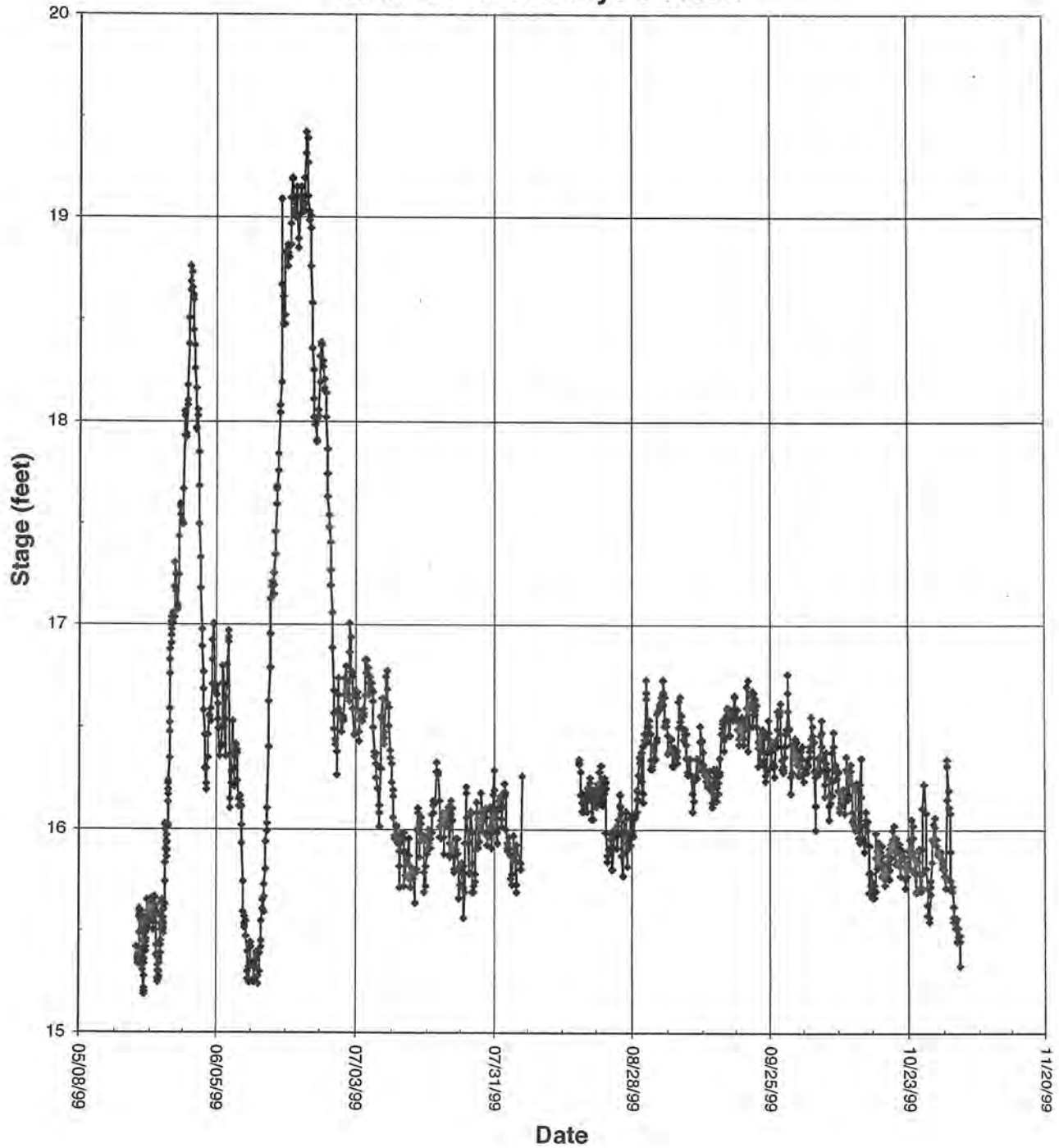
Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
CANYON CREEK DITCH Canyon Creek Ditch@Shannon St. T2S-R24E-SECTION12-TRACTBAAD	05/21/99	6.08		388			17	50	
	05/19/99	8.30	6.5						
	06/17/99	6.46	94.7						
	07/19/99	6.15	110.0						
	08/18/99	5.73	151.3						
	09/27/99	6.50	89.3						
	10/15/99	6.70	75.8						
	10/19/99	8.79	0.3						
	11/08/99	9.04							
	11/15/99	8.96							
	11/24/00	8.96							
	03/01/00	9.25	6.5						
	04/19/00	6.77							
	05/08/00	6.13							
	05/26/00	6.13		714					
	06/14/00	5.96							
Canyon Creek Ditch@51St, T01S-R25E-SECTION28-TRACTAACC	05/21/00	4.33		383	16.1	8.23	13	30	
	05/21/99	4.40							
	05/19/99		5.5						
	06/21/99	4.50							
Canyon Creek Ditch@Hesper Rd. T01S-R25E-SECTION23-TRACTABAA	06/16/99	1.54		125	16.1	7.97			
	06/12/00			133	16.7	7.88	37	130	
	07/07/00	7.17		183	21.3	8.02			
Canyon Creek Ditch@Niebauer T01S-R25E-SECTION27-TRACTBAAB	07/07/00	1.79		190	22.0	7.99			
	05/08/00			126	12.5	8.13			

Surface water field measurements

Location	Date	Depth to water (ft from MP)	Flow (cfs)	Conductance (umhos/cm)	Temperature (°C)	pH	Turbidity (NTU)	TSS (MG/L)	NO ₃ as N (mg/l)
BBWA BBWA @Hesper T01S-R25E-SECTION23-TRACTBBBA BBWA@Niebauer T01S-R25E-SECTION28-TRACTAABA BBWA @McMullan Hall T01N-R26E-SECTION32-TRACTBACC	06/12/00	5.92		133	16.1	7.96	51	180	
	07/07/00	5.75		192	21.0	8.03			
	06/14/99	7.03	294.0						
	06/28/99	6.30							
	07/09/99	6.08							
	07/21/99	6.07							
	06/14/99	8.00	390.4	177	15.1	7.97			
	07/21/99	7.50		193	19.1	8.06			
	06/12/00	7.42		134	18.7	8.2	37	120	
	07/07/00	9.50		189	20.0	8.05			
	06/28/99	7.42							
	07/09/99	7.21							
	07/21/99	11.25		202	19.7	8.19			
	07/10/00	10.25		203	22.3	7.86			
	04/21/00	7.80	142.9						
	05/17/99	7.61	155.5						
	06/17/99	6.36	319.2						
	07/06/99	5.75	402.8						
	07/08/99	5.48	444.9						
	07/09/99	5.52	417.4						
	07/19/99	5.66	415.6						
	07/21/99	5.52	438.5						
	08/18/00	5.66	416.6						
	10/12/99	7.00	231.3						
	10/15/99	10.25							
	04/19/00	7.90	143.7						
	05/31/00	6.70	288.0						
	06/14/00	6.25	422.1						
	07/07/00	5.44	451.7						
	08/02/00	5.19	492.4						
	09/25/00	6.83	251.9						
	05/21/99	4.00		235			6	10	
	06/17/99	6.36	319.2	107	15.0	7.8			
	07/07/00	5.43	451.7	192	19.3	7.93			
	10/08/00	7.17	211.0						
	10/16/00	10.25							

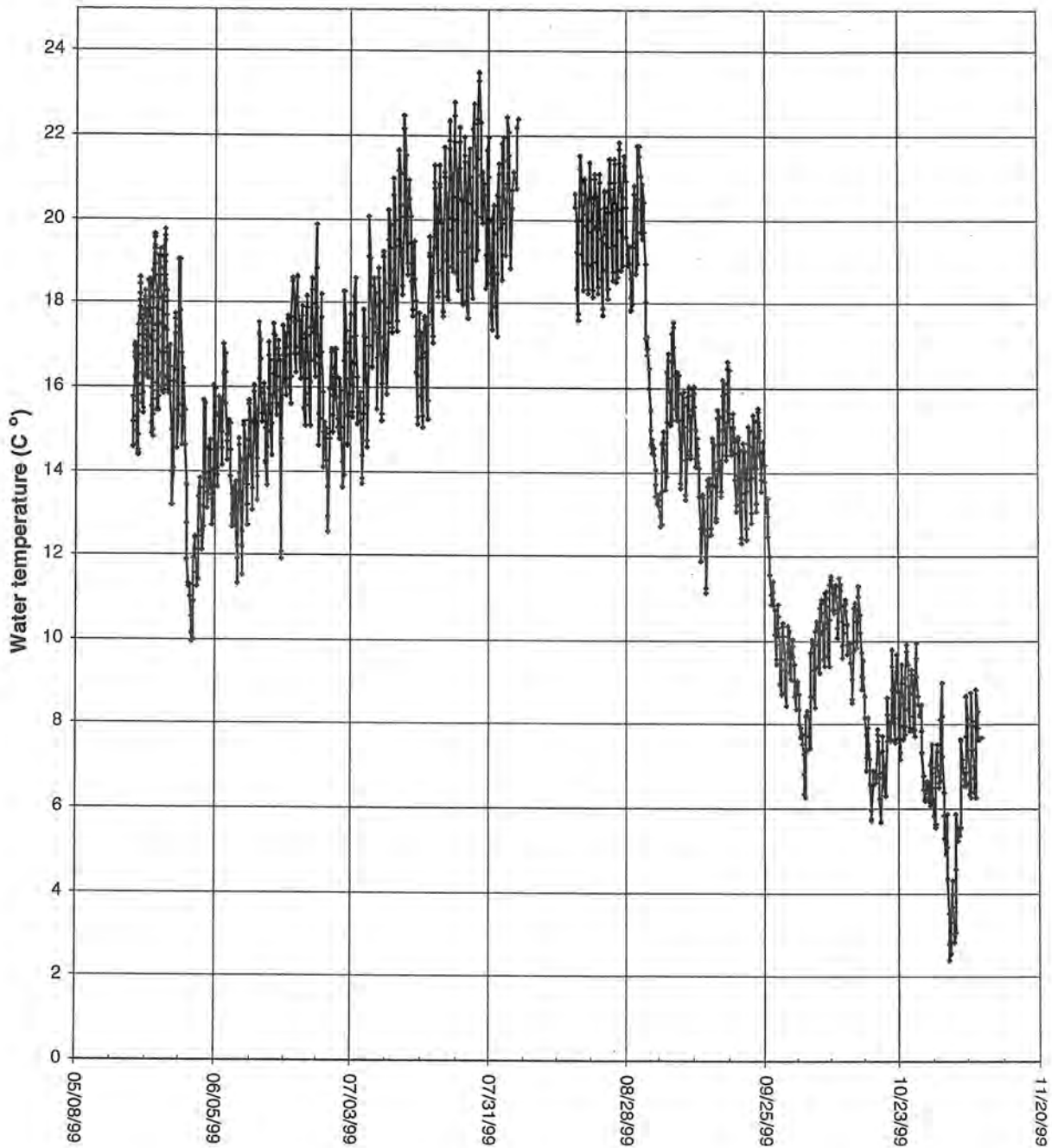
Data Collected by a Hydro Lab MiniSonde Probe
Location: Canyon Creek at Goodman Bridge, near the confluence with the Yellowstone River
Township 01S, Range 25E, Section 25 BBCC

Water Level of Canyon Creek



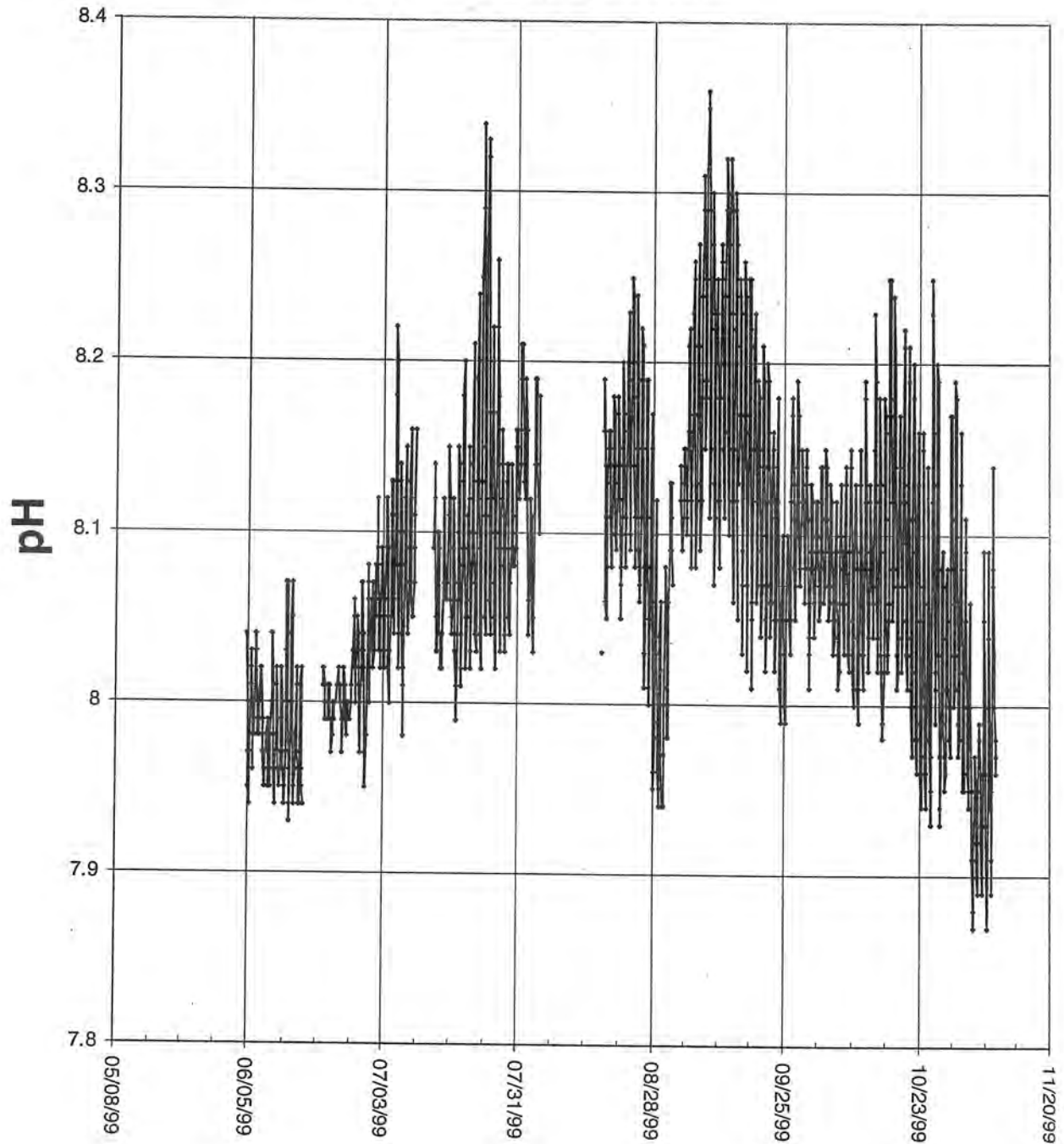
Data Collected by a Hydro Lab MiniSonde Probe
Location: Canyon Creek at Goodman Bridge, near the confluence with the Yellowstone River
Township 01S, Range 25E, Section 25 BBCC

Temperature of Canyon Creek



Data Collected by a Hydro Lab MiniSonde Probe
Location: Canyon Creek at Goodman Bridge, near the confluence with the Yellowstone River
Township 01S, Range 25E, Section 25 BBCC

pH of Canyon Creek



Data Collected by a Hydro Lab MiniSonde Probe
Location: Canyon Creek at Goodman Bridge, near the confluence with the Yellowstone River
Township 01S, Range 25E, Section 25 BBCC

Specific Conductance of Canyon Creek

