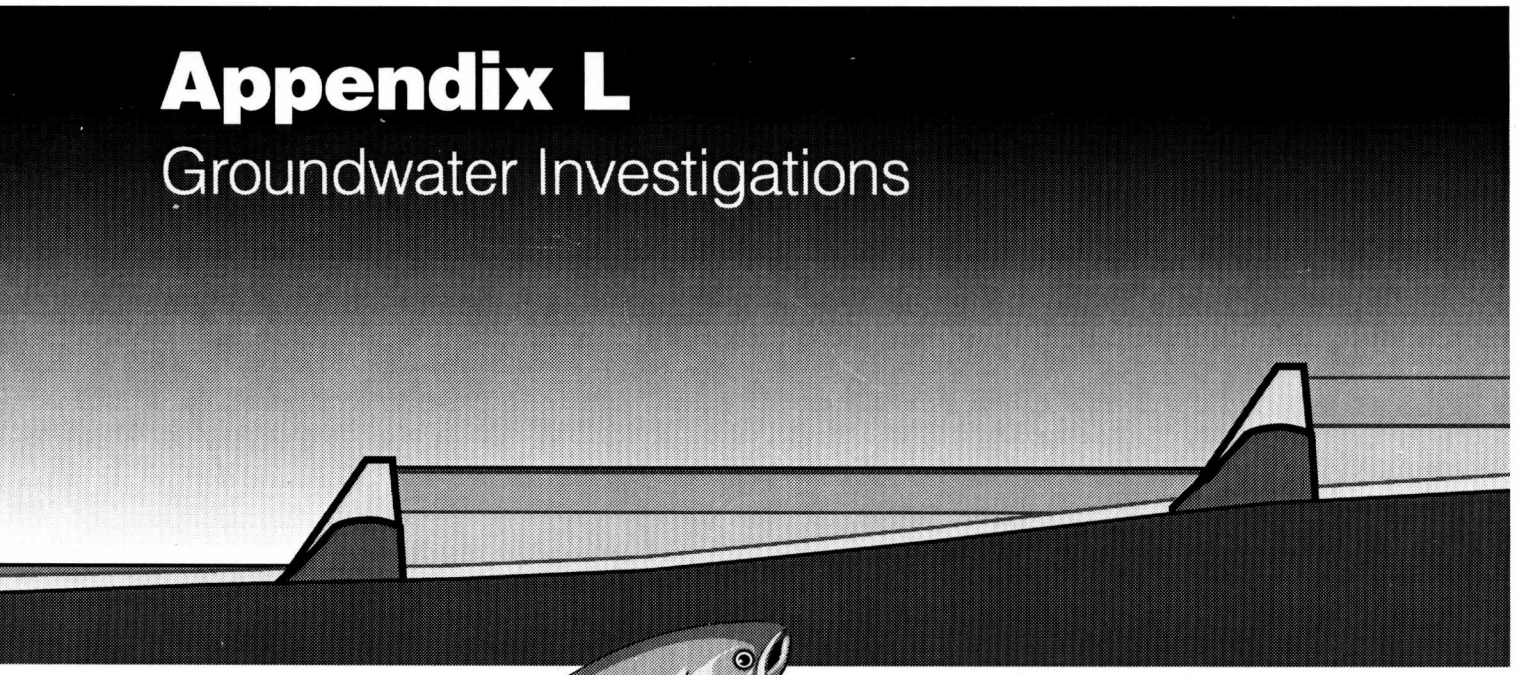
US Army Corps
of Engineers
Walla Walla District

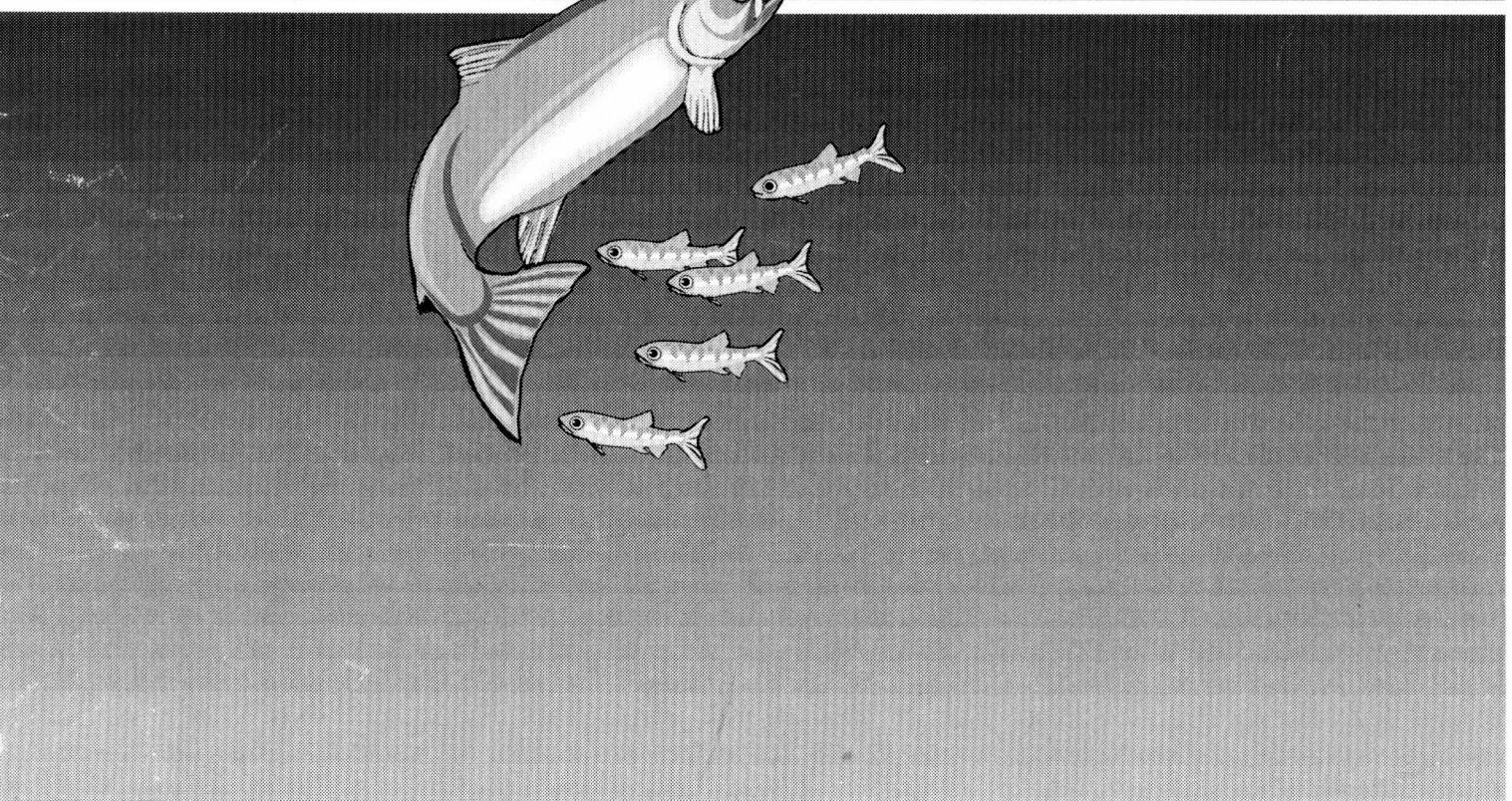
1992 Reservoir Drawdown Test

Lower Granite and Little Goose Dams

Appendix L

Groundwater Investigations





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APPENDIX L

GROUNDWATER INVESTIGATIONS

1992 Reservoir Drawdown Test

Lower Granite and Little Goose Dams

Fred Miklancic
Walla Walla District
U.S. Army Corps of Engineers

APPENDIX L

TEST DRAWDOWN 1992 OF LITTLE GOOSE AND LOWER GRANITE DAMS GROUNDWATER INVESTIGATIONS

1. INTRODUCTION.

In accordance with recommendations contained in the Record of Decision for the 1992 Options Analysis Document/Environmental Impact Statement for the Columbia River Salmon Flow Measures, a test drawdown of Little Goose and Lower Granite Reservoirs was conducted during the periods of 1 March 31 1992. The drawdown test enabled the Corps of Engineers to evaluate the effects and feasibility of conducting reduced reservoir water levels on a regular basis. The lowering of water levels within the reservoirs theoretically would increase instream velocities that would potentially move salmon smolts downstream at a faster rate, which would theoretically increase their survival.

A study was conducted by the U.S. Geological Survey (USGS) under contract to the Walla Walla District to measure the effects, if any, of the short-term drawdown of the Lower Granite Reservoir on ambient groundwater conditions.

Previous groundwater studies of the Lower Granite area by the Geological Survey indicate that the Snake River, in this area, cuts through basalt of Miocene age which is overlain, on the uplands, by eolian loess of Quarternary age. Alluvium is present locally along the river banks with extensive low terrace alluvium laying beneath the Lewiston-Clarkston area at the confluence of the Snake and Clearwater Rivers. Some of the wells along the banks of the river (or reservoir) are relatively shallow and finish in basalt bedrock or alluvium. The upland loess is largely unsaturated, and accordingly wells in these areas are relatively deep and finish in basalt. It was assumed that these upland wells would not be affected by the drawdown, particularly because of the short duration, and could therefore be used as control wells.

2. MONITORING SCHEDULE.

The Geological Survey inventoried 20-25 wells in the immediate vicinity of the reservoir to include those along the Lower Granite reservoir shoreline, below Lower Granite Dam, and on the uplands on both sides of the reservoir in both Washington and Idaho.

Sixteen of the inventoried wells were selected for monitoring prior to, during, and after the drawdown period. Eleven wells are in the immediate vicinity of Lewiston and Clarkston; three wells are in the Silcott area approximately nine miles downstream from Lewiston-Clarkston; one well is at Wawawai Park, three miles upstream from Lower Granite Dam; and the final well

is on the uplands east of Wawawai Park. All wells with the exception of the upland well are within a half-mile of the reservoir. The wells range in depth from 68 feet to 600 feet and are all finished in rock except for well number 36N/06W-25CDA1 which is in alluvium. Pertinent data for the monitoring wells to include local well number, location, altitude and depth, and a hydrograph for each well during the drawdown period, are included in Appendix L1.

3. GROUNDWATER REACTION.

In reviewing the hydrographs and comparing them to the hydrograph of the reservoir at the confluence, it is found that 12 wells are in direct hydraulic connection with the reservoir and the water levels changed with changes in the reservoir level. Four wells, well numbers 11N/45E-24L01, 11N/45E-24L02, 11N/46E-29Q01 and 13N/44E-15E01, showed no correlation with the reservoir changes. The well data can be basically categorized into three groups. The first group are those already mentioned that were not impacted by the drawdown. The second group well numbers 35N/06W-14DAA1, 35N/06W-12CCA1, 36N/06W-36ADB2, 11N/45E-17E01 and 11N/46E-21B01 fluctuated with the reservoir, but had water level drops ranging from 5 to 12 feet. The third group, well numbers 36N/06W-25CDA1, 11N/45E-20J01D2, 11N/45E-13R01, 11N/46E-18R01, 11N/46E-19B01, 11N/46E-19J01 and 13N/43E-02M01, fluctuated directly with the reservoir with water level drops ranging from 15-30 feet. Hydrographs of this latter group were almost symmetrical with the hydrograph at the reservoir at the confluence. As would be expected, the recovery of the water levels were more rapid in the third group of wells than those in the second group.

There has been no reported damage to any well in the vicinity of the reservoir as the result of the drawdown. The owner of one well, 36N/06W-25CDA1, reported a water level drop below the pump intake early in the drawdown phase. Since the reservoir is back to normal there appears to be no real problem with this particular well.

APPENDIX L-1

U.S. GEOLOGICAL SURVEY GROUNDWATER STUDY

United States Department of the Interior

GEOLOGICAL SURVEY

Water Resource Division
Pacific Northwest Area
Washington District
1201 Pacific Avenue - Suite 600
Tacoma, Washington 98402

April 29, 1992

Mr. Fred Miklancic
U.S. Army Corps of Engineers
Walla Walla District
Bldg. 602, City-County Airport
Walla Walla, Washington 99362-9265

Dear Fred:

The Washington District of the U.S. Geological Survey has completed its study of the effects that the lowering of lower Granite Reservoir had on ambient ground-water conditions. As you know, we monitored water levels in 17 wells approximately every other day for the period February 29 - April 8, 1992. The data that resulted from that effort are enclosed in various formats.

Our study effort began in late February with a field inventory of potential observation wells in both Washington and Idaho. First priority was given to wells that had been visited in the field as part of previous studies and that had been entered into our computerized Ground Water Site Inventory (GWSI) file. Where data were sparse or lacking, a door-to-door method of canvassing was employed.

Because most of our personnel in the Pasco and Spokane Field Offices were committed to assisting with the surface-water phase of the drawdown study, we elected to hire a local observer to make most of the water-level measurements. This gentleman was Mr. Ross Floyd of Lewiston, Idaho, recently retired from the physics department of Lewis and Clark College. The choice turned out to be a fortunate one; Mr. Floyd proved to be dedicated, thorough, and highly interested in the study.

The resulting water-level data, copies of which were forwarded to you earlier by FAX, were entered into GWSI and now become a permanent part of our ground-water data base. Much of the enclosed material is in the form of retrievals from that data base.

The enclosed materials fall into four general categories:

* A table of geographic and physical data for the observation wells used in the study.

* Sketches of the (local) well-numbering systems used in Washington and in Idaho. In addition to a local well number, each well has a formal, unique identification number based loosely on latitude and longitude.

* A table of water levels measured in the study wells from late February to early April, 1992.

* Hydrographs of water levels in the observation wells and in Lower Granite Reservoir, plotted to a common vertical scale and time base.

This completes our study of the effects of lowered reservoir levels on ambient ground-water conditions. Should you or your staff have questions about the study or the resulting data, please call me in Tacoma at (206) 593-6510.

Sincerely,

Norman P. Dion

Norman P. Dion
Supervisory Hydrologist

Enclosure

WELL-NUMBERING SYSTEM (IDAHO)

The well-numbering system (fig. 1) used by the U.S. Geological Survey in Idaho indicates the location of wells within the official rectangular subdivision of the public lands, with reference to the Boise base line and meridian. The first two segments of the number designate the township and range. The third segment gives the section number, followed by three letters and a numeral, which indicate the ¼ section (160-acre tract), ¼-¼ section (40-acre tract), ¼-¼-¼ section (10-acre tract), and serial number of the well within the tract, respectively. Quarter sections are lettered A, B, C, and D in counterclockwise order from the northeast quarter of each section. Within quarter sections, 40-acre and 10-acre tracts are lettered in the same manner. Well 08S 24E 31DAC1 is in the SW¼NE¼SE¼ sec. 31, T. 8 S., R. 24 E., and was the first well inventoried in that tract.

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To Norm Dixi	From A. Tungate
Co. USGS	Co.
Dept.	Phone # 208 334-1743
Fax # 206 593-6514	Fax #

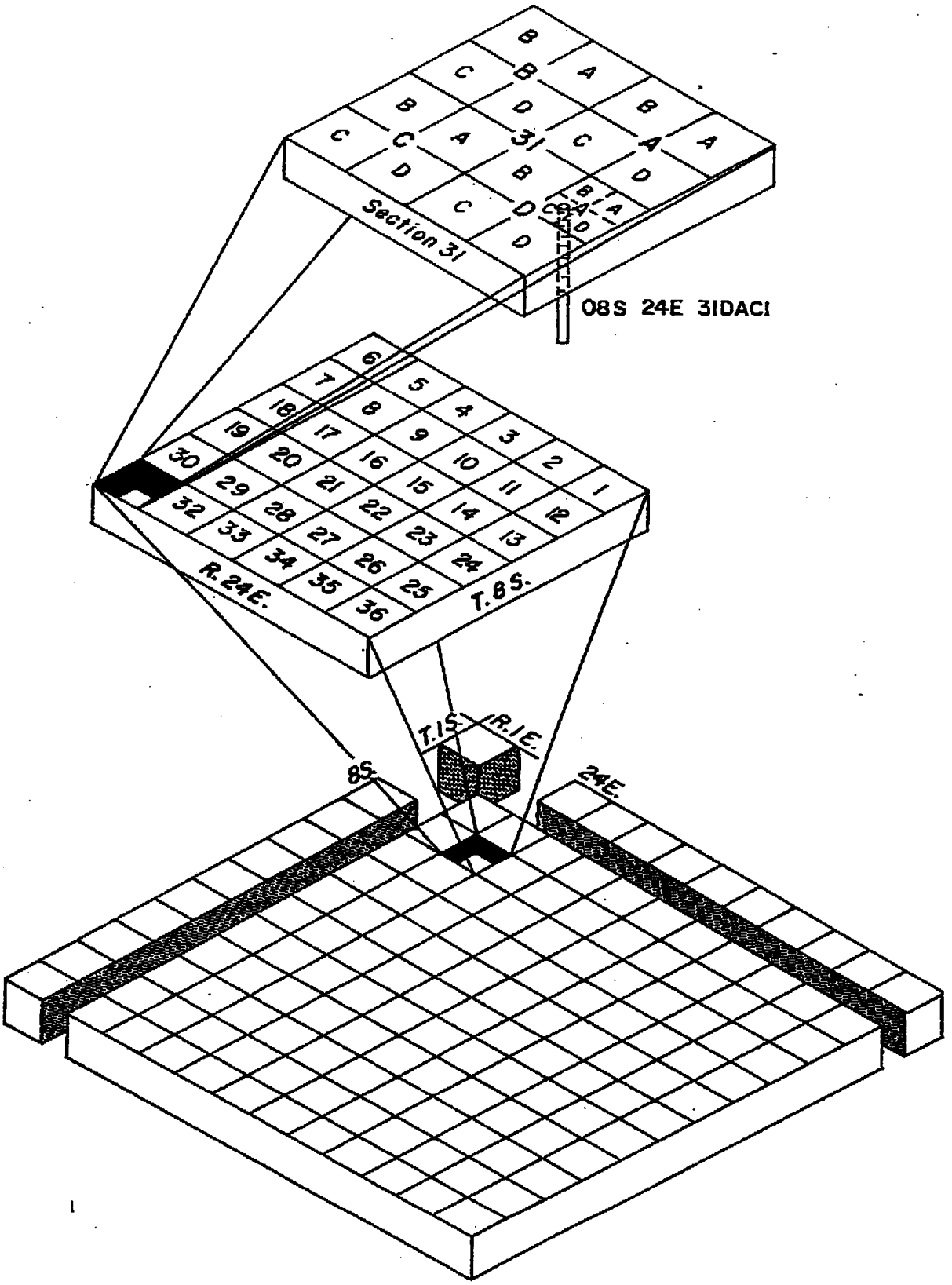

Figure 1.--Well-numbering system.

Well-Numbering System (WASHINGTON)

The well-numbering system used by the U.S. Geological Survey in the State of Washington is based on the rectangular subdivision of public land, which indicates township, range, section, and 40-acre tract within the section. For example, in well number 02N/03E-12P02 (see figure 2), the part preceding the hyphen indicates the township and range (T.02 N., R.03 E.) north and east of the Willamette base line and meridian, respectively. The first number following the hyphen (12) indicates the section, and the letter (P) gives the 40-acre tract within that section. The last number (02) is the serial number of the well in that 40-acre tract. If a well has been deepened, the serial number is followed by the letter "D" and a number indicating the sequence of the deepening. For example, if 02N/03E-12P02 had been deepened twice, it would now be numbered 02N/03E-12P02D2.

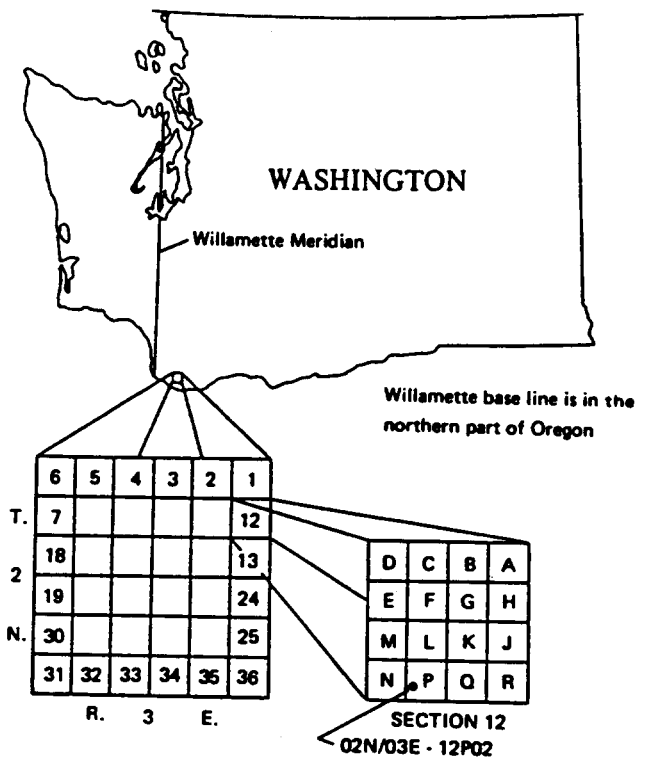

FIGURE 2.–Well-numbering system in Washington.

Acknowledgments

Appreciation is expressed to municipal and industrial employees and private well owners who allowed wells to be sampled. Their cooperation was essential to the study.

LOCAL WELL NUMBER	STATE	LATITUDE (D/M/S)	LONGITUDE (D/M/S)	ALTITUDE OF LAND SURFACE (FEET)	DEPTH OF WELL (FEET)	DIAMETER OF CASING (IN)	PRIMARY USE OF WATER *
35N/06W-14DAA1	ID	462233	1170242	790	115	12 8	N
35 ~~36~~N/06W-12CCA1	ID	462311	1170225	860	600	16 10	P
36N/06W-25CDA1	ID	462511	1170206	745	70	--	S
36N/06W-36ADB2	ID	462527	1170137	730	352	16	U
11N/45E-17E01	WA	462607	1171215	840	225	8	H
~~11N/45E-20D01~~	~~WA~~	~~462532~~	~~1171208~~	~~880~~			S unable to measure.
11N/45E-20J01D2	WA	462503	1171120	758.5	190	8 5	H
11N/45E-24L01	WA	462449	1170641	770	68	8	H
11N/45E-24L02	WA	462449	1170639	770	81	8 5	H
11N/46E-13R01	WA	462542	1170615	990	318	6	H
11N/46E-18R01	WA	462536	1170450	960	298	6 4	H
11N/46E-19B01	WA	462524	1170515	780	394	10	N
11N/46E-19J01	WA	462454	1170502	750	110	6	S
11N/46E-21B01	WA	462528	1170237	770	112	8	C
11N/46E-29Q01	WA	462357	1170400	950	288	8	H
13N/43E-02M01	WA	463815	1172232	800	250	14 10 8	H
13N/44E-15E01	WA	463642	1171615	2510	210	8	H

* C=COMMERCIAL
H=DOMESTIC
N=INDUSTRIAL
P=PUBLIC SUPPLY
S=STOCK
U=UNUSED

LOCAL WELL NUMBER	WATER-LEVEL DATE	MEASUREMENT TIME	DEPTH TO WATER (FEET)
35N/06W-14DAA1	02-20-92	1320	43.79
	02-24-92	1425	44.71
	02-29-92	1450	43.38
	03-02-92	1310	46.25
	03-04-92	1345	44.93
	03-06-92	1330	47.97
	03-08-92	1320	46.66
	03-10-92	1335	47.73
	03-12-92	1300	48.56
	03-14-92	1325	48.90
	03-16-92	1305	49.67
	03-19-92	1315	51.03
	03-22-92	1420	53.13
	03-24-92	1350	53.99
	03-26-92	1110	53.90
	03-28-92	1110	54.94
	03-30-92	1120	54.54
	04-02-92	1120	52.50
	04-08-92	1150	50.25
35 ~~36~~N/06W-12CCA1	02-20-92	1420	136.35
	02-24-92	1440	136.03
	02-29-92	1455	136.50
	03-02-92	1325	136.11
	03-04-92	1405	135.71
	03-06-92	1350	137.75
	03-08-92	1340	137.36
	03-10-92	1350	138.90
	03-12-92	1315	140.61
	03-14-92	1314	140.84
	03-16-92	1320	141.15
	03-19-92	1335	139.36
	03-22-92	1435	142.40
	03-24-92	1405	143.18
	03-26-92	1125	144.53
	03-28-92	1125	143.79
	03-30-92	1135	145.02
	04-02-92	1135	146.94
	04-08-92	1210	143.96
36N/06W-25CDA1	02-22-92	0950	13.78
	02-24-92	0835	12.02
	02-29-92	0825	13.49
	03-02-92	0745	14.13
	03-04-92	0750	16.18
	03-06-92	0810	19.58
	03-08-92	1200	20.91
	03-10-92	0810	22.61
	03-12-92	0820	25.45
	03-14-92	0825	27.61
	03-16-92	0830	28.73
	03-19-92	0830	28.48
	03-22-92	0840	28.53
	03-24-92	0825	28.66
	03-26-92	0840	28.64
	03-27-92	0815	28.62
	03-27-92	1420	28.62
	03-28-92	0830	28.99
	03-29-92	0825	28.60

	03-29-92	1425	28.66
	03-30-92	0830	29.07
	03-31-92	0825	28.57
	03-31-92	1445	28.59
	04-02-92	0835	26.99
	04-08-92	0855	19.03
36N/06W-36ADB2	02-20-92	1420	1.58
	02-24-92	1350	3.57
	02-29-92	1430	3.15
	03-02-92	1250	3.54
	03-04-92	1320	4.06
	03-06-92	1305	4.81
	03-08-92	1300	5.59
	03-10-92	1310	6.81
	03-12-92	1230	7.57
	03-14-92	1300	8.47
	03-16-92	1240	9.10
	03-19-92	1245	10.12
	03-22-92	1400	11.29
	03-24-92	1330	12.23
	03-26-92	1050	12.75
	03-28-92	1045	12.89
	03-30-92	1100	12.50
	04-02-92	1055	11.96
	04-08-92	1130	10.23

LOCAL WELL NUMBER	WATER-LEVEL DATE	MEASUREMENT TIME	DEPTH TO WATER (FEET)
11N/45E-17E01	02-21-92	1400	117.13
	02-24-92	1120	117.56
	02-29-92	1135	116.78
	03-02-92	1015	117.36
	03-04-92	1015	117.31
	03-06-92	1030	117.15
	03-08-92	0950	117.93
	03-10-92	0950	118.07
	03-12-92	1000	118.16
	03-14-92	1015	119.74
	03-16-92	1015	119.00
	03-19-92	1015	120.18
	03-22-92	1050	120.76
	03-24-92	1015	121.16
	03-26-92	1020	121.18
	03-28-92	1015	123.94
	03-30-92	1030	122.39
	04-02-92	1020	122.34
	04-08-92	1045	121.88
11N/45E-20D01	02-21-92	1325	165.76
	02-24-92	1035	167.55
	03-06-92	1005	170.04
11N/45E-20J01D2	02-22-92	1315	22.76
	02-24-92	1540	22.62
	02-29-92	1530	20.86
	03-02-92	1435	27.66
	03-04-92	1510	31.16
	03-06-92	1510	34.60
	03-08-92	1440	36.84
	03-10-92	1455	38.74
	03-12-92	1420	40.67
	03-14-92	1445	42.63
	03-16-92	1435	44.52
	03-19-92	1420	45.88
	03-22-92	1540	47.21
	03-24-92	1505	48.13
	03-26-92	1330	49.32
	03-27-92	0940	49.52
	03-27-92	1545	49.43
	03-28-92	1400	48.18
	03-29-92	0950	47.06
	03-29-92	1535	46.55
	03-30-92	1540	43.33
	03-31-92	0940	37.24
	03-31-92	1555	35.31
	04-02-92	1410	24.97
	04-08-92	1420	23.05
11N/45E-24L01	02-21-92	--	16.98
	02-24-92	1550	17.01
	02-29-92	1610	16.85
	03-02-92	1455	16.93
	03-04-92	1525	16.97
	03-06-92	1525	17.03
	03-08-92	1500	17.17
	03-10-92	1555	17.23
	03-12-92	1440	17.21

	03-14-92	1505	17.28
	03-16-92	1450	17.30
	03-19-92	1440	17.42
	03-22-92	1555	17.45
	03-24-92	1525	17.63
	03-26-92	1345	17.70
	03-28-92	1415	17.69
	03-30-92	1355	17.66
	04-02-92	1425	17.45
	04-08-92	1440	17.40
11N/45E-24L02	02-24-92	1610	27.38
	02-29-92	1620	27.16
	03-02-92	1505	27.27
	03-04-92	1540	27.29
	03-06-92	1540	27.38
	03-08-92	1510	27.51
11N/46E-13R01	02-21-92	1215	220.42
	02-24-92	0950	220.43
	02-29-92	1000	227.03
	03-02-92	0900	220.17
	03-04-92	0905	223.76
	03-06-92	0940	225.85
	03-08-92	1055	228.25
	03-10-92	0930	230.63
	03-12-92	0930	232.96
	03-14-92	0940	235.2
	03-16-92	0945	237.33
	03-19-92	0945	240.00
	03-22-92	0945	241.83
	03-24-92	0945	243.06
	03-26-92	0950	244.14
	03-27-92	0900	244.68
	03-27-92	1505	245.83
	03-28-92	0935	245.17
	03-29-92	0920	245.21
	03-29-92	1510	245.10
	03-30-92	1000	244.57
	03-31-92	0910	243.24
	03-31-92	1525	243.03
	04-02-92	0950	241.63
	04-08-92	1015	229.35
11N/46E-18R01	02-21-92	0920	222.71
	02-24-92	0905	225.76
	03-02-92	0815	225.57
	03-04-92	0825	226.64
	03-06-92	0840	227.90
	03-08-92	1140	228.90
	03-10-92	0845	230.29
	03-12-92	0845	231.58
	03-14-92	0900	233.09
	03-16-92	0905	234.61
	03-19-92	0855	236.94
	03-22-92	1335	238.13
	03-24-92	0850	239.40
	03-26-92	--	240.12
	03-28-92	0855	240.98
	03-30-92	0920	240.64
	04-02-92	0905	240.14
	04-08-92	0930	234.36
11N/46E-19B01	02-21-92	1100	22.48
	02-24-92	0925	22.46
	02-29-92	0910	24.74

	03-02-92	0835	26.43
	03-04-92	1230	29.37
	03-06-92	0920	33.14
	03-08-92	1115	35.05
	03-10-92	0905	37.59
	03-12-92	0910	39.92
	03-14-92	0920	42.04
	03-16-92	0920	43.97
	03-19-92	0915	45.68
	03-22-92	0910	46.81
	03-24-92	0905	49.59
	03-26-92	0920	48.66
	03-27-92	0840	48.87
	03-27-92	1445	48.86
	03-28-92	0910	48.29
	03-29-92	0855	46.91
	03-29-92	1450	46.31
	03-30-92	0935	45.52
	03-31-92	0845	39.67
	03-31-92	1505	38.07
	04-02-92	0925	30.65
	04-08-92	0950	24.99
11N/46E-19J01	02-24-92	1625	13.71
	02-29-92	1645	14.63
	03-02-92	1525	14.41
	03-04-92	1605	17.12
	03-06-92	1555	18.80
	03-08-92	1530	20.64
	03-10-92	1530	22.36
	03-12-92	1455	24.06
	03-14-92	1520	25.88
	03-16-92	1510	27.53
	03-19-92	1455	29.25
	03-22-92	1610	30.79
	03-24-92	1540	31.93
	03-26-92	1400	32.93
	03-27-92	1000	33.10
	03-27-92	1600	33.01
	03-28-92	1430	32.82
	03-29-92	1005	31.45
	03-29-92	1555	31.08
	03-30-92	1410	29.27
	03-31-92	1000	27.63
	03-31-92	1600	28.01
	04-02-92	1435	23.83
	04-08-92	1455	19.23
11N/46E-21B01	02-22-92	1755	35.72
	02-24-92	1720	35.65
	02-29-92	1735	35.93
	03-02-92	1545	36.33
	03-04-92	1625	37.08
	03-06-92	1620	38.02
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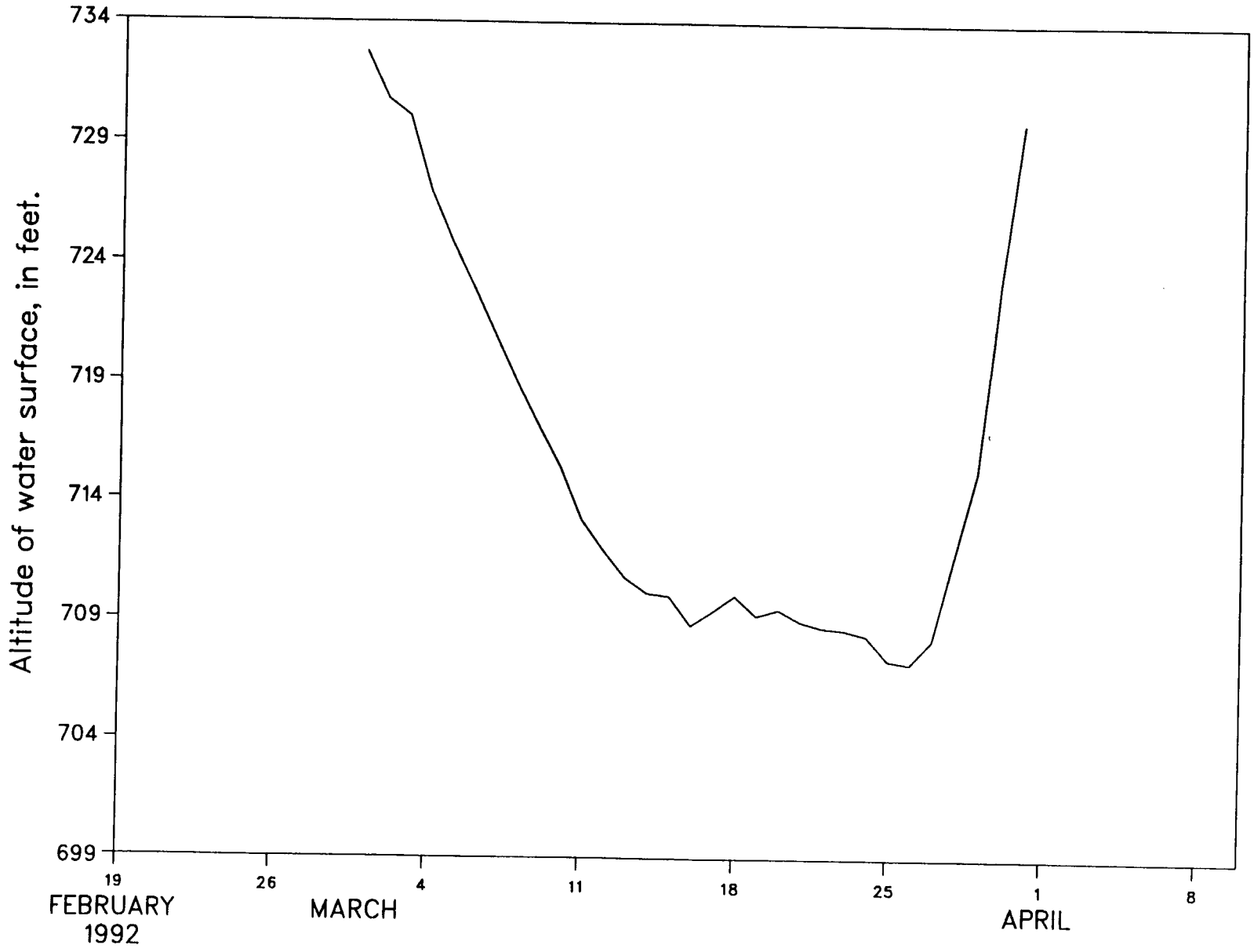
	03-14-92	1540	42.63
	03-16-92	1530	43.65
	03-19-92	1515	45.04
	03-22-92	1630	46.14
	03-24-92	1555	46.83
	03-26-92	1420	47.47
	03-27-92	1015	47.76
	03-27-92	1620	47.86
	03-28-92	1450	48.08

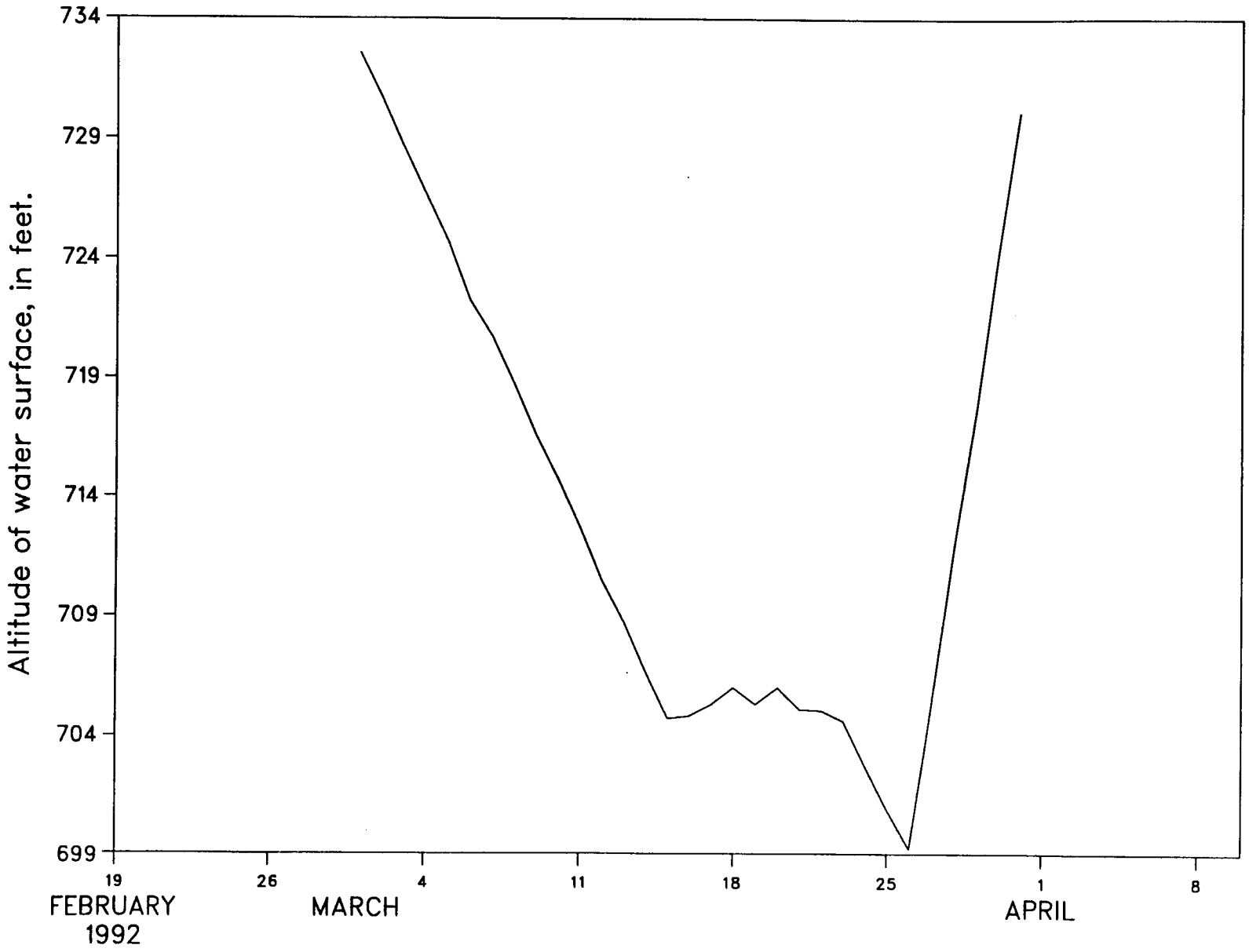
	03-29-92	1020	48.24
	03-29-92	1615	48.20
	03-30-92	1430	48.07
	03-31-92	1015	47.72
	03-31-92	1630	47.55
	04-02-92	1455	46.04
	04-08-92	1515	42.19
11N/46E-29Q01	02-24-92	1640	213.89
	02-29-92	1710	213.52
	03-02-92	1400	211.4
	03-04-92	1435	212.3
	03-06-92	1435	211.4
	03-08-92	1415	212.4
	03-10-92	1420	214.29
	03-12-92	1355	213.56
	03-14-92	1410	213.79
	03-16-92	1355	213.76
	03-19-92	1355	208.03
	03-22-92	1455	210.51
	03-26-92	1255	213.55
	03-28-92	1330	215.30
	03-30-92	1315	214.04
	04-02-92	1340	215.52
	04-08-92	1355	215.94
13N/43E-02M01	02-22-92	1350	62.53
	02-24-92	1200	62.26
	02-29-92	1230	63.96
	03-02-92	1100	65.86
	03-04-92	1100	68.83
	03-06-92	1125	72.83
	03-08-92	0905	75.33
	03-10-92	1050	78.82
	03-12-92	1045	81.89
	03-14-92	1100	85.12
	03-16-92	1055	87.78
	03-19-92	1105	89.39
	03-22-92	1140	91.64
	03-24-92	1140	91.92
	03-24-92	1145	91.95
	03-25-92	2230	92.9
	03-26-92	0740	93.33
	03-26-92	2130	93.98
	03-27-92	0740	93.33
	03-27-92	1945	92.43
	03-28-92	0910	93.2
	03-28-92	2025	89.79
	03-29-92	0750	87.99
	03-29-92	1910	86.05
	03-30-92	1200	82.63
	03-31-92	1320	77.44
	04-01-92	0945	73.22
	04-02-92	1240	69.21
	04-03-92	1355	66.55
	04-08-92	1355	63.77
13N/44E-15E01	02-21-92	1715	10.02
	02-24-92	1220	11.31
	02-29-92	1325	18.39
	03-02-92	1130	10.72
	03-04-92	1135	10.09
	03-06-92	1155	11.46
	03-08-92	0840	12.13
	03-10-92	1120	10.68
	03-12-92	1120	15.74

03-14-92	1125	12.97
03-16-92	1125	13.56
03-19-92	1130	13.91
03-22-92	1210	13.24
03-24-92	1100	14.43

LOWER GRANITE CONFLUENCE



LOWER GRANITE FOREBAY



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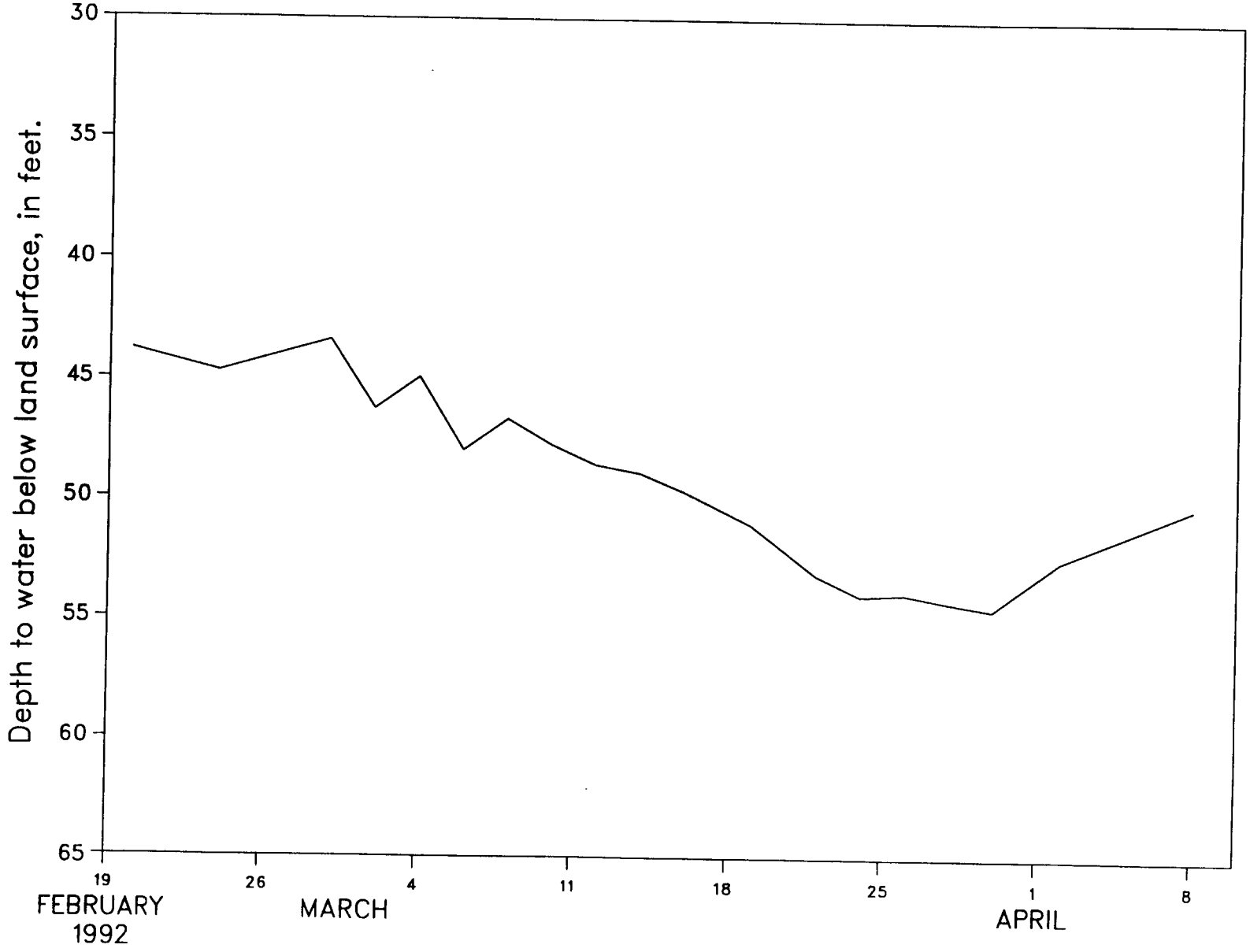

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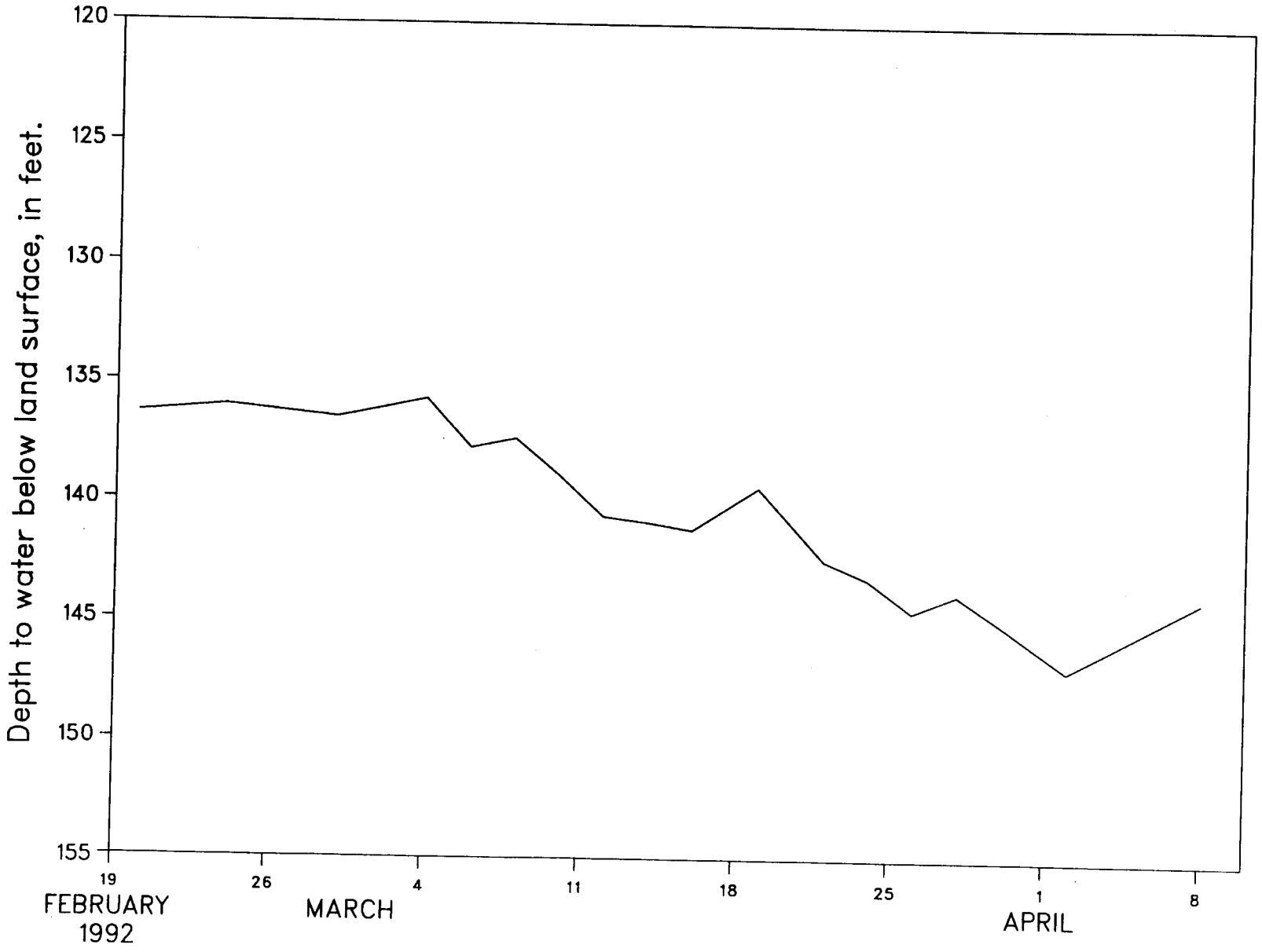

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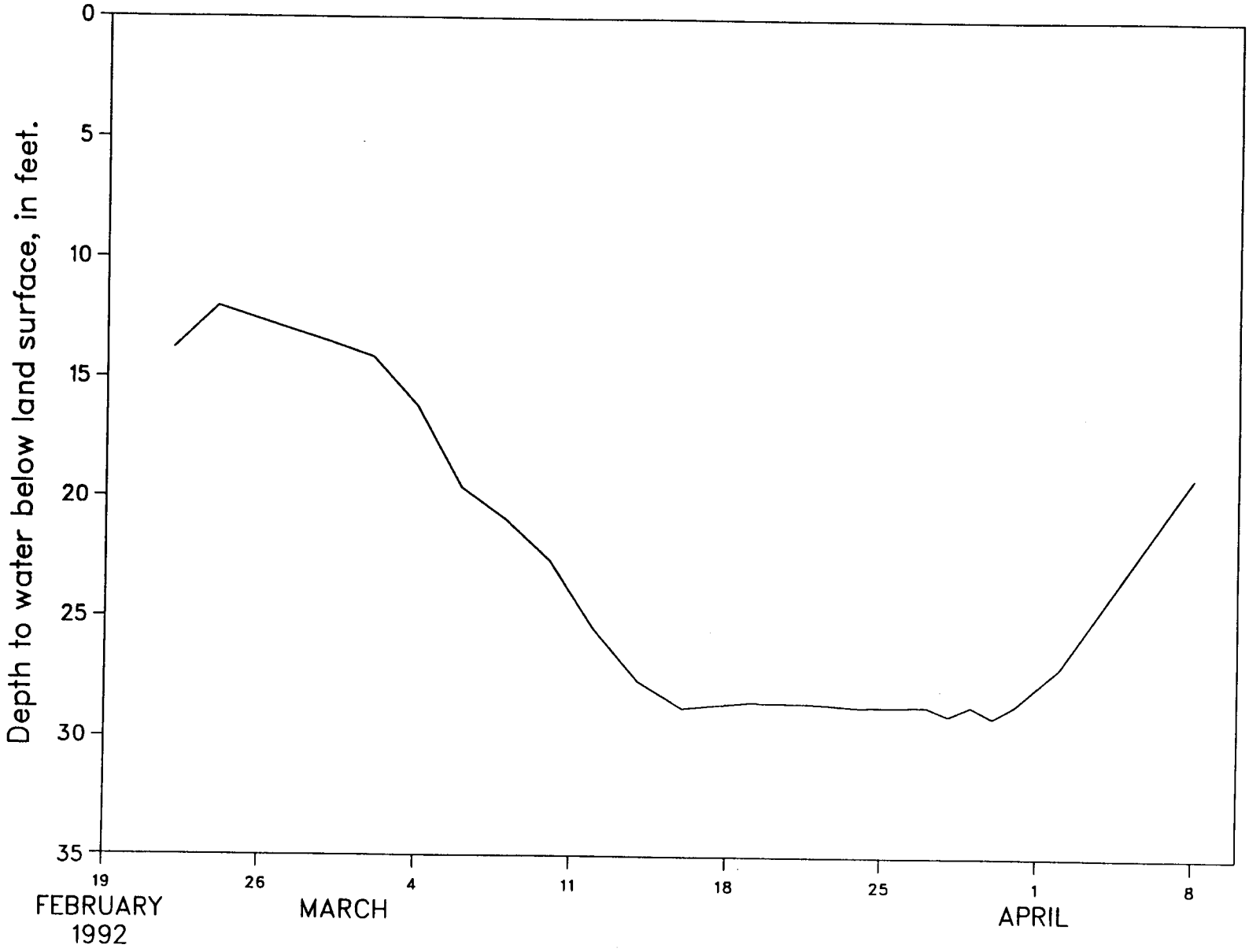

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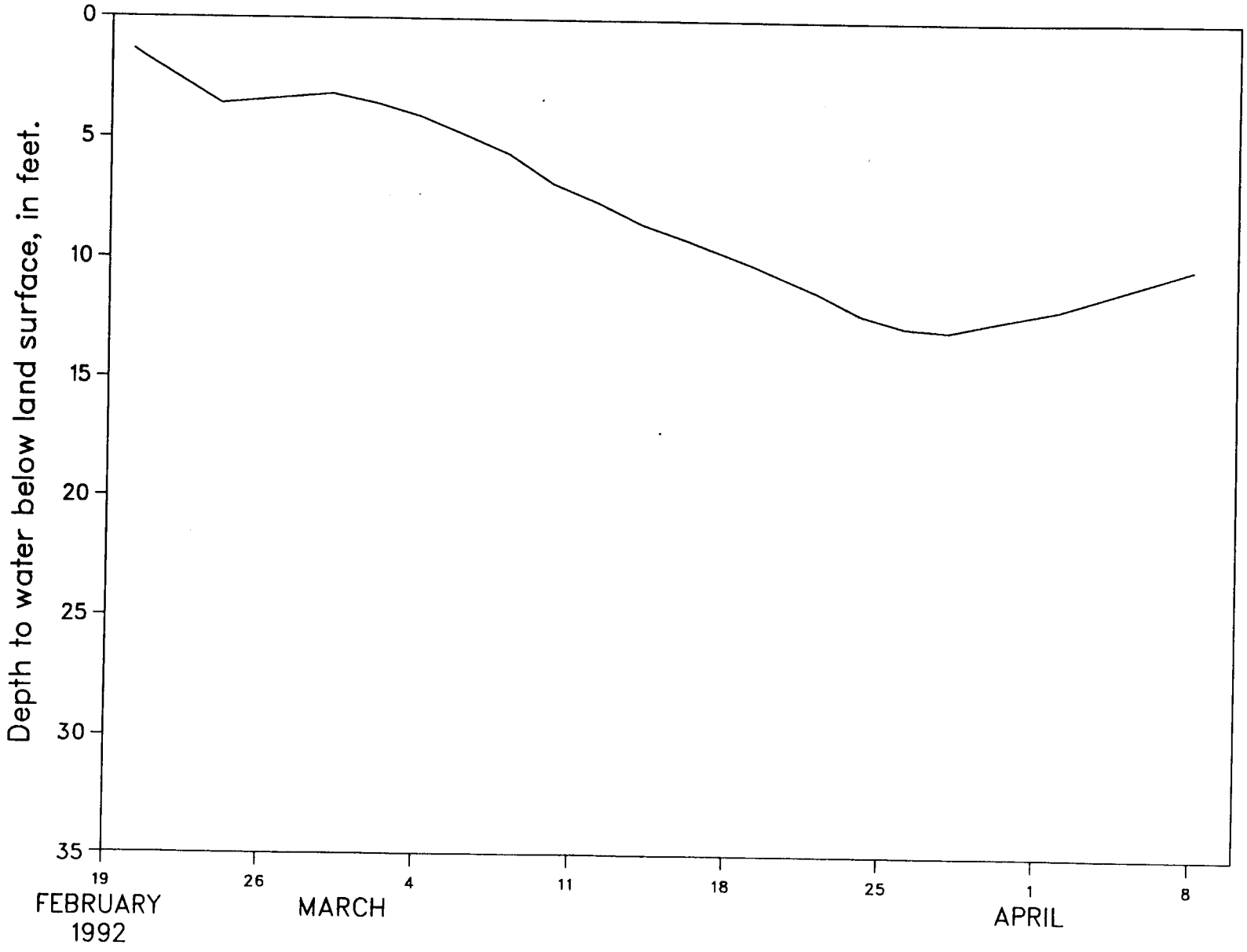

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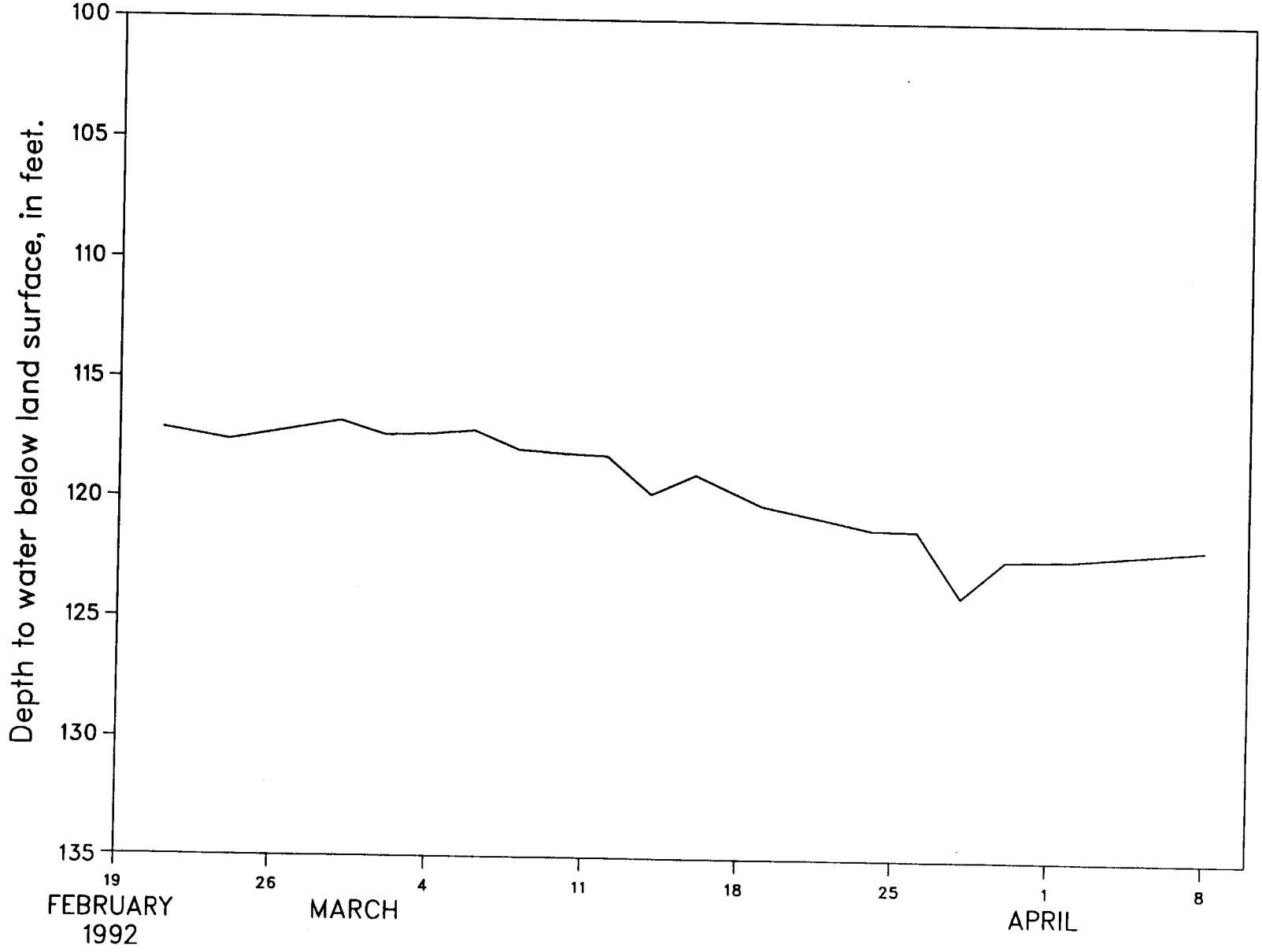

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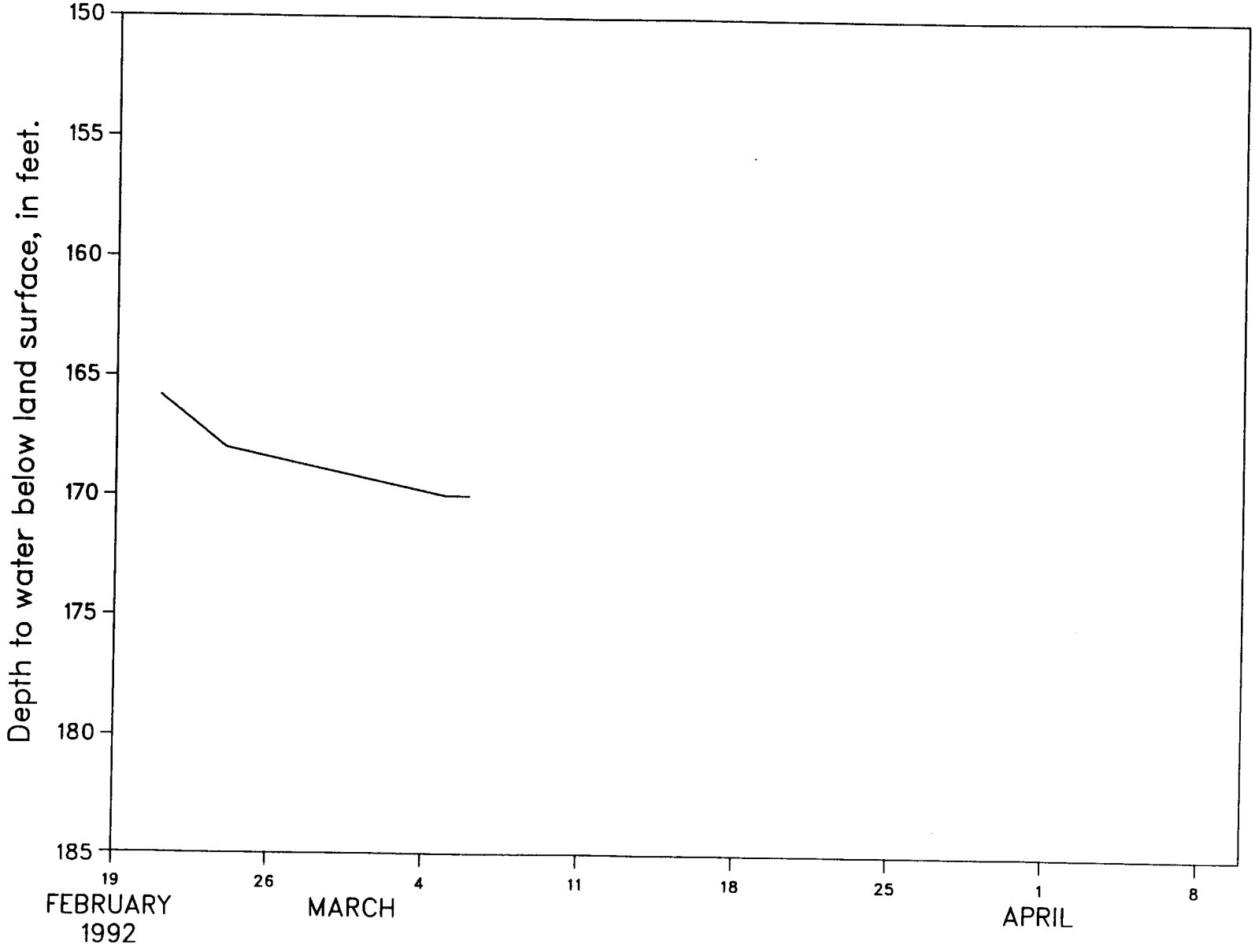

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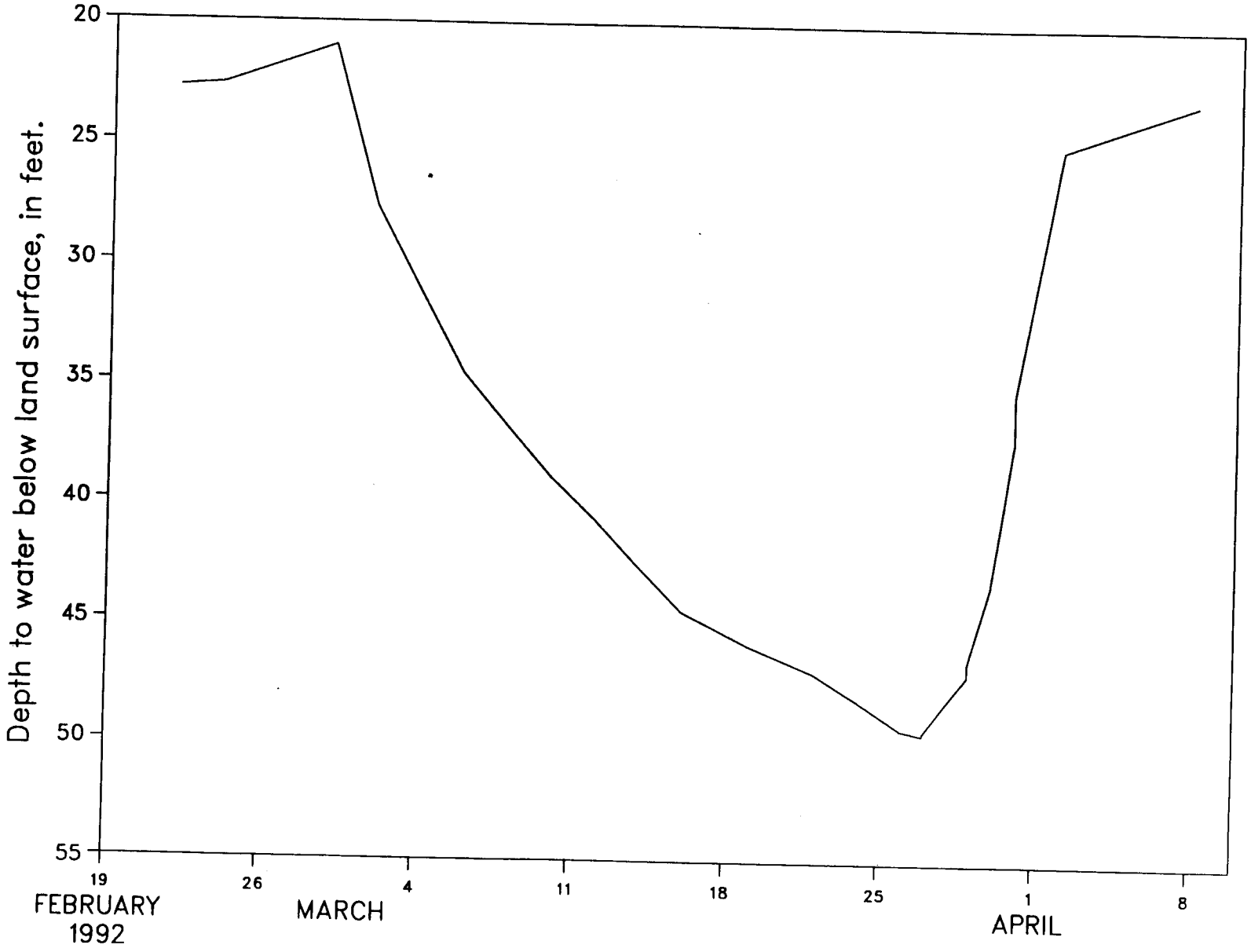

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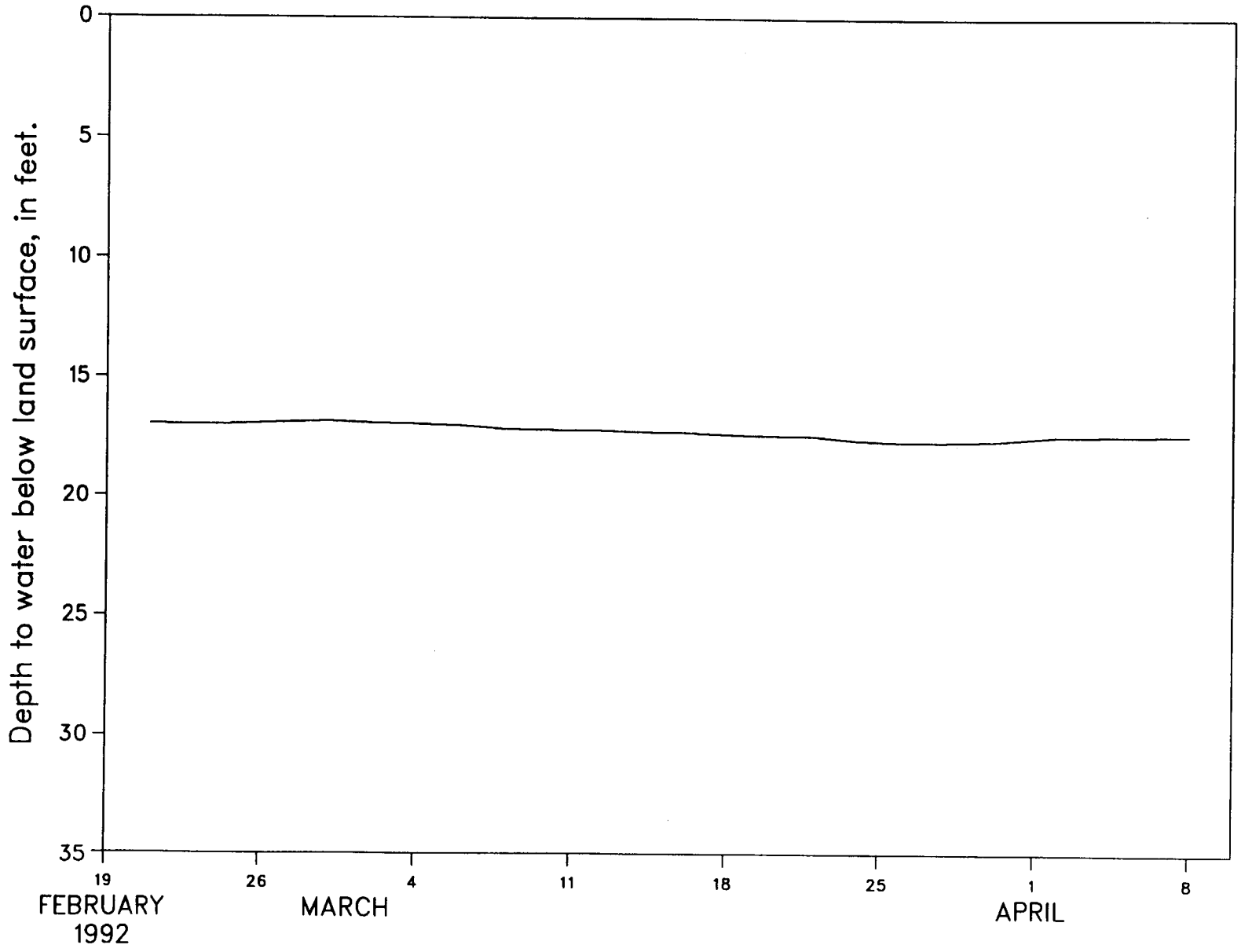

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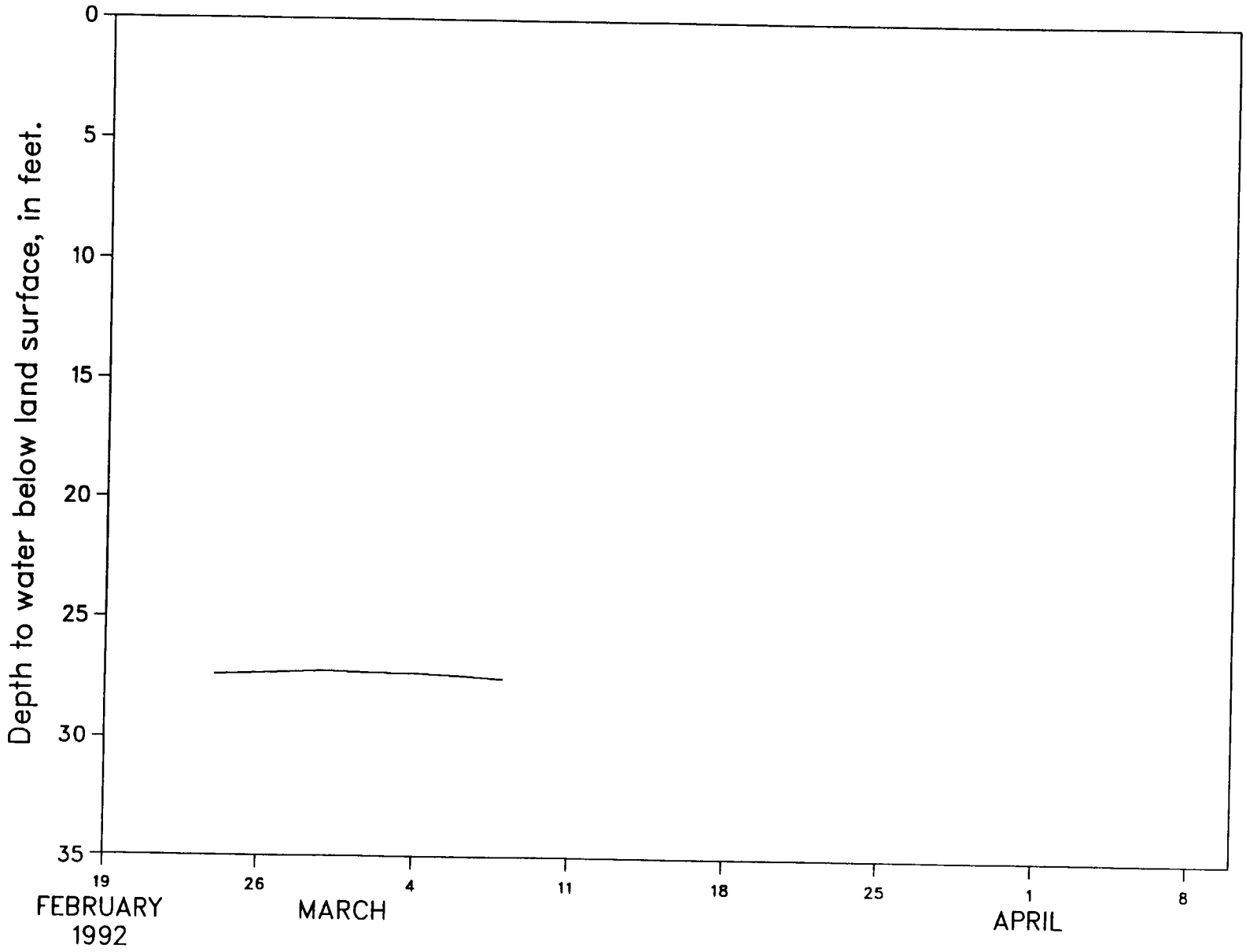

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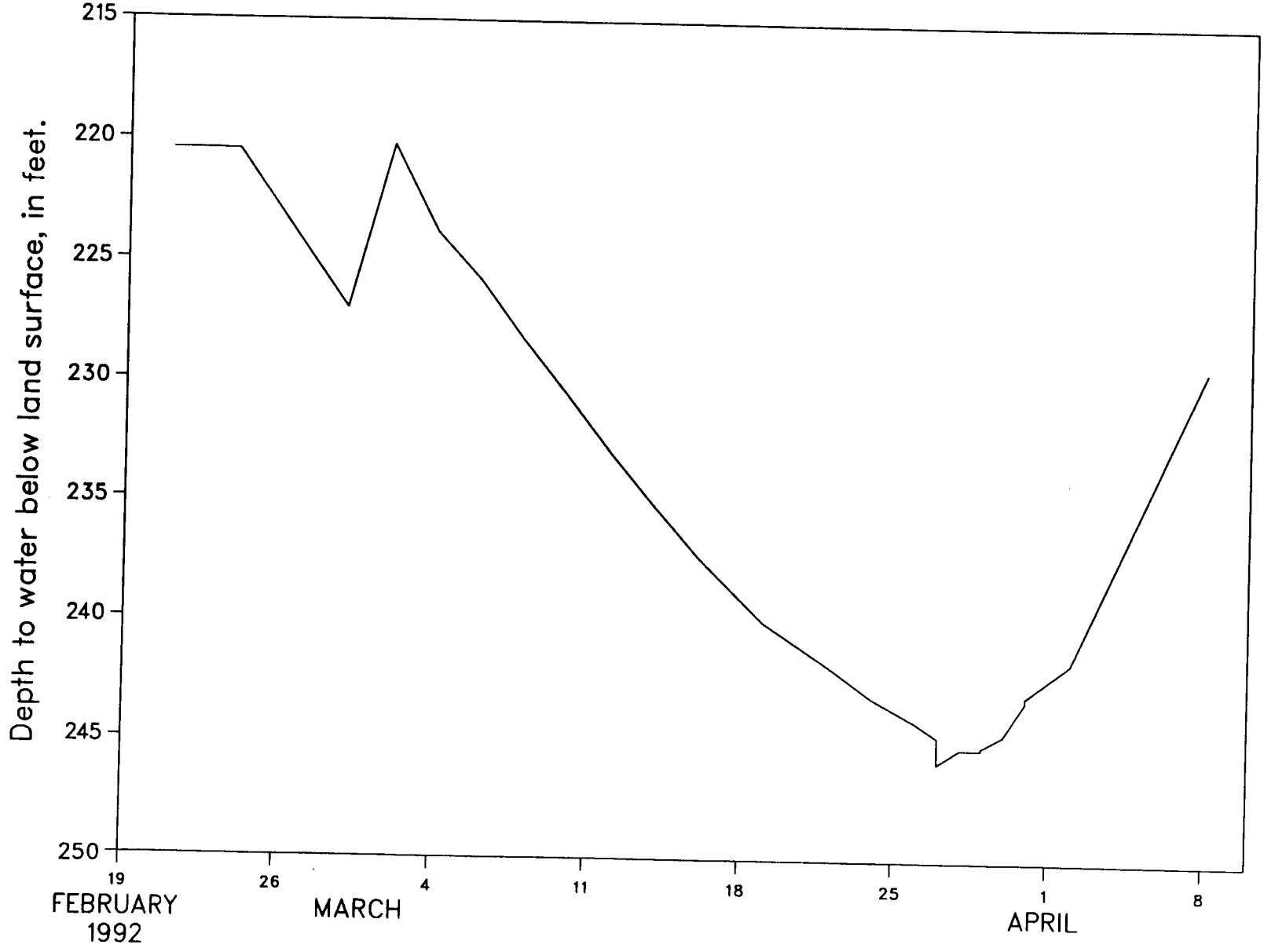

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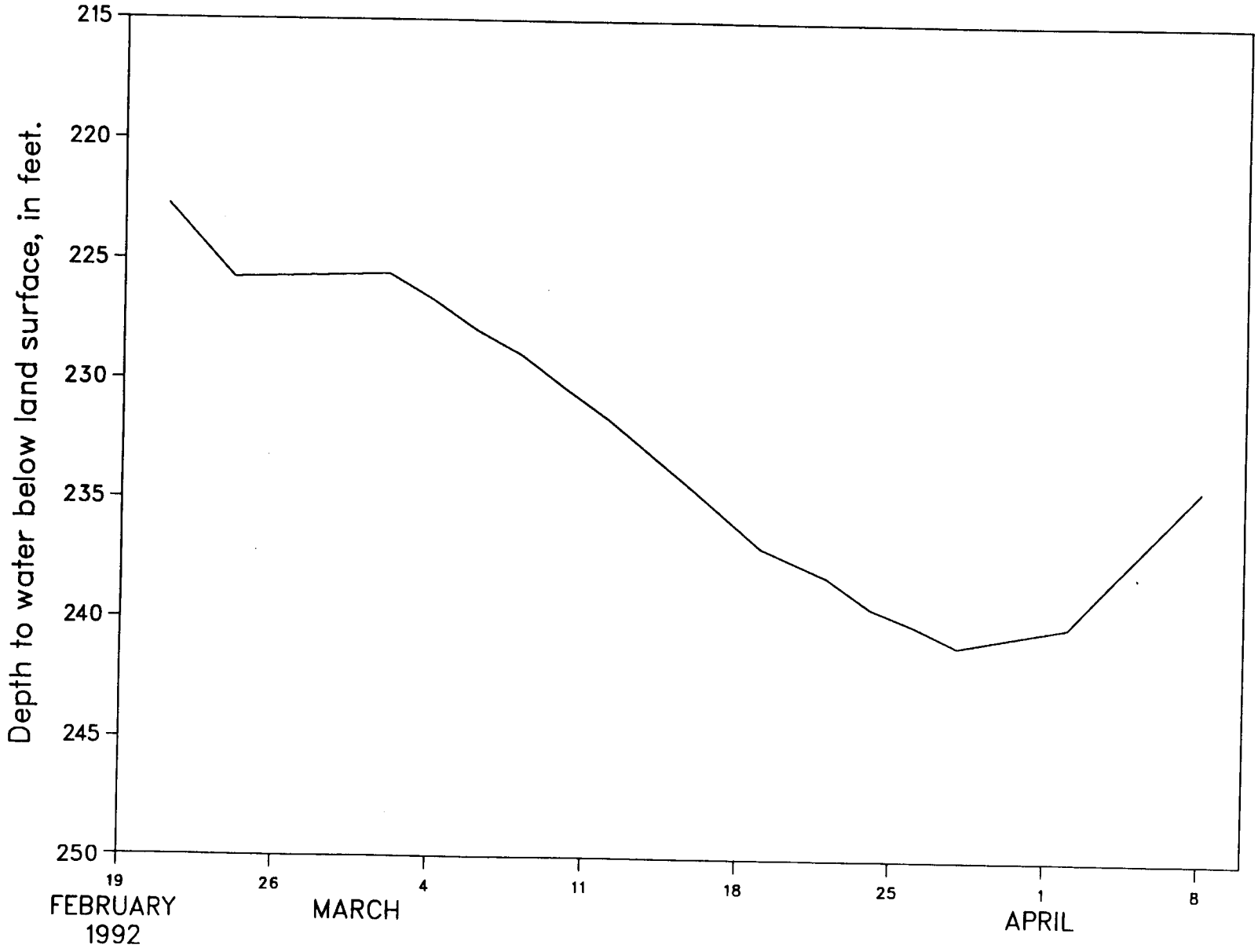

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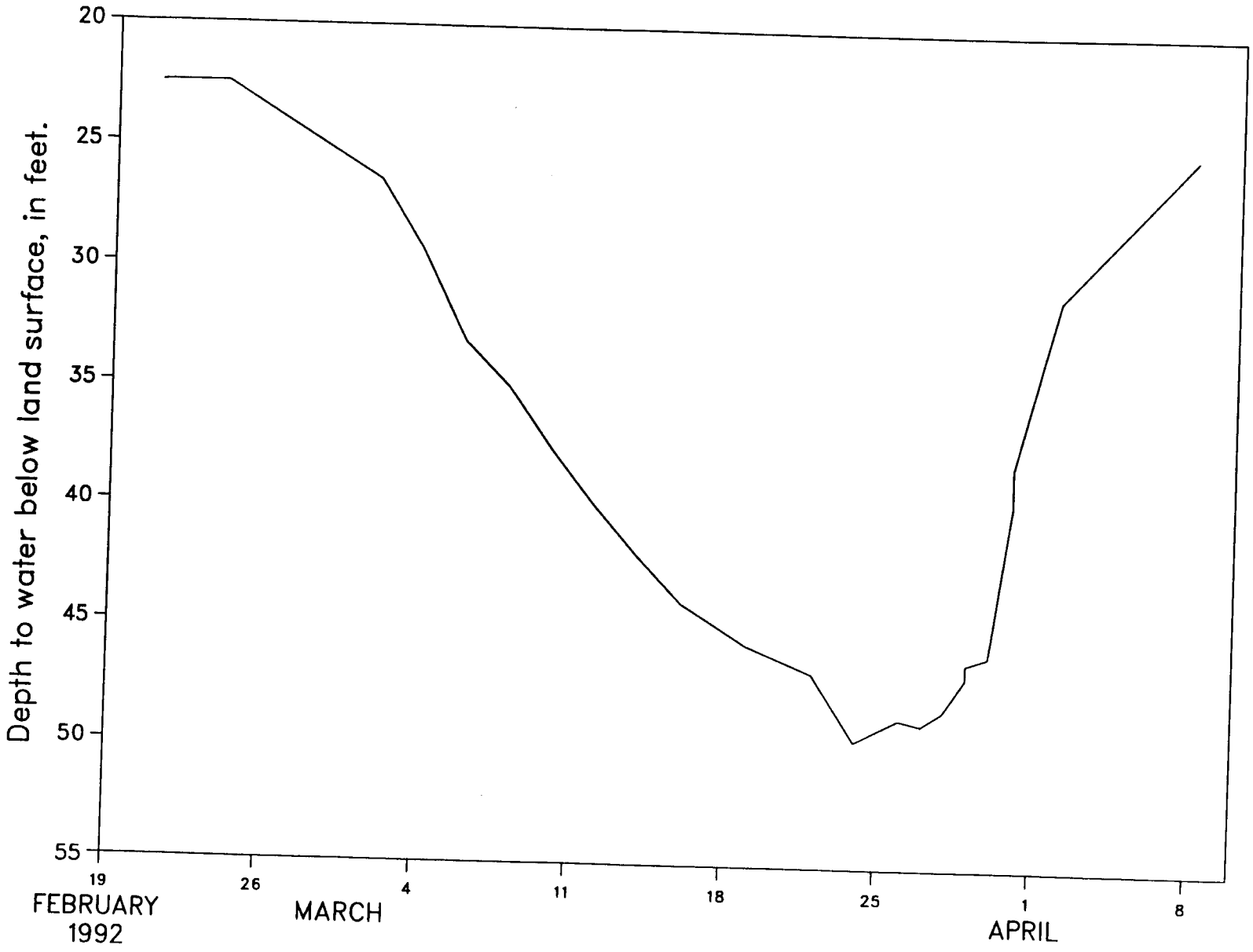

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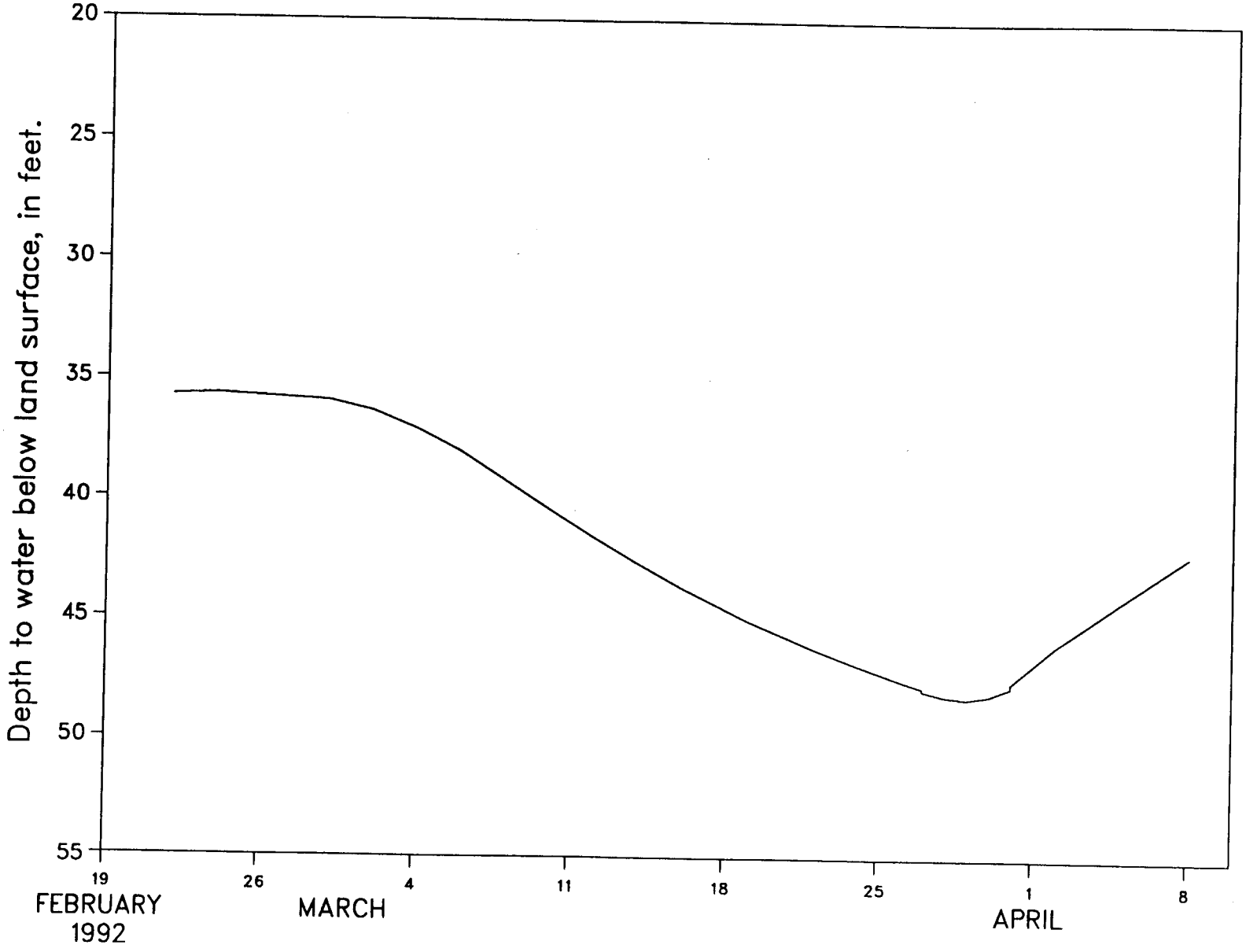

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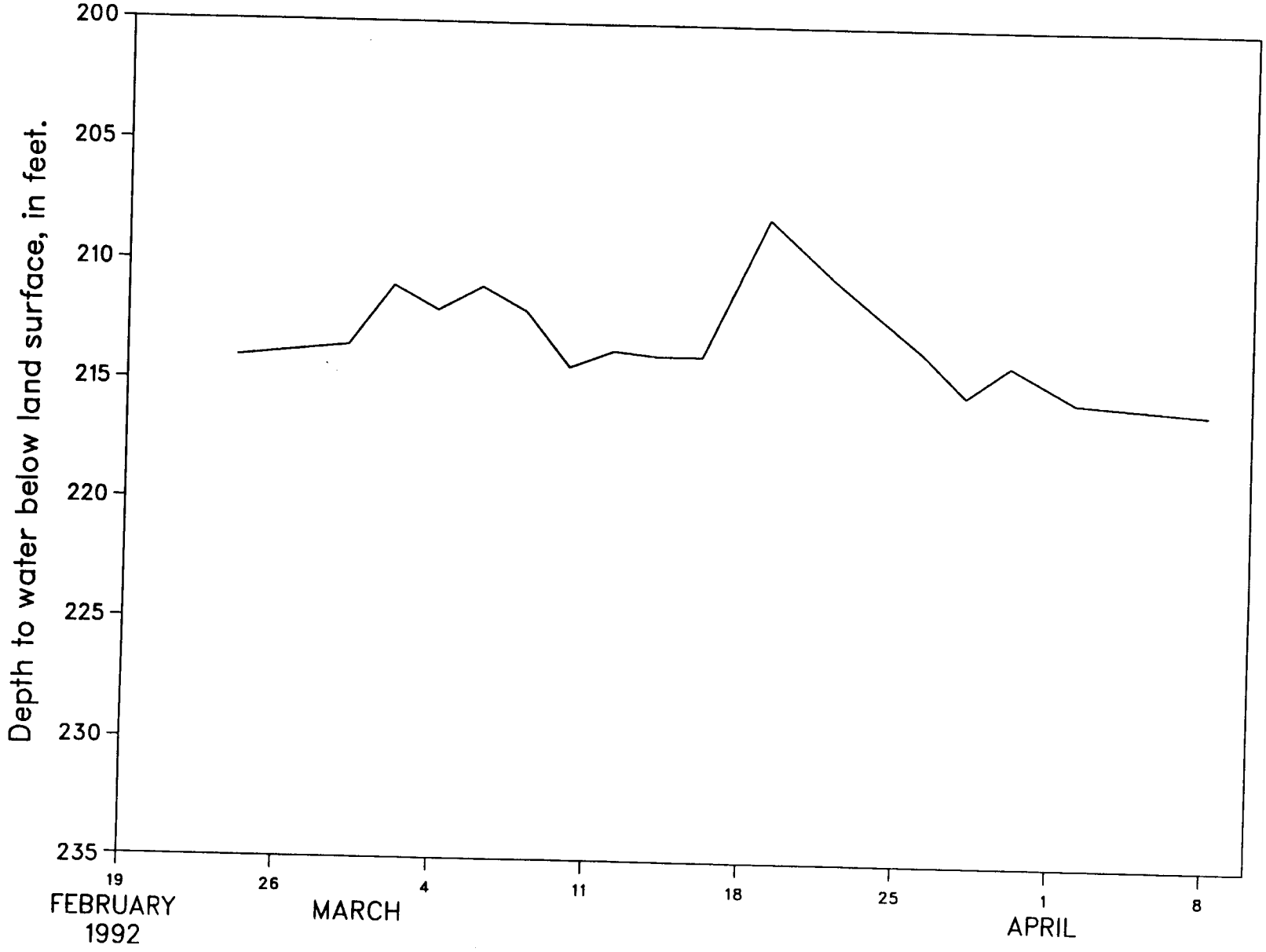

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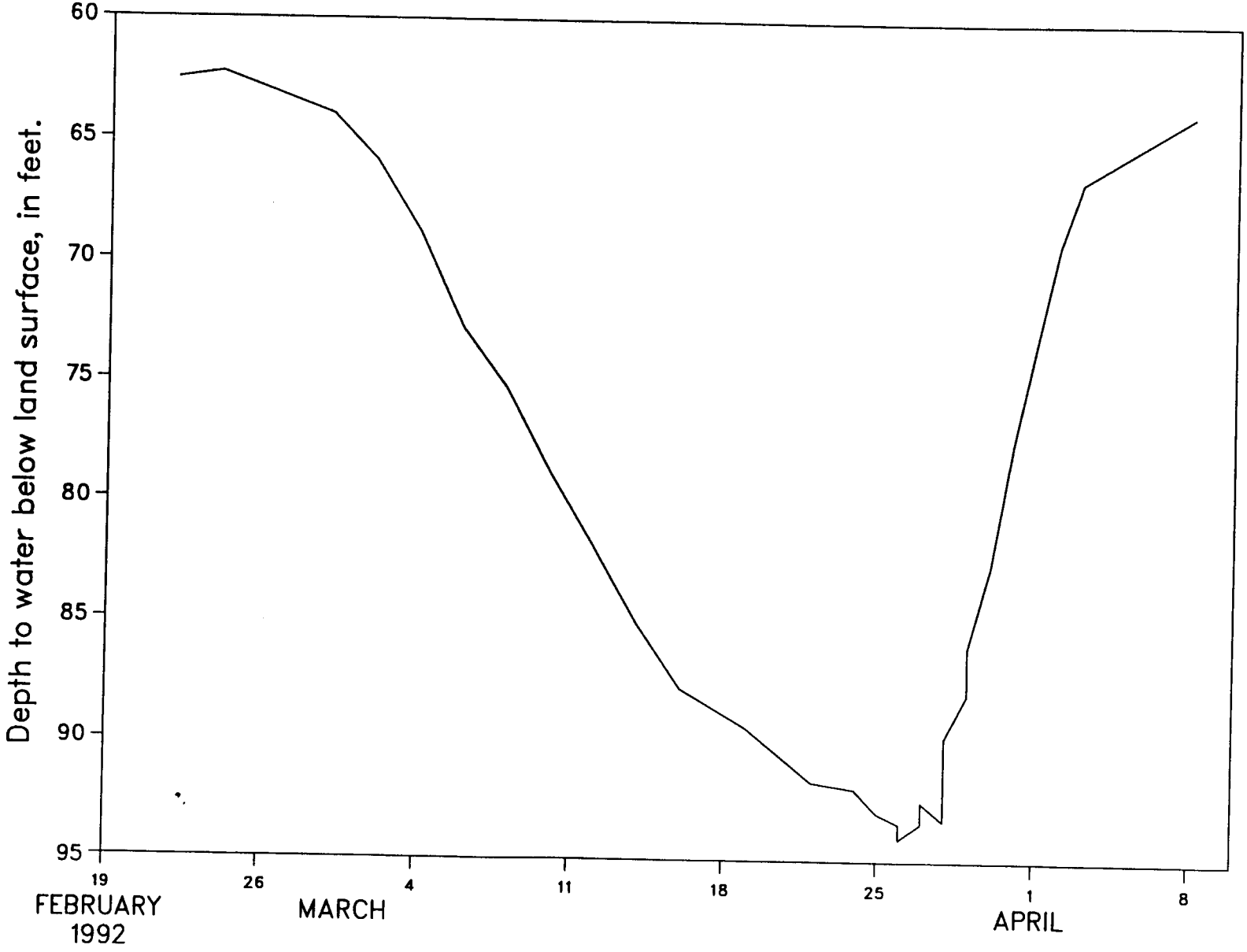

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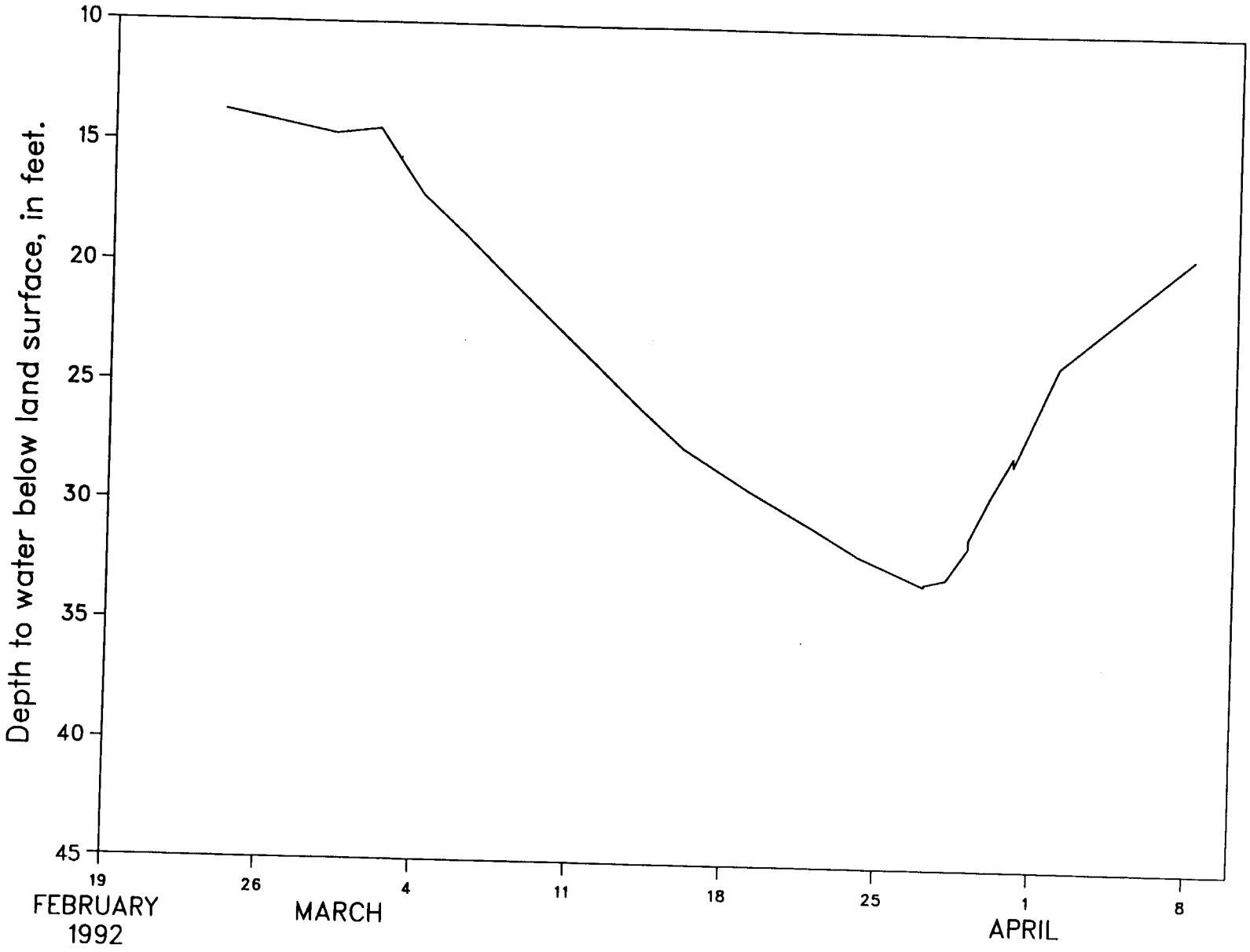
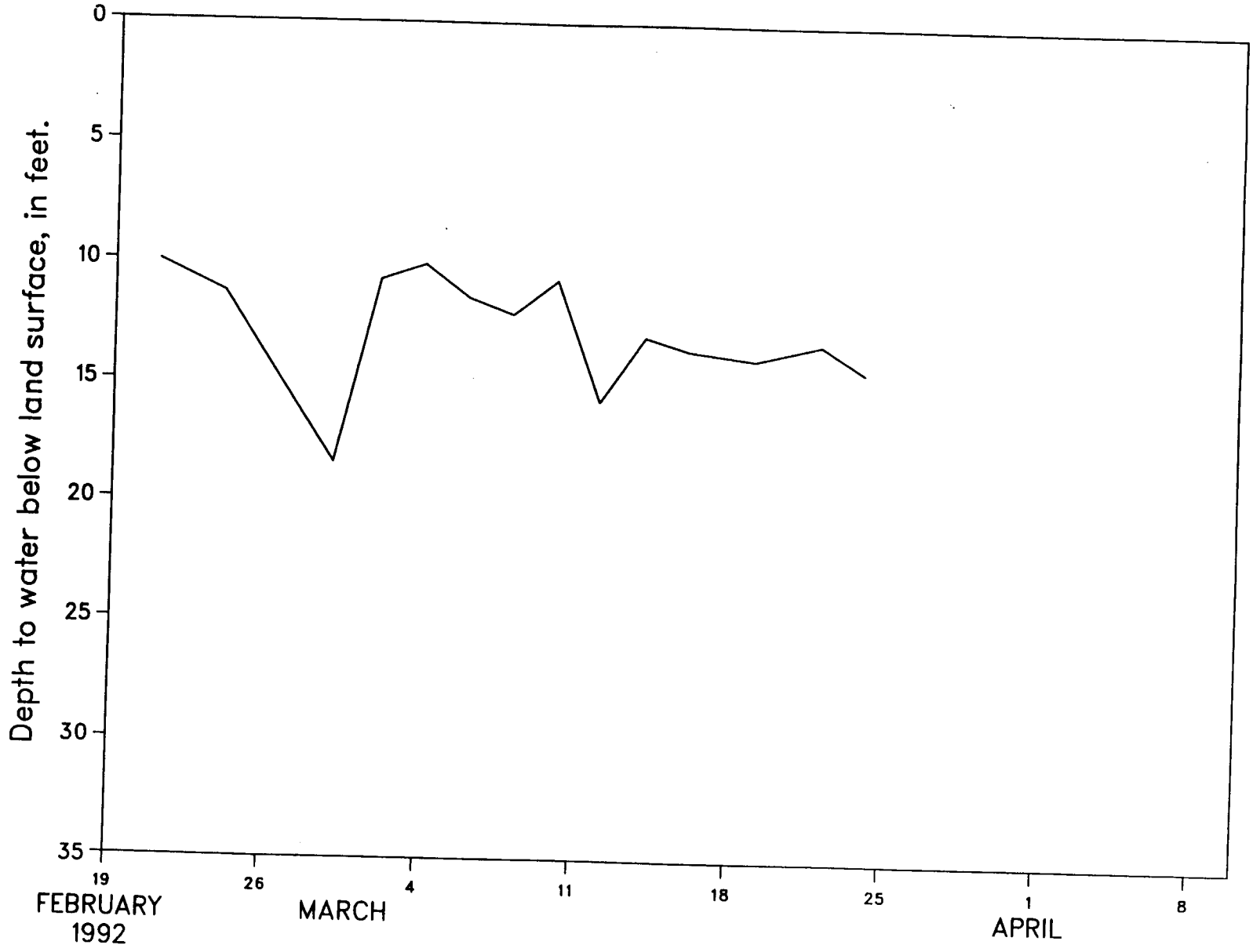
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