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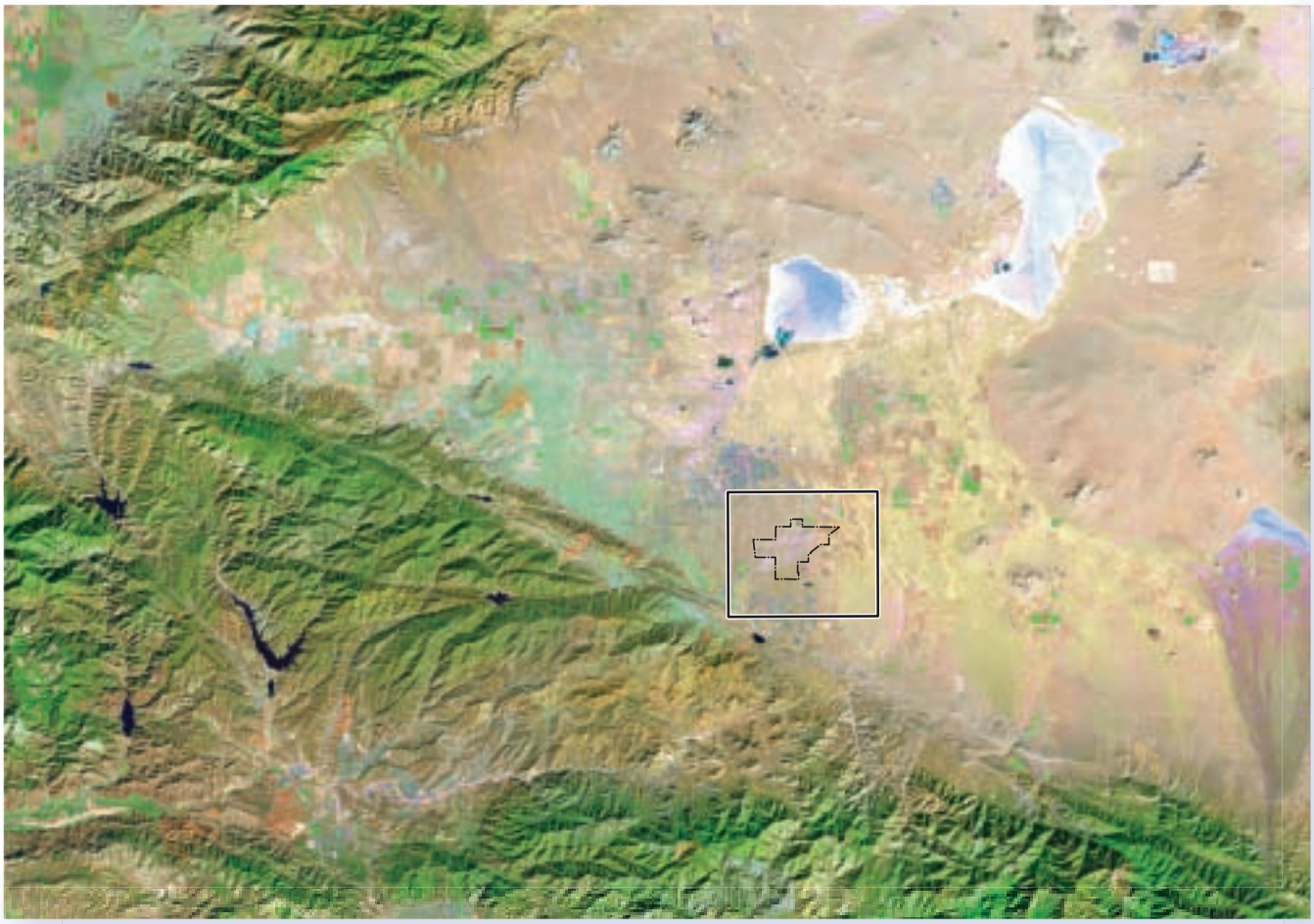

Scientific Investigations Report 2005-5074

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

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by Michael J. Rymer,
USGS, Geologic Division

Generalized Water-Level Contours, September–October 2000 and March–April 2001, and Long-Term Water-Level Changes, at the U.S. Air Force Plant 42 and Vicinity, Palmdale, California

By Allen H. Christensen

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U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
Gale A. Norton, Secretary

U.S. Geological Survey
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Conversion Factors and Vertical Datum

Conversion Factors

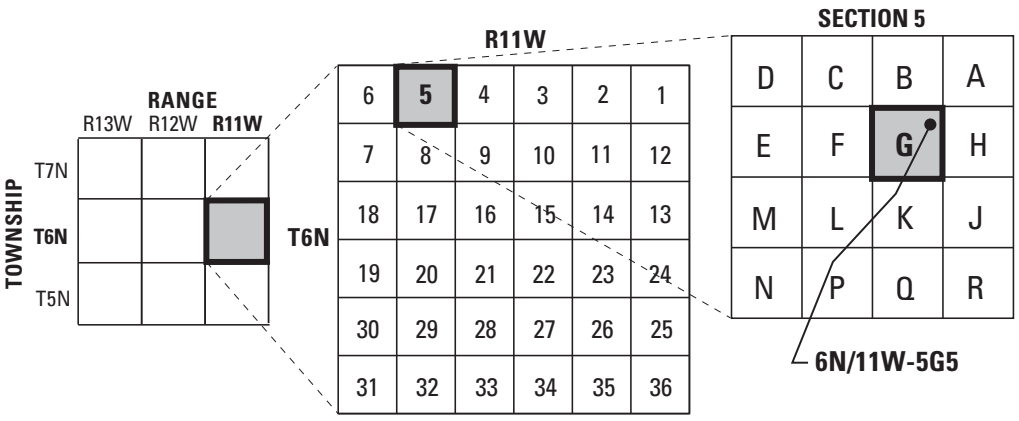
Multiply	By	To obtain
inch (in.)	2.54	centimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square miles (mi^2)	2.590	square kilometers

Vertical Datum

Sea level: In this report “sea level” refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929) a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Altitude, as used in this report, refers to distance above or below sea level.

Well Numbering System



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Generalized Water-Level Contours, September–October 2000 and March–April 2001, and Long-Term Water-Level Changes, at the U.S. Air Force Plant 42 and Vicinity, Palmdale, California

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Abstract

Historically, the U.S. Air Force Plant 42 has relied on ground water as the primary source of water owing, in large part, to the scarcity of surface water in the region. Ground-water withdrawal for municipal, industrial, and agricultural use has affected ground-water levels at U.S. Air Force Plant 42, and vicinity. A study to document changes in ground-water gradients and to present historical water-level data was completed by the U.S. Geological Survey in cooperation with the U.S. Air Force. This report presents historical water-level data, hydrographs, and generalized seasonal water-level and water-level contours for September–October 2000 and March–April 2001. The collection and interpretation of ground-water data helps local water districts, military bases, and private citizens gain a better understanding of the ground-water flow systems, and consequently water availability.

During September–October 2000 and March–April 2001 the U.S. Geological Survey and other agencies made a total of 102 water-level measurements, 46 during September-October 2000 and 56 during March–April 2001. These data document recent conditions and, when compared with historical data, document changes in ground-water levels. Two water-level contour maps were drawn: the first depicts water-level conditions for September–October 2000 map and the second depicts water-level conditions for March–April 2001 map. In general, the water-level contour maps show water-level depressions formed as result of ground-water withdrawal. One hundred sixteen long-term hydrographs, using water-level data from 1915 through 2000, were constructed to show water-level trends in the area. The hydrographs indicate that water-level decline occurred throughout the study area, with the greatest declines south of U.S. Air Force Plant 42.

Introduction

Historically, the U.S. Air Force Plant 42 (Plant 42) has relied on ground water as the primary source of water owing,in large part, to the scarcity of surface water in the region. Since 1972, supplemental surface water has been imported from the California State Water Project to help meet the demand for water. Despite the importation of surface water, ground-water withdrawal for municipal, industrial, and agricultural use has resulted in ground-water-level declines at Plant 42 and vicinity as large as 200 ft since the early 1900s. Localized heavy ground-water withdrawal has caused several ground-water depressions whose shape and magnitude can change with seasonal variation in ground-water withdrawal. To better understand the effects of ground-water withdrawal on ground-water levels and movement in the area, the U.S. Geological Survey (USGS), in cooperation with the U.S. Air Force, collected data from approximately 100 wells located within about 2 mi from Plant 42 and used these data to construct two generalized water-level-contour maps of the aquifer system underlying Plant 42 and the surrounding area. This report also presents hydrographs, water-quality data, and other related well information for selected wells at Plant 42 and vicinity via the USGS National Water Information System Web site (NWISWeb). The well identifiers plotted on *plates 1* and *2* are linked to hydrographs contained in this document. Located at the bottom of each hydrograph is a link to the California NWISWeb home page for the well. For further information regarding California NWISWeb go to *http://waterdata.usgs.gov/ca/nwis/*

Acknowledgments

The author thanks the personnel of the U.S. Air Force, various defense contractors, Los Angeles Department of Airports, Palmdale Water District, and Los Angeles County Sanitation District, who provided water-level data and access to their wells for this study.

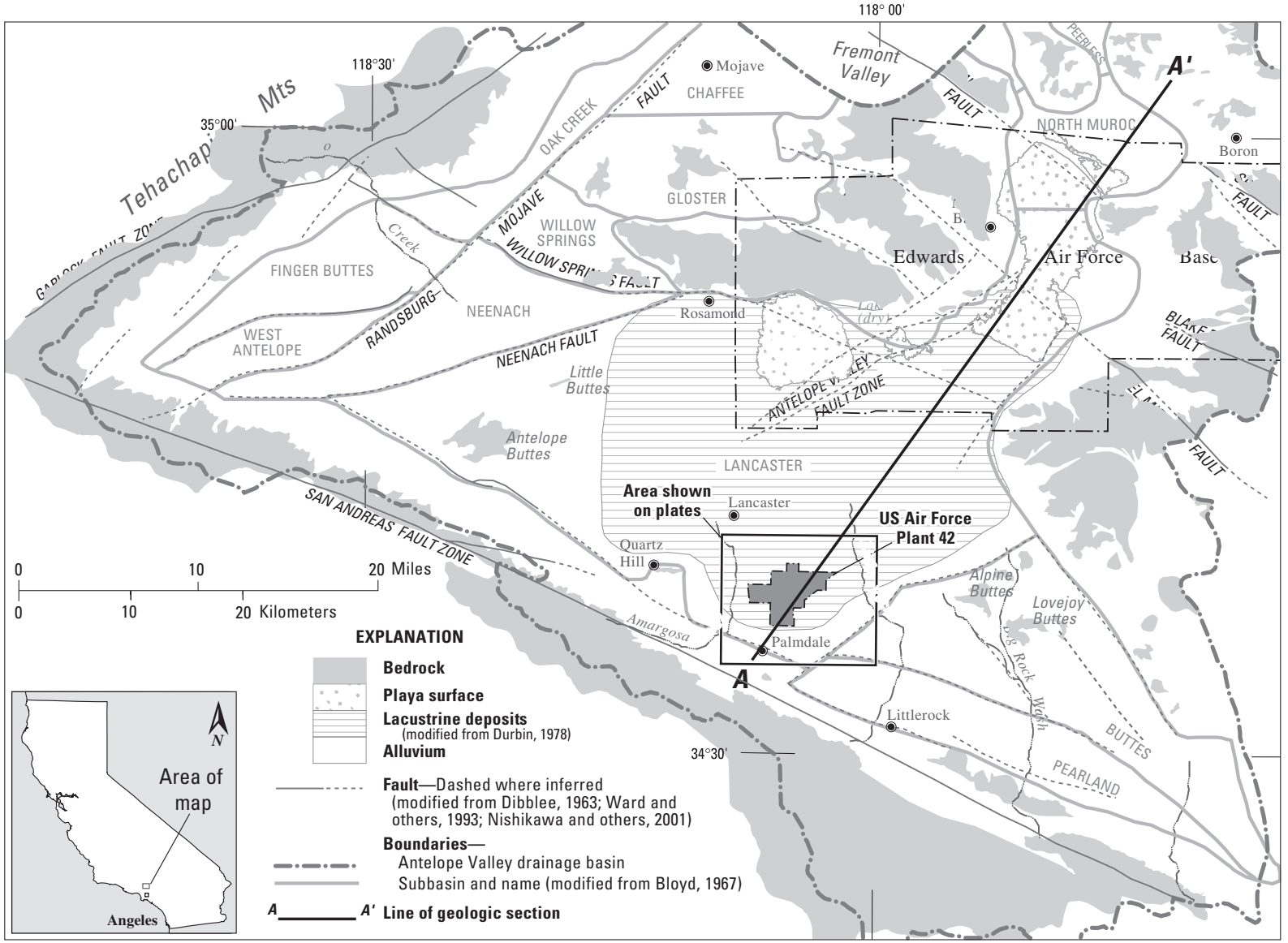
Description of Study Area

Plant 42 is located in the south-central part of Antelope Valley about 50 mi north of the city of Los Angeles (*fig. 1*). Antelope Valley is a closed topographic basin in the western part of the Mojave Desert. Plant 42 is about 1.5 mi northeast of Palmdale and 3 mi southeast of Lancaster in Los Angeles County, California (*fig. 1*). The study area shown on plates 1 and 2 is about 55 mi^2, and extends from just west of 10th Street West, eastward to 70th Street East (about 8 mi) and from Avenue K on the north to Avenue R in Palmdale on the south (about 7 mi). The study area was designed to include wells with water-level data that were within about 2 mi of the Plant 42 boundary and north of the two unnamed faults located southwest and southeast of Plant 42 (*fig. 1*). The climate in the Plant 42 area is semiarid to arid with an average annual precipitation of approximately 8 to10 in. per year, most of which occurs in the winter months (Duell, 1987).

Geohydrology

The geohydrology of Antelope Valley and the Plant 42 area has been described in detail by previous investigators. The general geologic structure of Antelope Valley was defined by Mabey (1960) using gravity surveys. The surficial geology of the valley was mapped and described by Hewett (1954) and Dibblee (1959, 1960, 1981). Additional studies on the ground-water resource in Antelope Valley and the Plant 42 area are documented in reports by Thayer (1946), Dutcher and Worts (1963), Koehler (1966), Carlson and others (1998), and Leighton and Phillips (2003). The geohydrology of the south-central part of Antelope Valley is summarized in this report, but the reader is referred to the aforementioned reports for more a detailed geohydrologic description of Antelope Valley.

Antelope Valley was formed as a result of downfaulted basement/bedrock and sedimentary fill between the Garlock and the San Andreas Fault zones (*fig. 1*). The basement complex that underlies the sedimentary fill consists of pre-Cenozoic igneous and Tertiary sedimentary rocks (Hewett, 1954; Dibblee, 1963). The unconsolidated deposits of Pliocene to Holocene age that form the ground-water basin exceed 5,000 ft in thickness in places (Dutcher and Worts, 1963). The unconsolidated units were described by Leighton and Phillips (2003) as lacustrine or alluvial and are divided hydrostratigraphically into the upper, middle, and lower aquifers (*fig. 2*). The unconfined upper aquifer consists of unconsolidated Pleistocene to Holocene alluvial deposits derived from local mountains. The upper aquifer yields water readily to wells and is the main production aquifer in the vicinity of Plant 42. The middle and lower aquifers consist of older and deeper units of the unconsolidated alluvium of Pliocene and Pleistocene age that become increasingly compacted and indurated at depth, and thus yield less water to wells with increasing depth (Dutcher and Worts, 1963). The approximate areal distribution of the lacustrine deposits extends northward from north of Palmdale, west past Quartz Hill, east to the subbasin boundary, and north to Rosamond and Rogers Lake where the unit crops out (*fig. 1*). The lacustrine deposits are as much as 300 ft thick and consist of beds of brown and blue clays. The brown clays contain some sandy deposits and in places yield some water to wells, whereas, the blue clays yield little or no water to wells and were considered non-water bearing by Dutcher and Worts (1963). In the vicinity of Plant 42 the lacustrine deposits are deepest, with a maximum depth exceeding 800 ft, north of Palmdale (*fig. 2*). In the vicinity of Plant 42, the lacustrine deposits are generally reported in driller's logs as brown clays below 400 ft and blue clays below approximately 650 to750 ft (Koehler, 1966).



Modified from Phillips and Leighton, 2003

Figure 1. Location of faults, ground-water subbasins, line of geologic section, and approximate areal extent of lacustrine deposits in Antelope Valley ground-water basin, California.

Ground-Water Levels and Movement

Water-level data were collected from 46 wells during fall (September–October) 2000 and from 56 wells in spring (March–April) 2001. These data were used in combination with historical data to define a generalized water-level surface and the direction of ground-water movement in the study area for September–October 2000 (*plate 1*) and for March–April 2001 (*plate 2*). Water-level measurements from 46 wells were used to construct the fall water-level map: all 46 wells were known or were assumed to be perforated in the upper aquifer only or in combination with deeper aquifers; 16 wells were perforated in both the middle and upper aquifers; and, one well, on the basis of its 1,200 ft total depth, was assumed to be perforated in all three aquifers. Included in the 46 wells counted as perforated in the upper aquifer were four wells without information regarding perforated interval or total depth. Water-level measurements from 56 wells were used to construct the spring water-level map: all 56 wells were known or were assumed to be perforated in the upper aquifer only or in combination with deeper aquifers; 14 wells were perforated in both the middle and upper aquifers; and, two wells were perforated into the upper, middle, and lower aquifers. Of these two wells, one had known perforation information, the other was assumed to be perforated in all three aquifers on the basis of its 1,200 ft total depth. Included in the 56 wells counted as perforated in the upper aquifer were eight wells without information regarding perforated interval or total depth. Geologic data do not indicate the presence of a confining layer between the upper and middle aquifers; therefore, it is assumed that at a given location water levels in the middle and upper aquifers are similar. Most water-level measurements were made by the USGS with calibrated steel or electric tapes, and some water levels were reported by local water agencies. Water-level altitudes were calculated by subtracting the measured depth to water from the land-surface datum (determined from a leveling survey or estimated from topographic maps).

The values and locations of the water-level contours were estimated by linearly interpolating water-level data for the time period represented by each map. Where data were unavailable, the general contour shape and position were determined from previous local and regional water-table maps (Carlson and Phillips, 1998; Carlson and others, 1998; Christensen, 1999) and the contours are dashed to indicate uncertainty. For selected wells, a hydrograph of historical water-level data (1915 to 2001) is presented (wells shown on maps as blue circles on *plates 1* and *2*). Data used to construct each hydrograph can be obtained by using the link located at bottom of each hydrograph.

Ground-water flow is from areas of higher water-level altitude to areas of lower water-level altitude and is perpendicular (see arrows shown on *plates 1* and *2*) to lines of equal water-level altitude (contours) shown on the water-level maps (*plates 1* and *2*). In September–October 2000 and March–April 2001, water-level depressions were located (1) south of Plant 42, (2) near the northern boundary of Plant 42, and (3) northwest of Plant 42, and were formed as a result of ground-water withdrawal (*plates 1* and *2*). Ground water flows toward these water-level depressions, with ground-water divides forming between the depressions. In addition, the water-level altitudes of these depressions were as much as 30 ft lower in September-October following high summer demands for ground water in the area (*plates 1* and *2*).

The pattern of the water-level contours indicates that the unnamed faults in the study area are barriers to ground-water flow. For example, the water level is about 350 ft lower in well 6N/11W-19F1 than in well 6N/11W-31A1 (*plate 1*) on opposite sides of the unnamed northwest-trending fault just north of Palmdale. The barrier effect of faults probably is caused by compaction and deformation of water-bearing deposits immediately adjacent to the faults and by cementation of the fault zone by mineral deposits from ground water (Londquist and Martin, 1991).

Water-Level Changes

Historical water-level data were used in conjunction with data collected during this study to determine long-term water-level changes in the study area by constructing water-level hydrographs for selected wells. These long-term hydrographs indicate a general water-level decline within the study area, with the greatest decline occurring from the late 1950s to the mid 1970s; however, some wells in the study area show a slight rise in water levels after the late 1970s. The greatest declines, in excess of 200 ft, were in wells located south of Plant 42 (wells 6N/11W-19E2 and 6N/11W-20G2). The water levels in hydrographs from wells located east of about 40th Street East also declined until the late 1970s when the general trend of decline reversed to a general rise in water levels (wells 6N/11W-11M1 and 7N/11W-27Q1). A possible explanation for this general rise in water levels may be the increase in precipitation within the Little Rock Wash watershed during the late 1970s and/or a regional reduction in ground-water withdrawal that began in the mid-1960s (National Climatic Data Center, 2003; Leighton and Phillips, 2003).

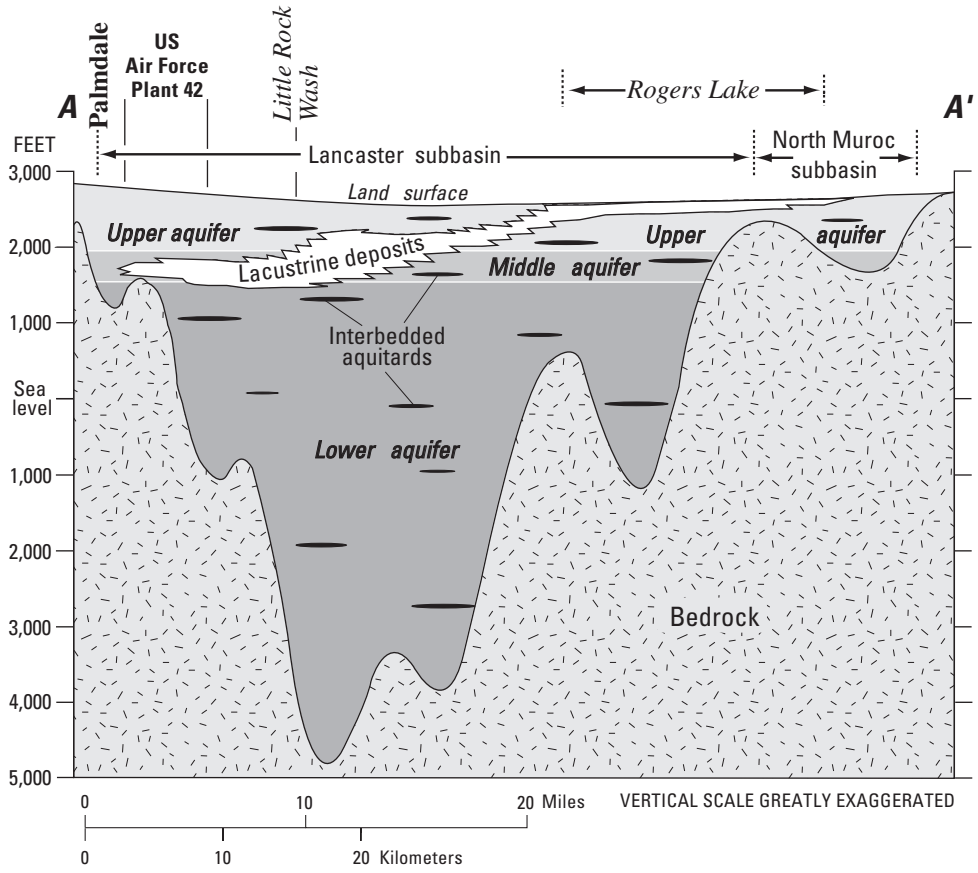


Figure 2. Generalized geologic section showing relation of lacustrine deposits to aquifers in the Lancaster subbasin in the Antelope Valley ground-water basin, California (modified from Londquist and others, 1993). Line of section is shown on figure 1.

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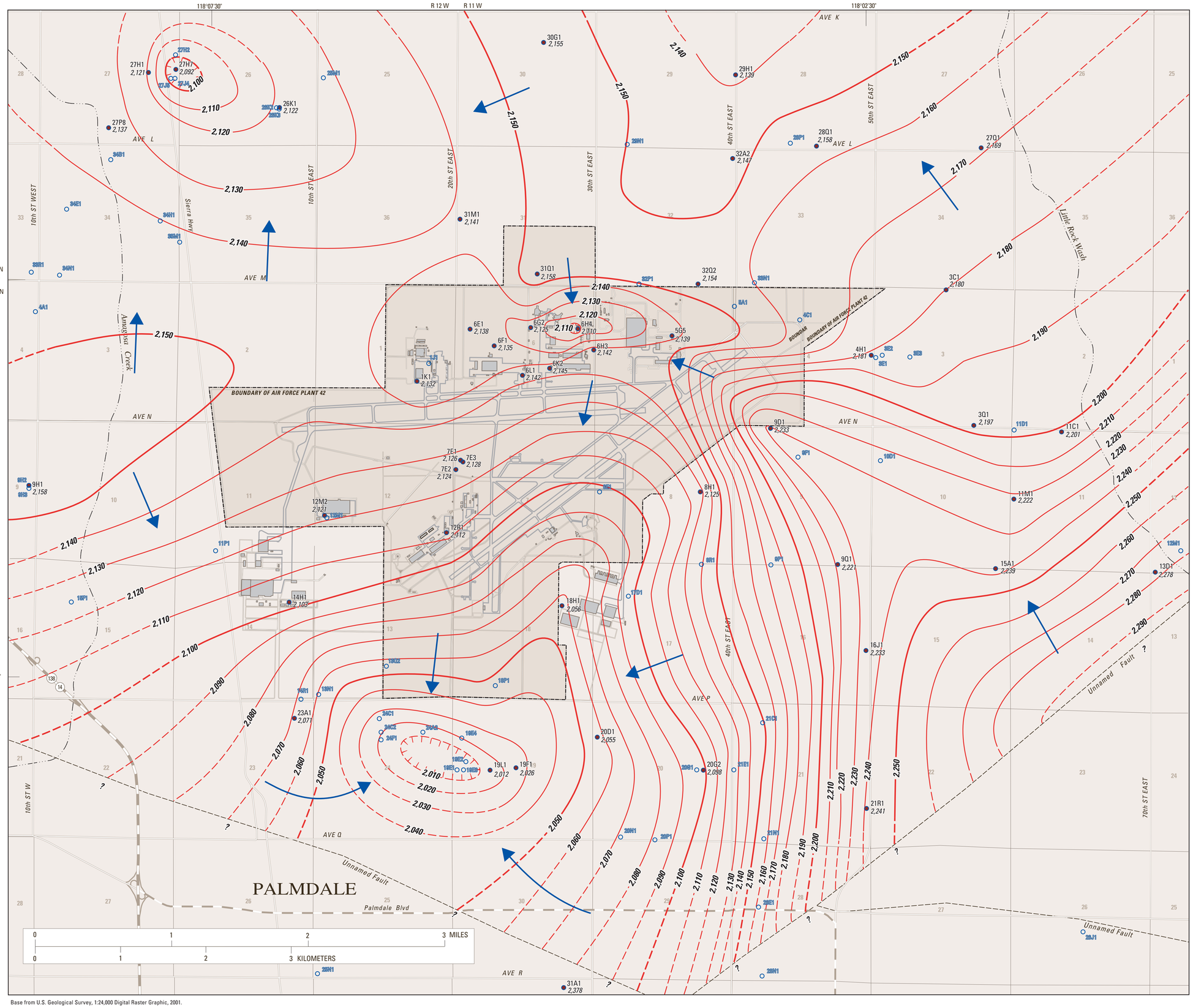
SCIENTIFIC INVESTIGATIONS REPORT 2005–5074
Generalized water-level, September–October, 2000, at U.S. Air Force Plant 42—**PLATE 1 OF 2**

Christensen, A.H., 2004, Generalized water-level and long-term water-level changes, September-October 2000 and March-April 2001, at the U.S. Air Force Plant 42 and vicinity, Palmdale, California



EXPLANATION

3C1 2,185 — **Well with September–October water-level altitude and hydrograph data—** Number in italics is water-level altitude, in feet above NAVD88

3E2 — **Well with historical data and hydrograph data**

2,190 — **Water-level contour—** Shows generalized water-level altitude, in feet above NAVD88

2,200 — Dashed where approximately located. Hachures indicate depression. Contour interval is 10 feet

Direction of ground-water movement

Fault—Dashed where approximately located

Vertical Datum
Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88); horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

Conversion Factors

Multiply	By	To obtain
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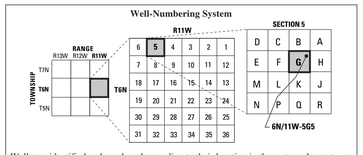

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Base from U.S. Geological Survey, 1:24,000 Digital Raster Graphic, 2001.

GENERALIZED WATER-LEVEL MAP, SEPTEMBER-OCTOBER 2000, AT THE U.S. AIR FORCE PLANT 42 AND VICINITY, PALMDALE, CALIFORNIA

By Allen H. Christensen

2004

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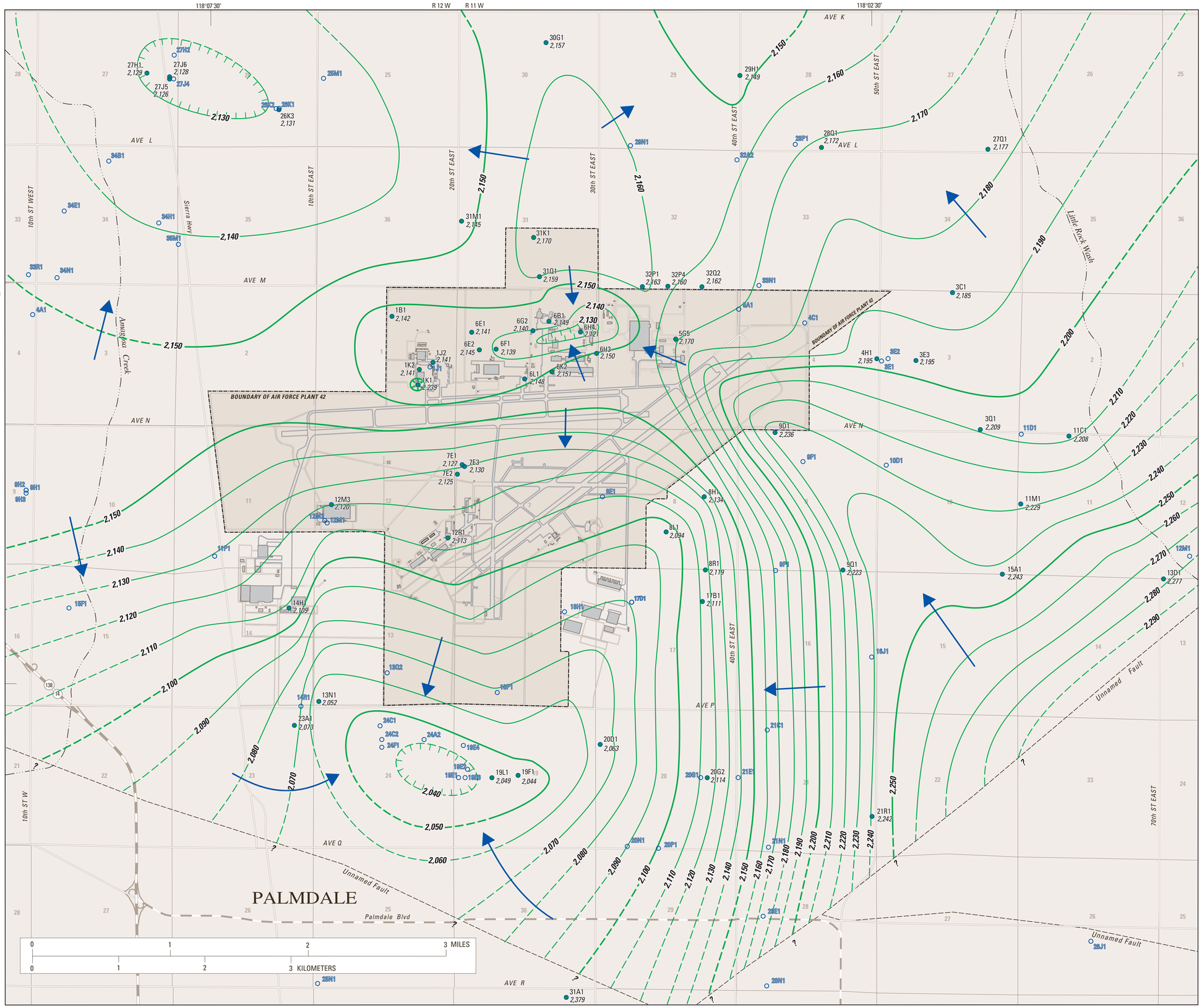
SCIENTIFIC INVESTIGATIONS REPORT 2005–5074

Generalized water-level, September–October, 2000, at U.S. Air Force Plant 42—**PLATE 2 OF 2**

Christensen, A.H., 2004, Generalized water-level and long-term water-level changes, September-October 2000 and March-April 2001, at the U.S. Air Force Plant 42 and vicinity, Palmdale, California



Base from U.S. Geological Survey, 1:24,000 Digital Raster Graphic, 2001.

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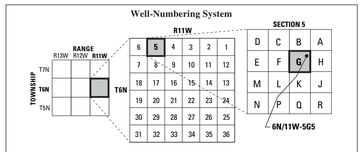

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GENERALIZED WATER-LEVEL, MARCH-APRIL 2001, AT THE U.S. AIR FORCE PLANT 42 AND VICINITY, PALMDALE, CALIFORNIA

By Allen H. Christensen

2004

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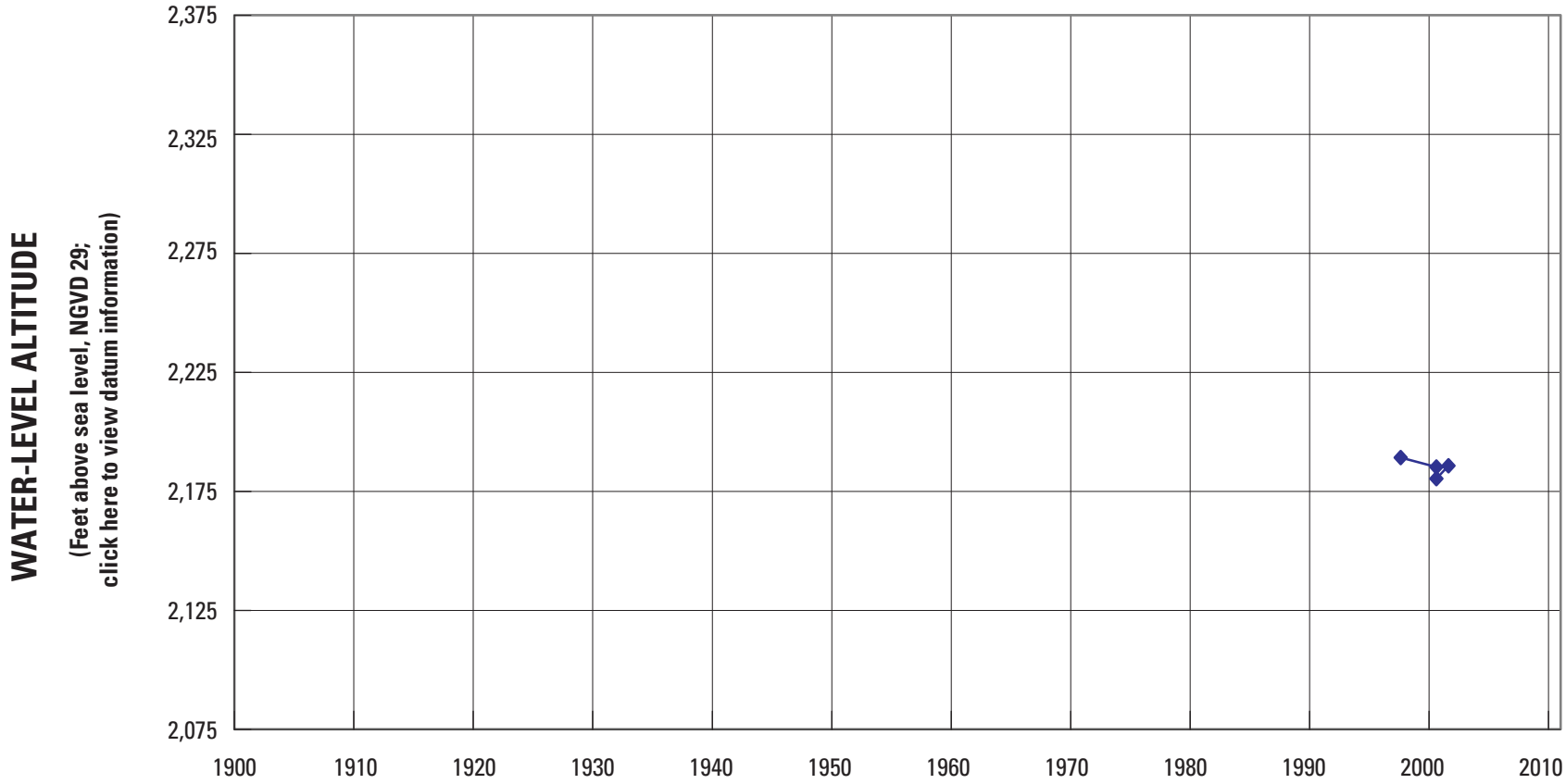
HYDROGRAPHS

006N011W03C001S

(Click here to view well location)

Fall, 2000 Spring, 2001



(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

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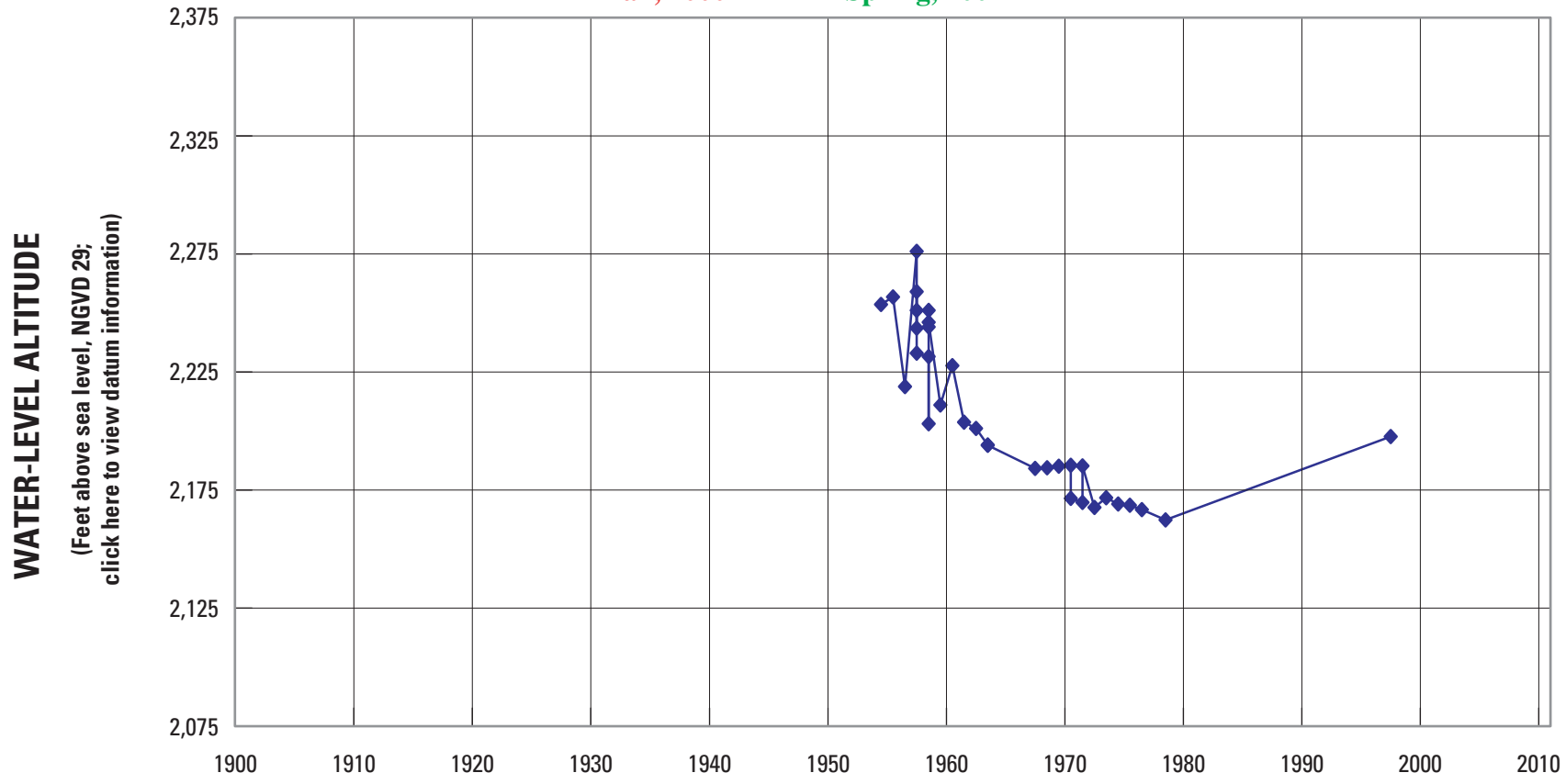
(Click here to view well location)

Fall, 2000 Spring, 2001



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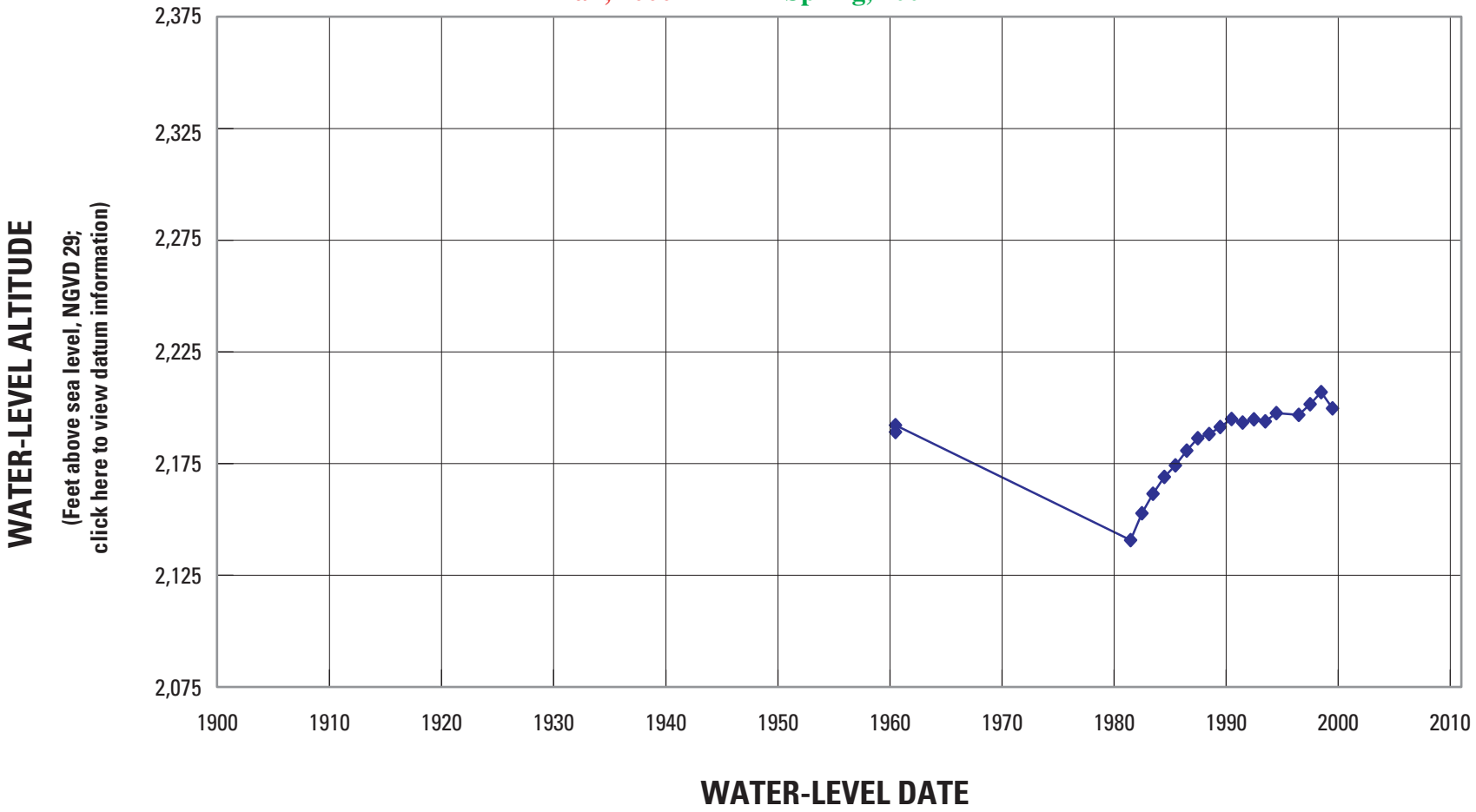

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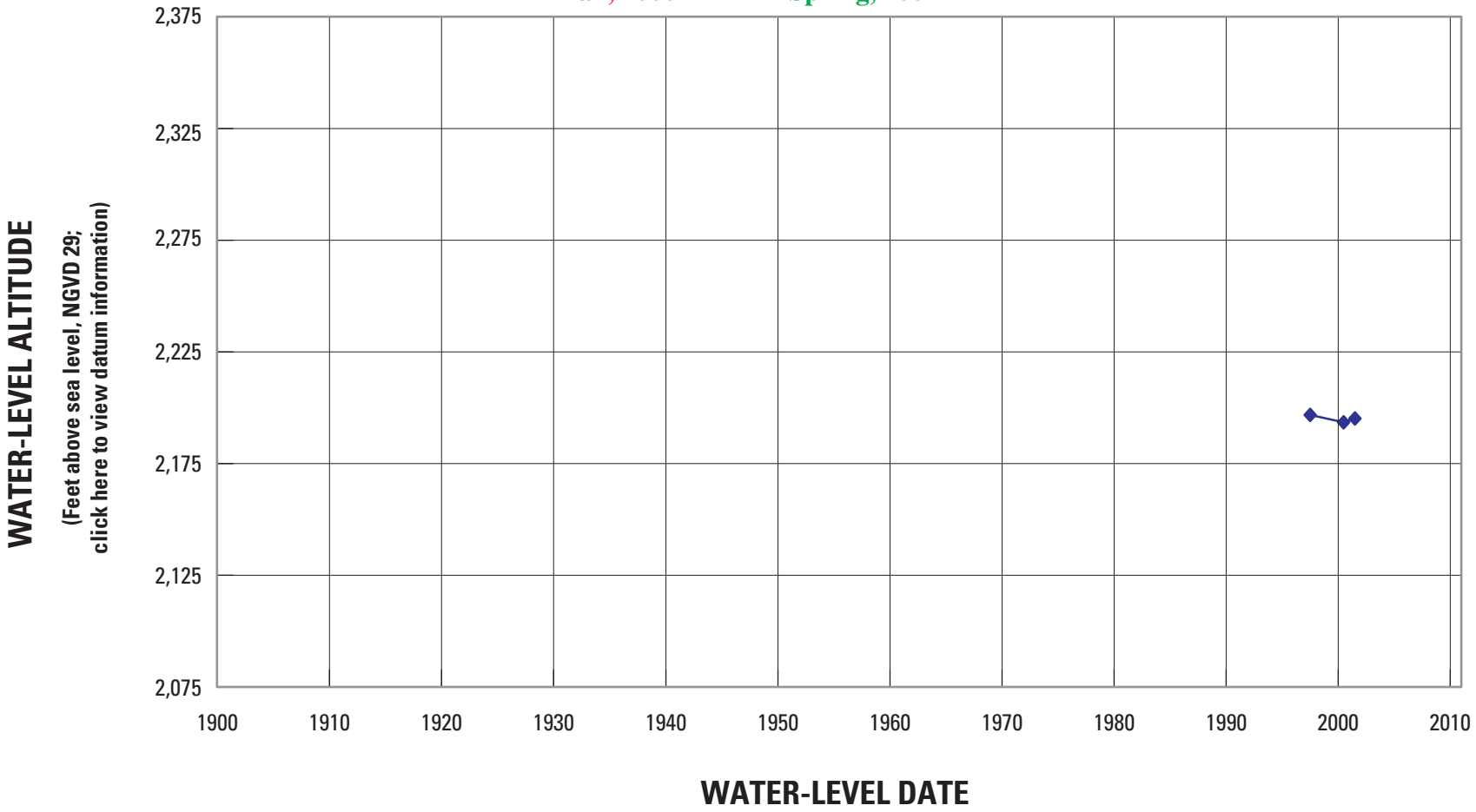
(Click here to view well location)

Fall, 2000 Spring, 2001



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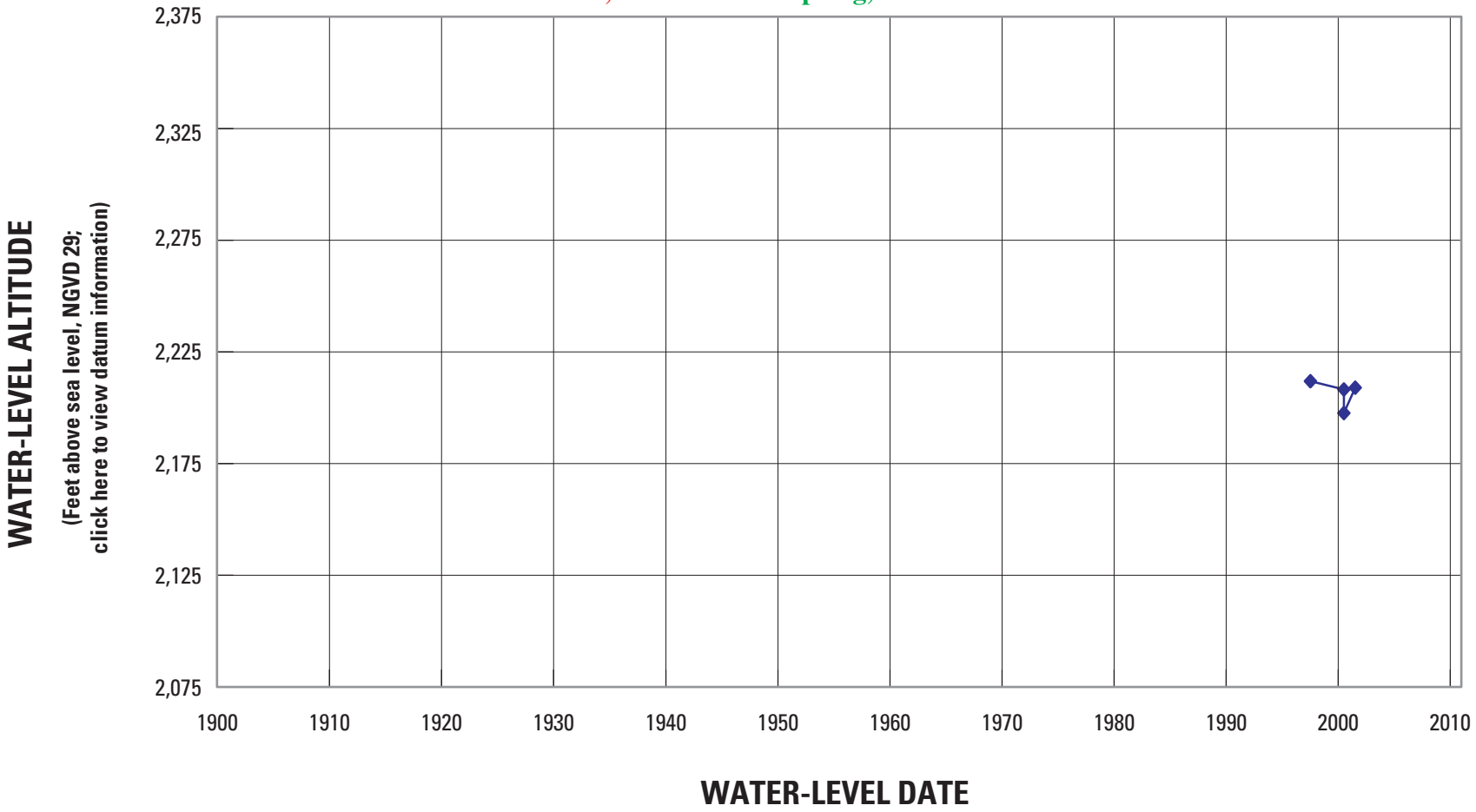
006N011W03Q001S

(Click here to view well location)

Fall, 2000 Spring, 2001



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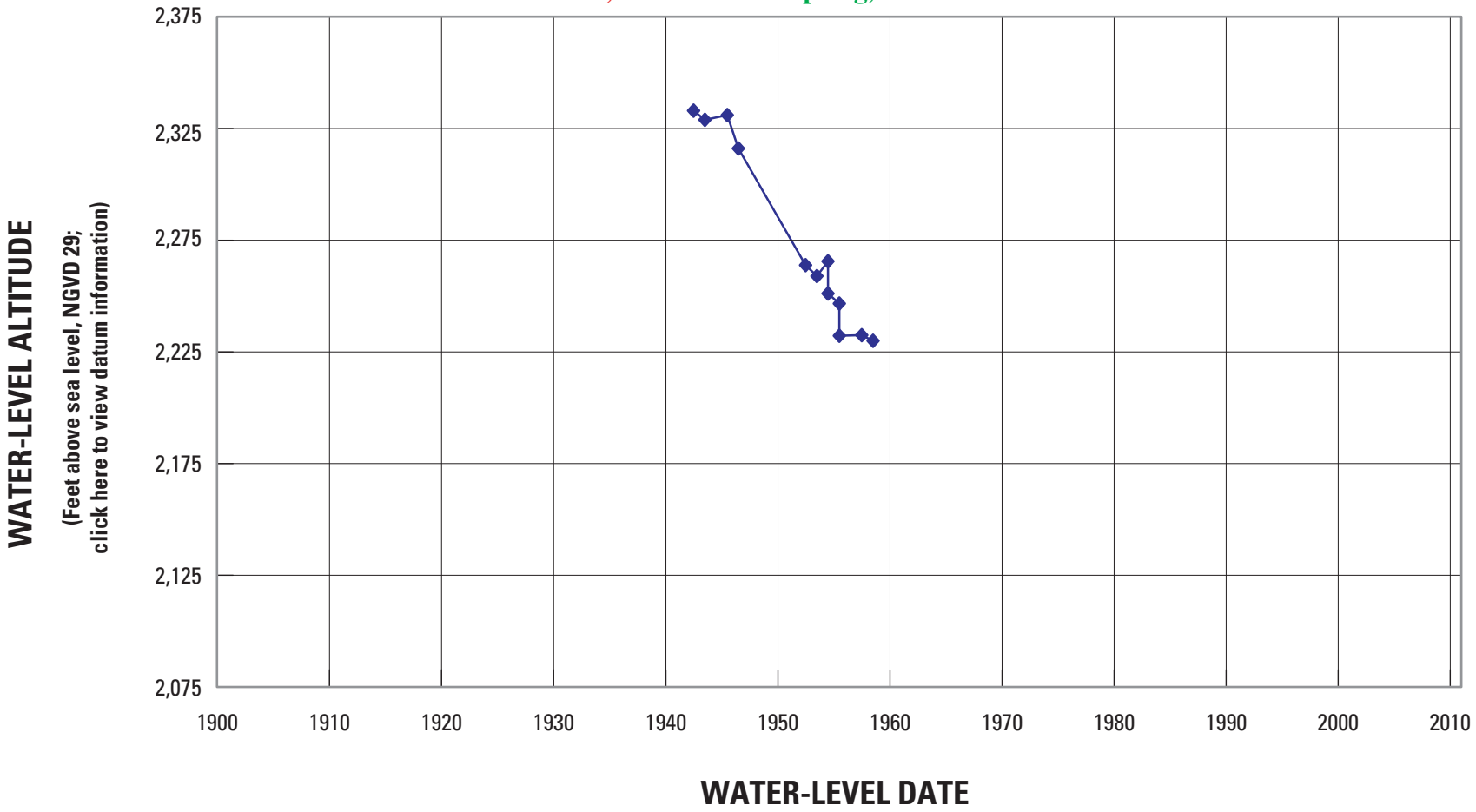
Fall, 2000 Spring, 2001



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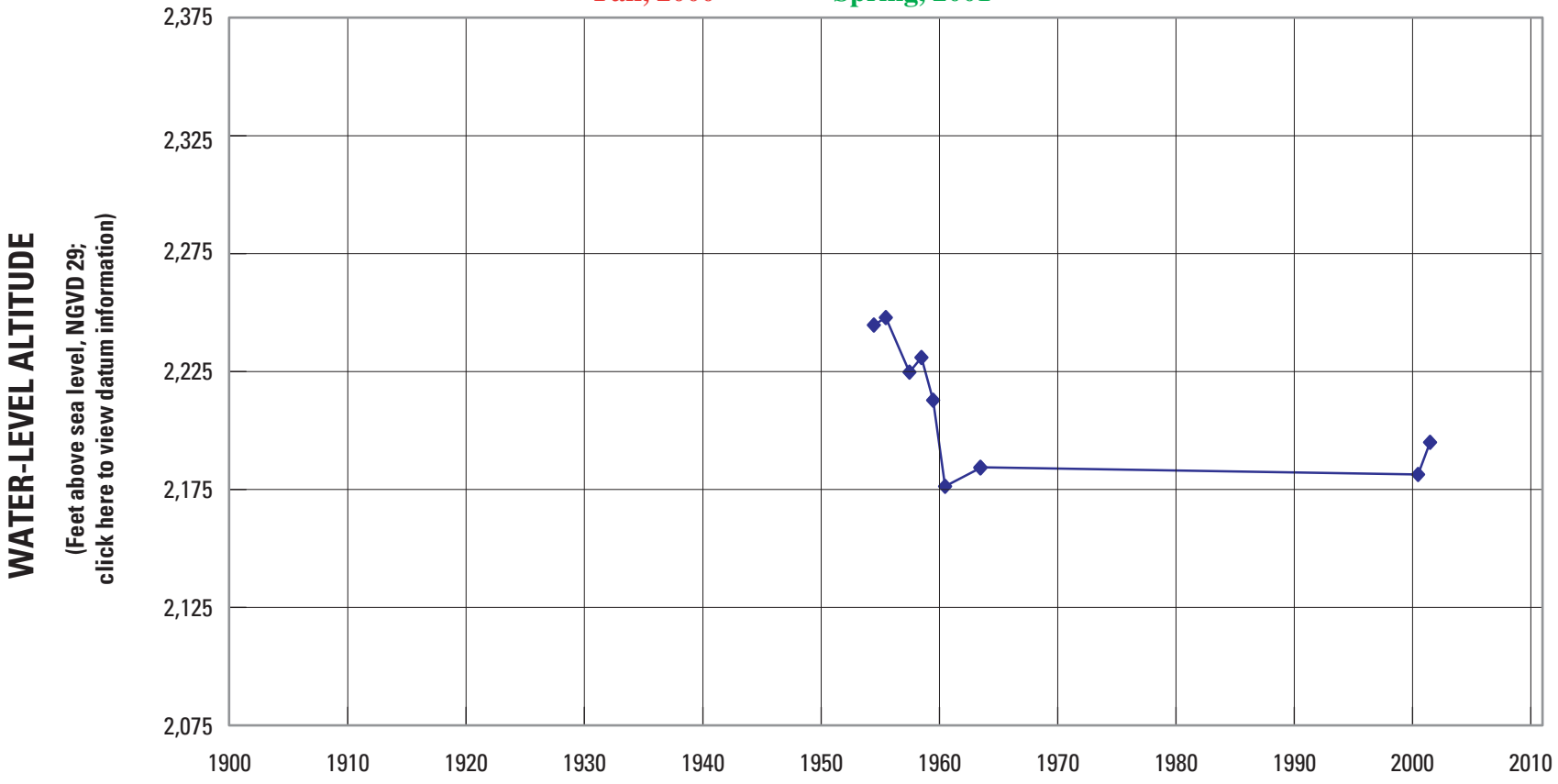

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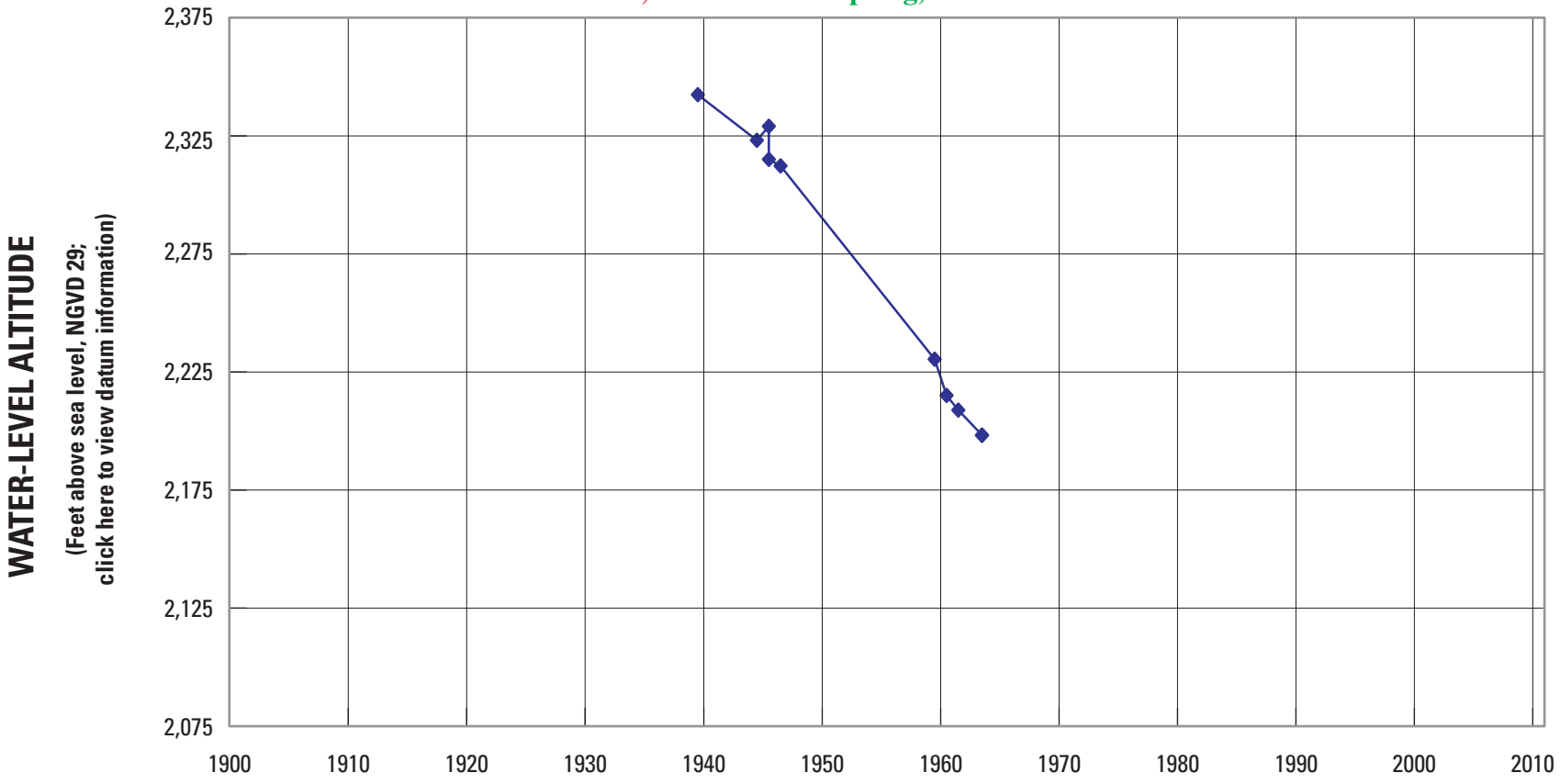

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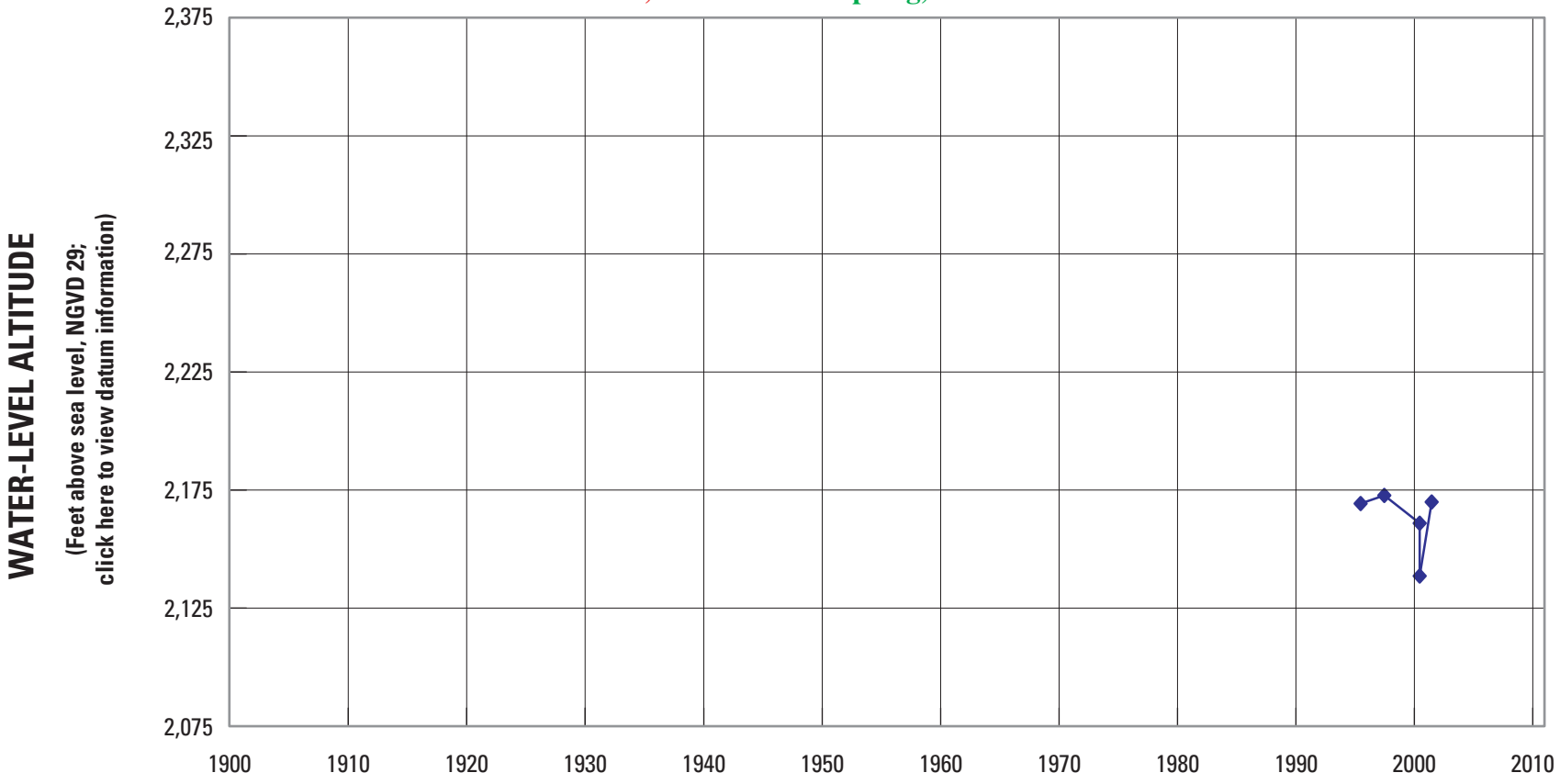

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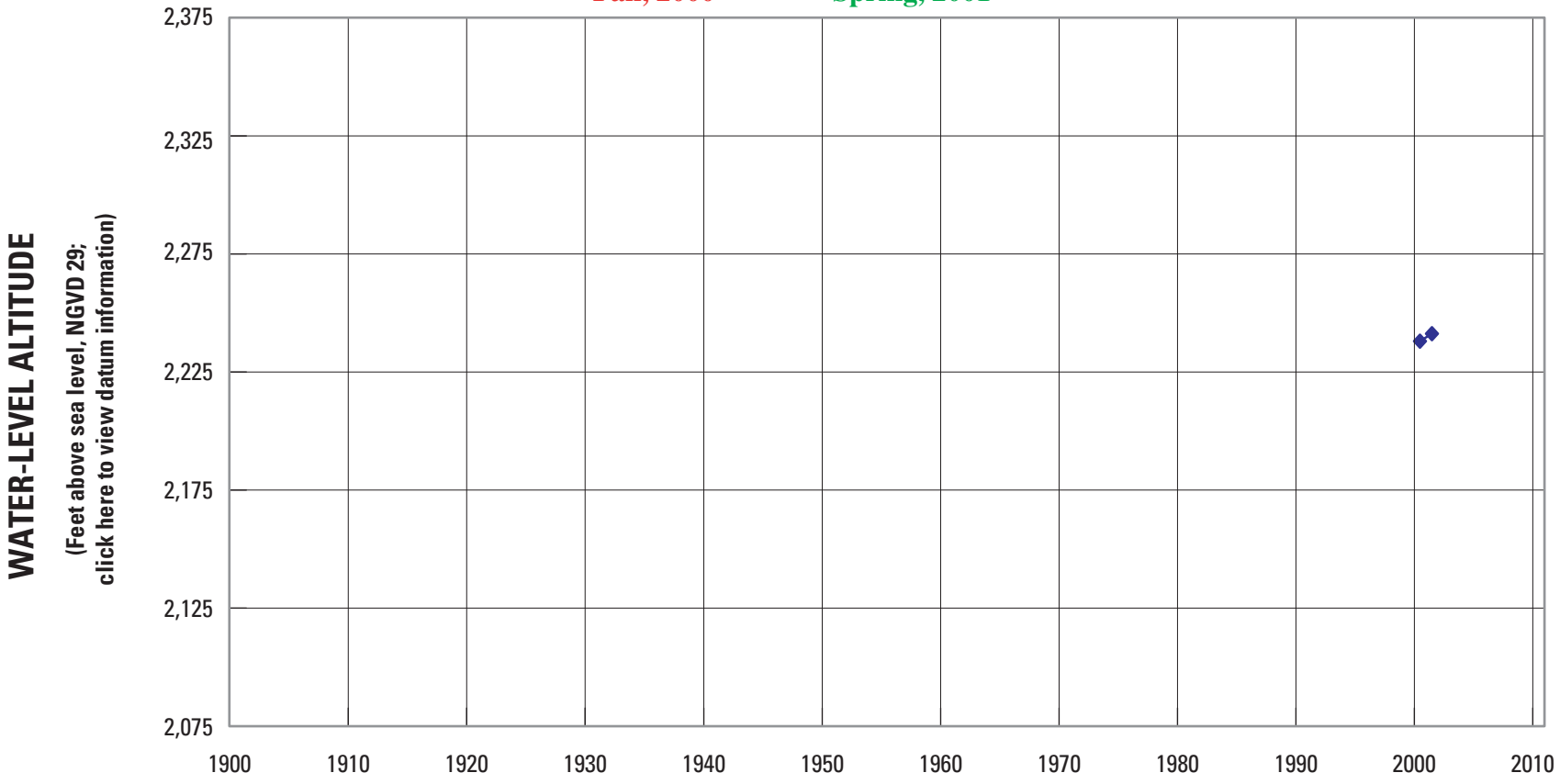

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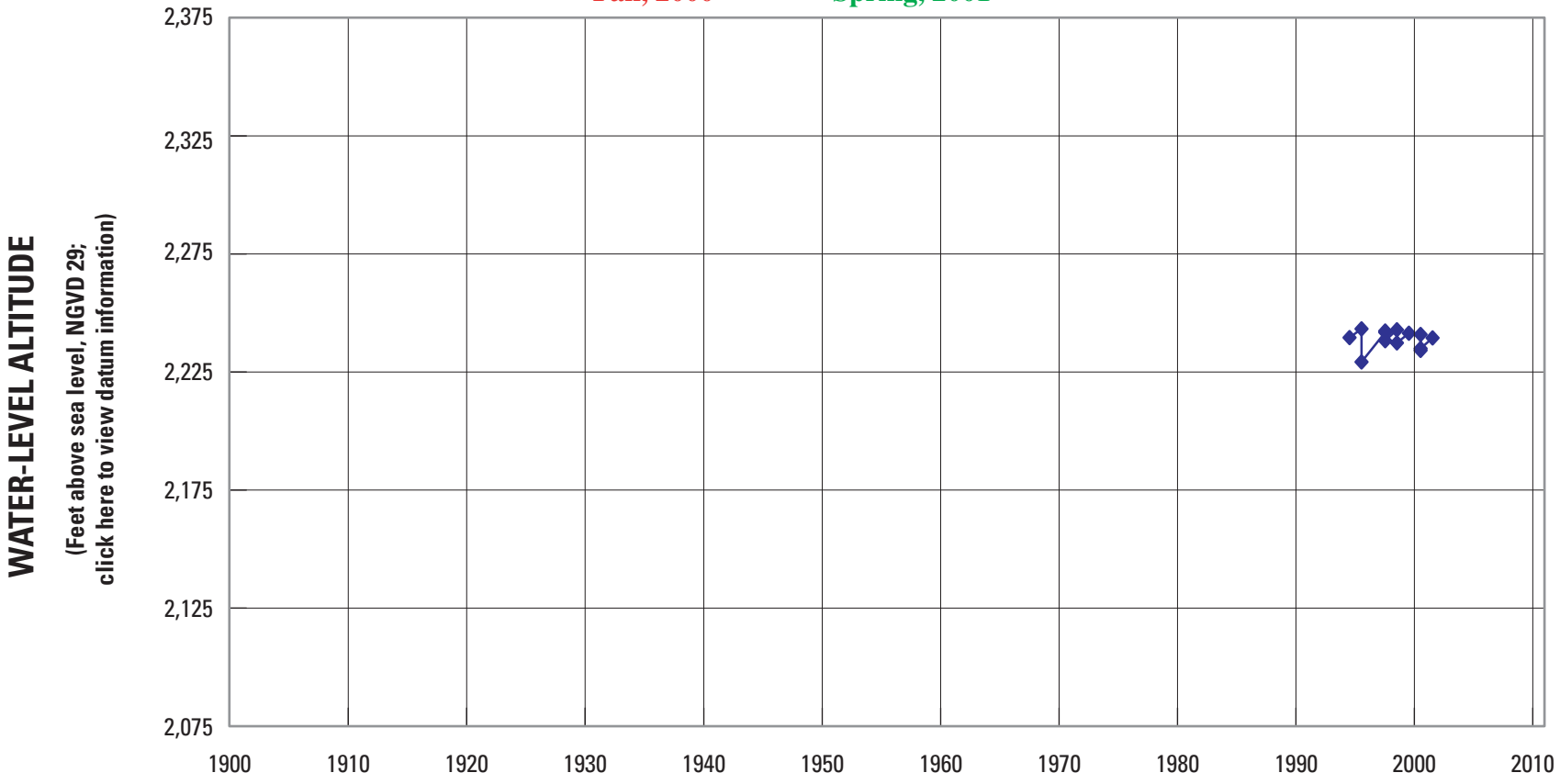
Fall, 2000 Spring, 2001



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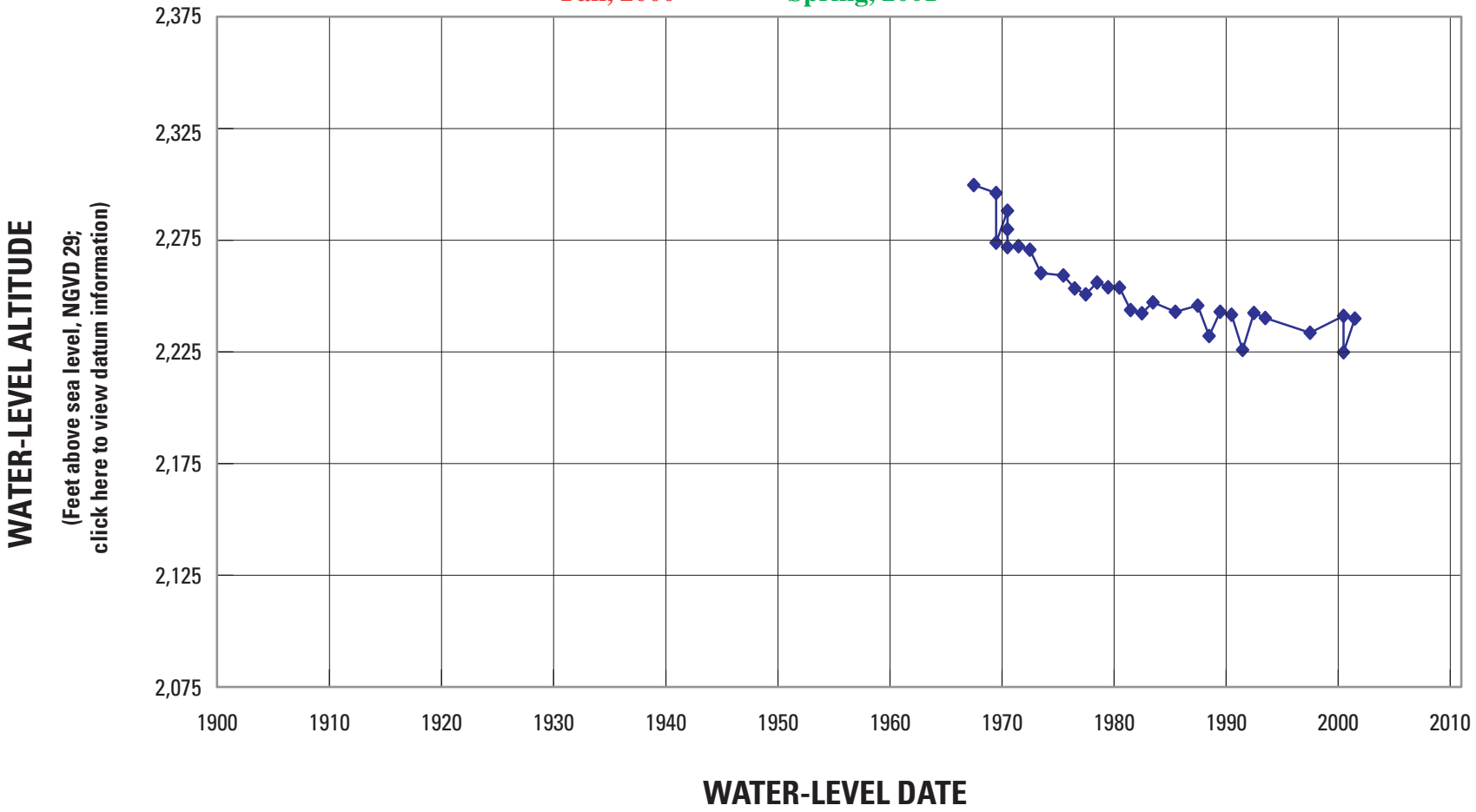

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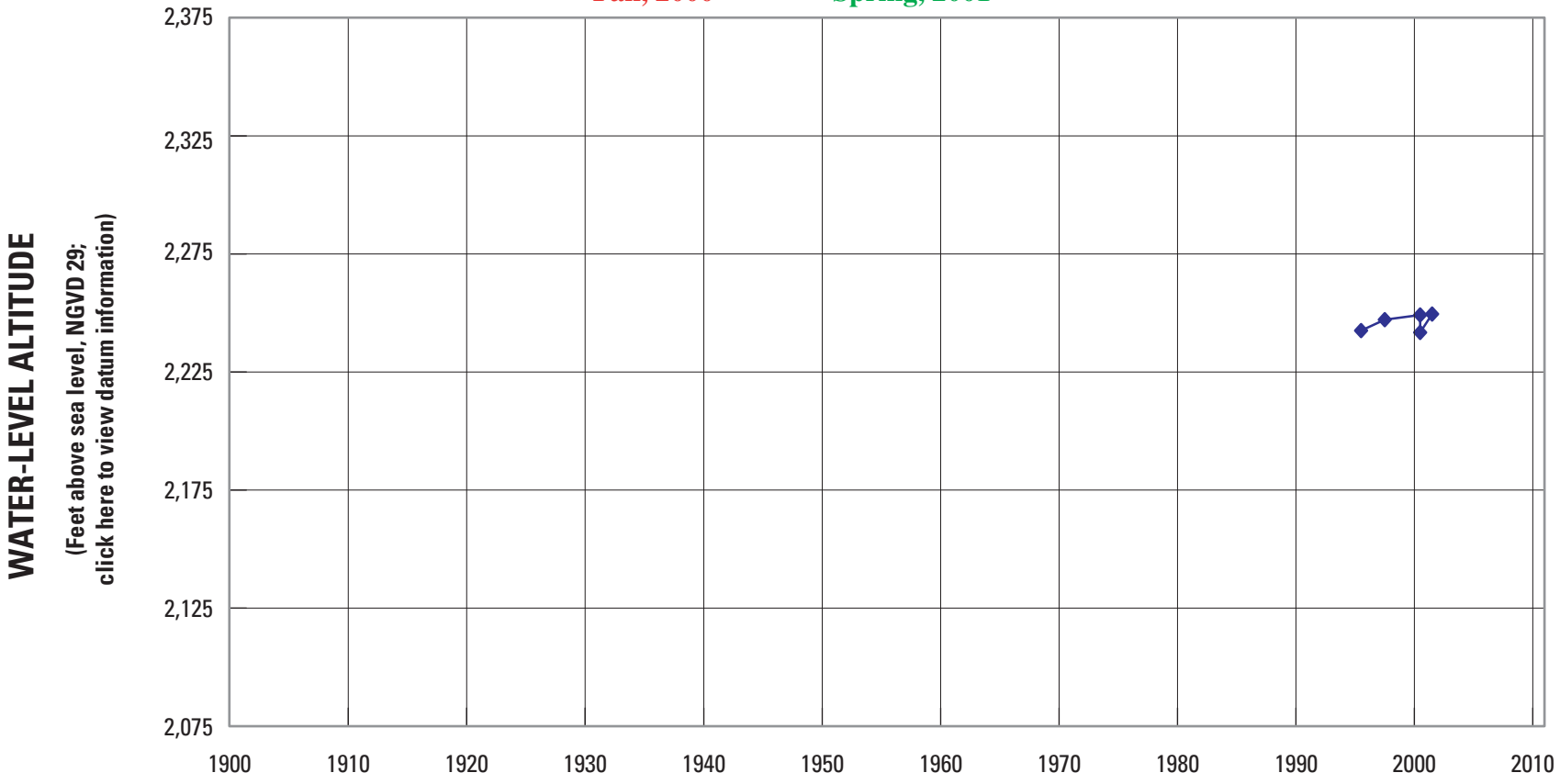
Fall, 2000 Spring, 2001



WATER-LEVEL ALTITUDE

(Feet above sea level, NGVD 29; click here to view datum information)

WATER-LEVEL DATE

(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

006N011W06H004S

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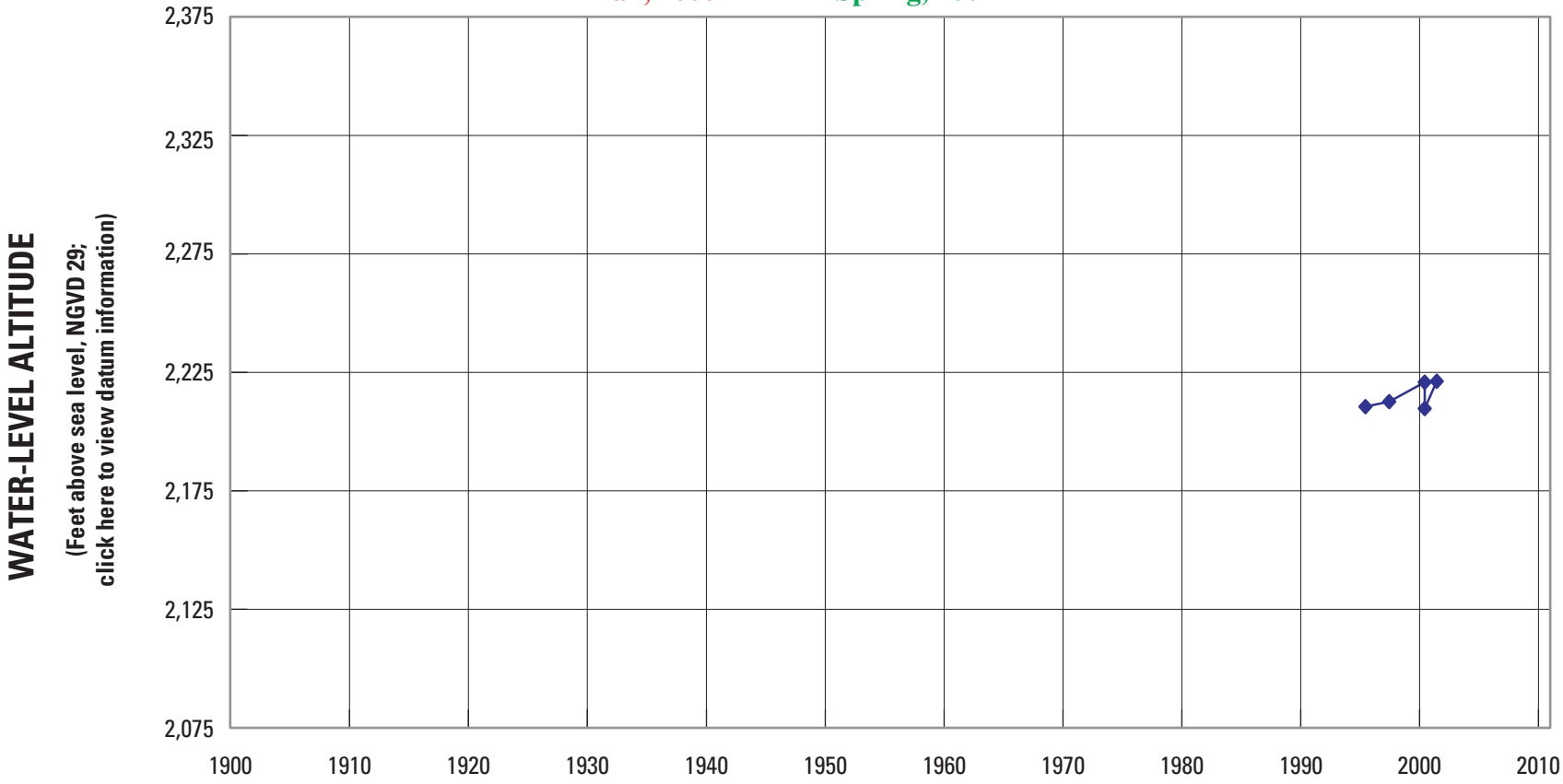
Fall, 2000 Spring, 2001



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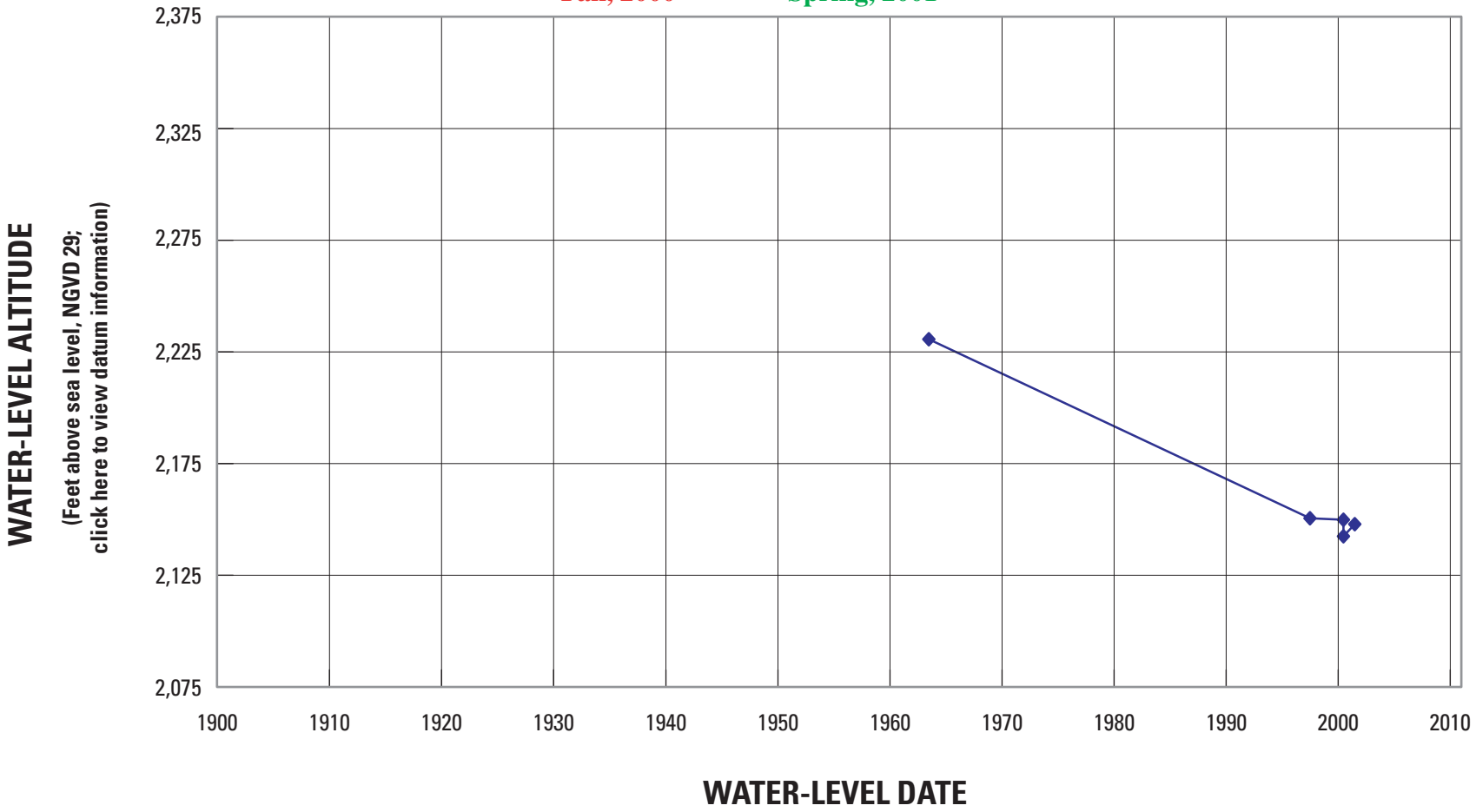

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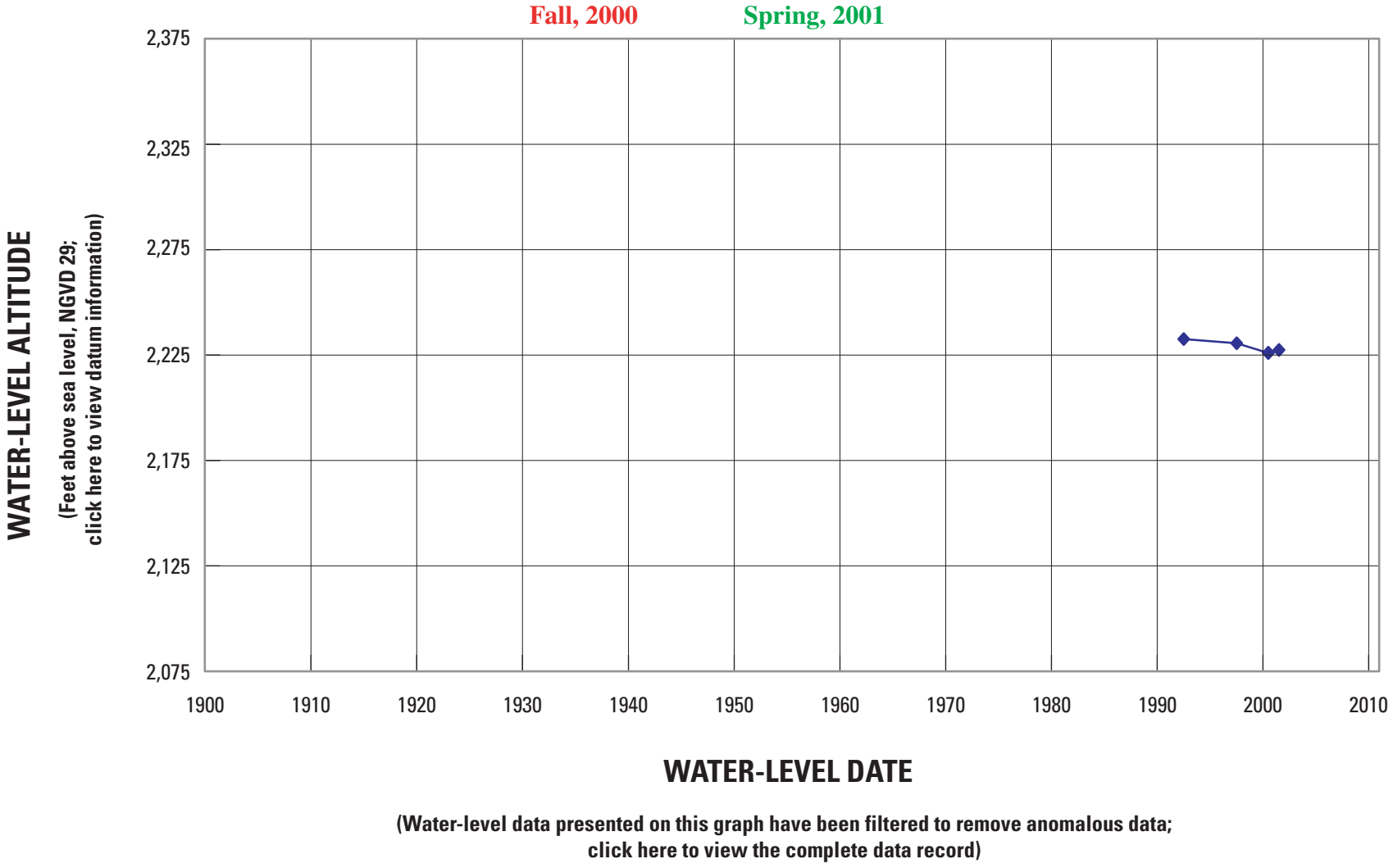

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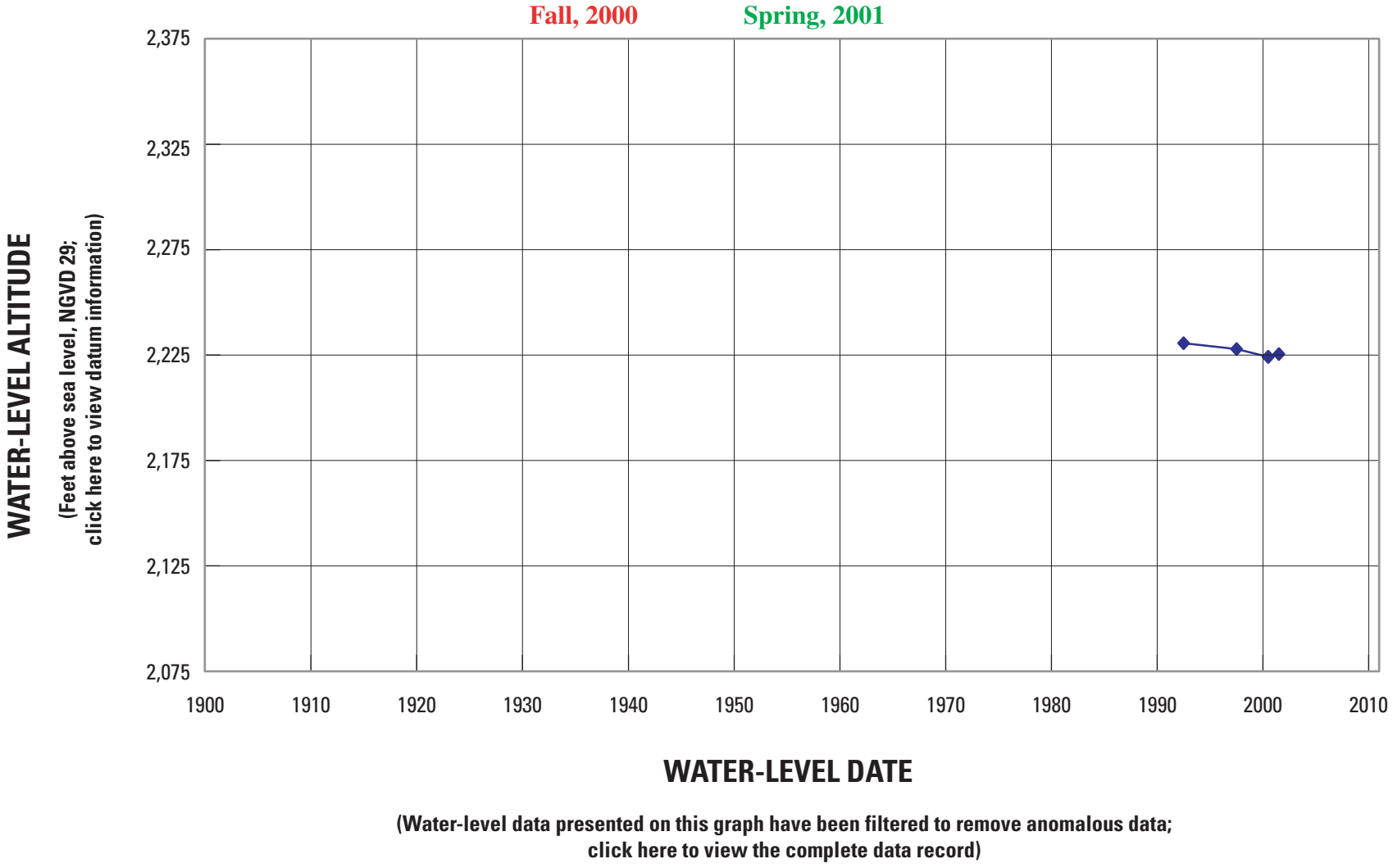

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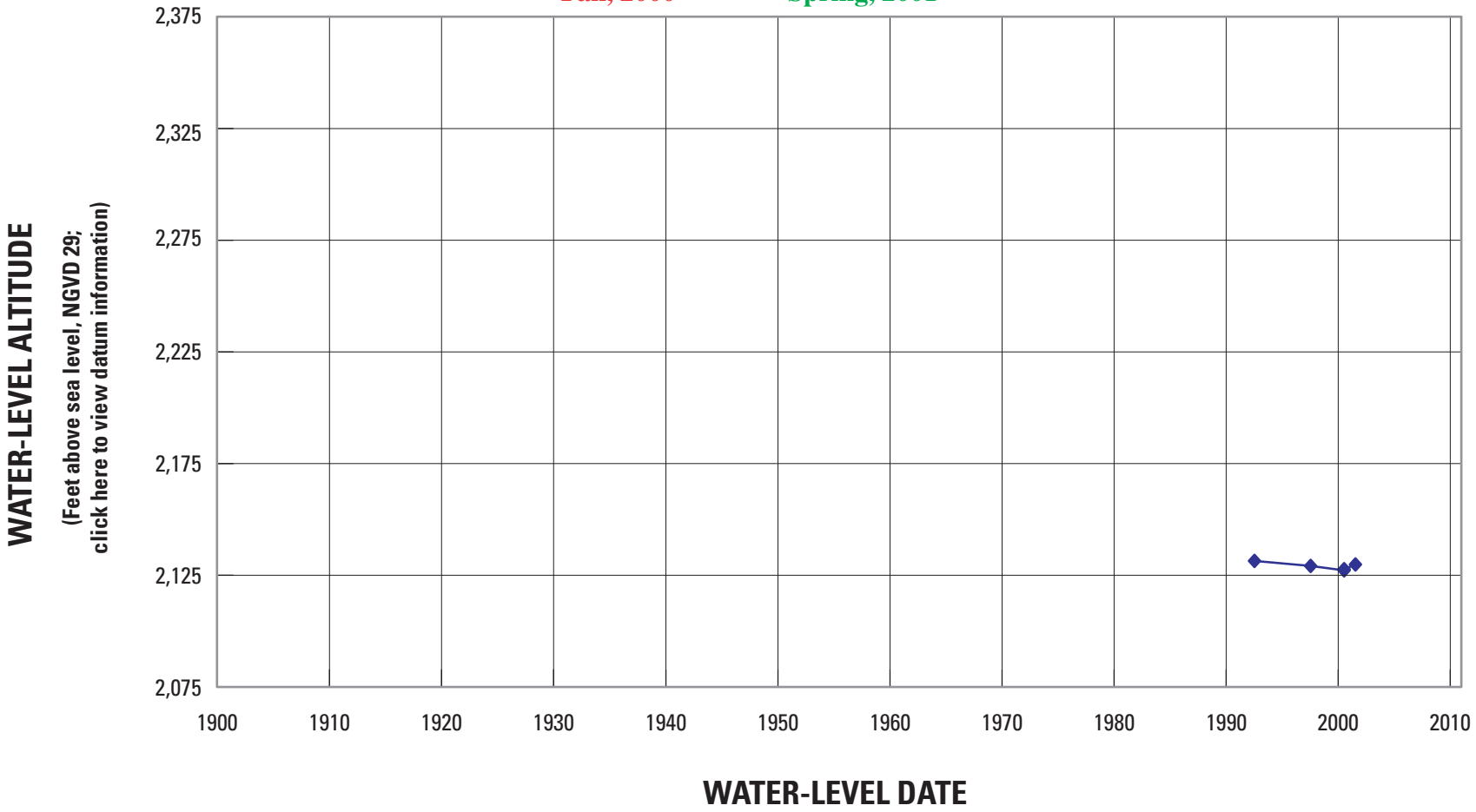

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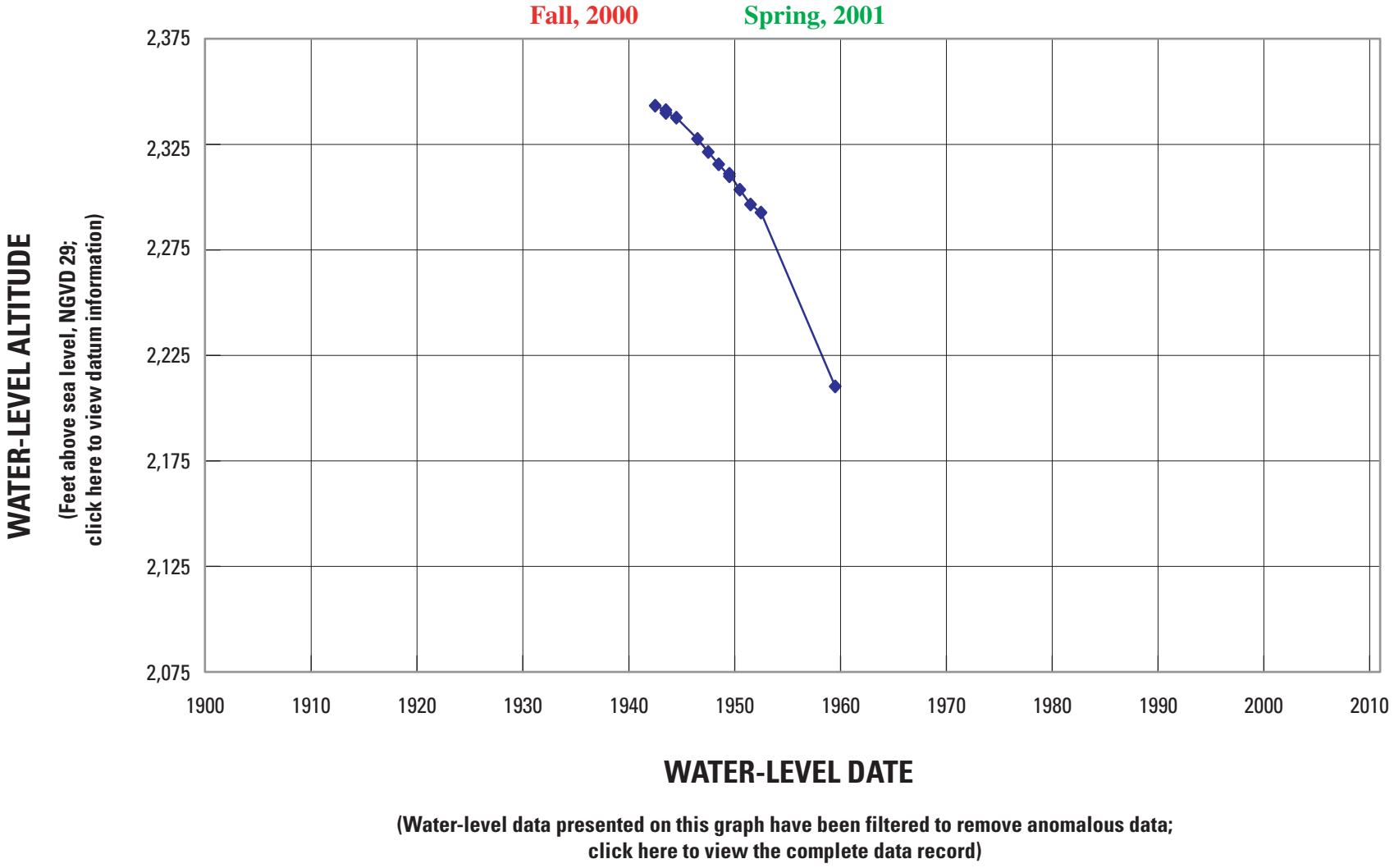

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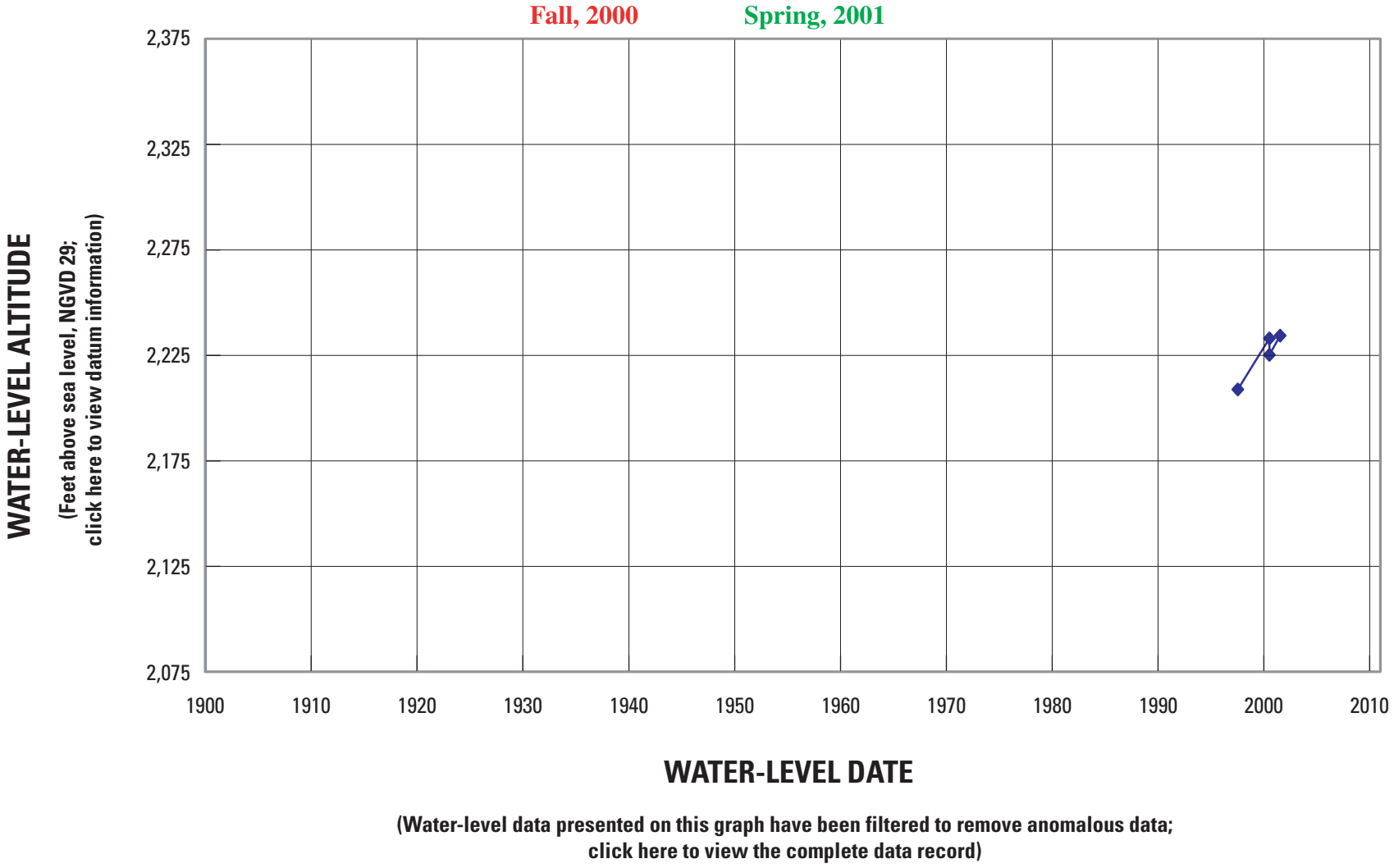

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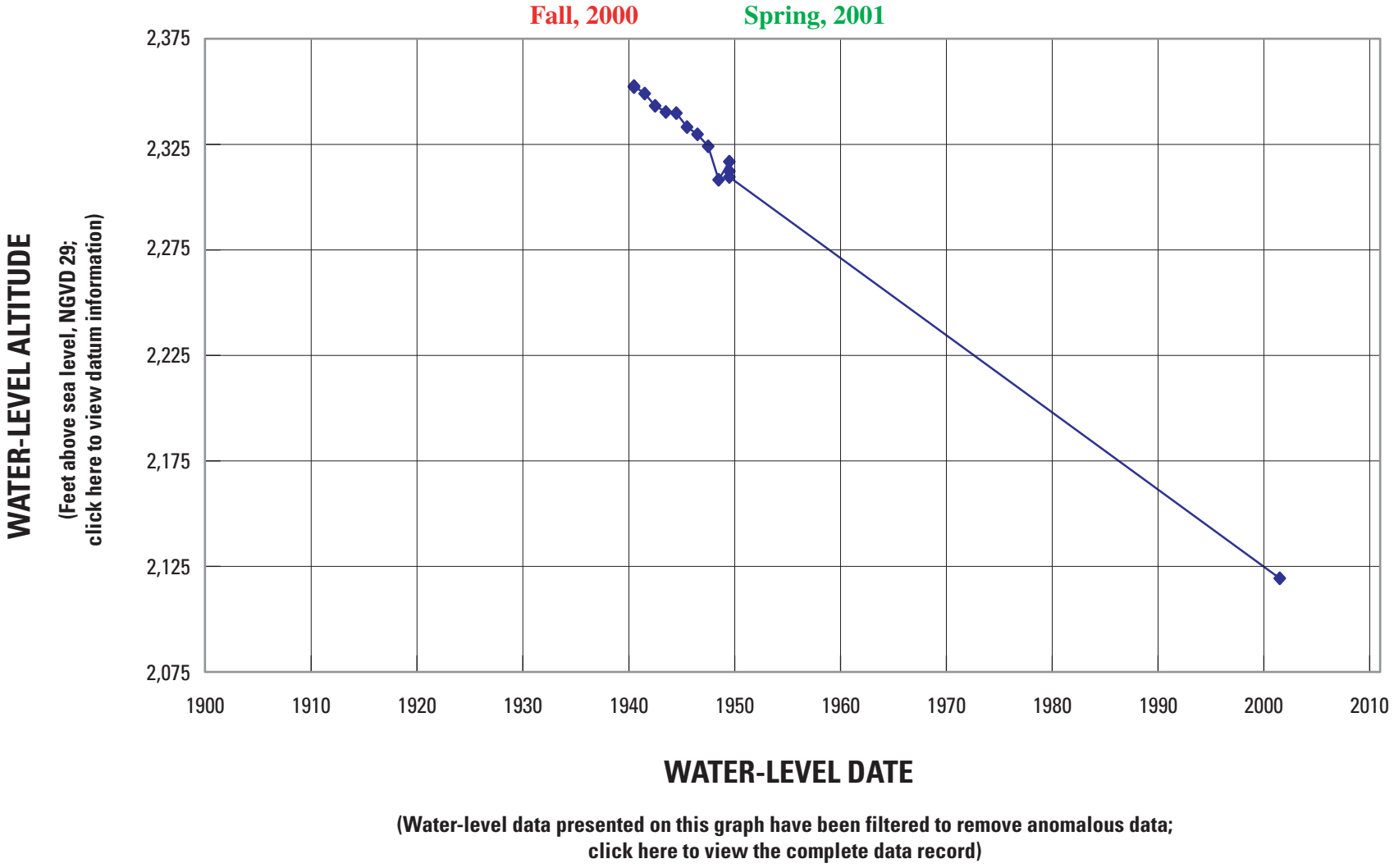

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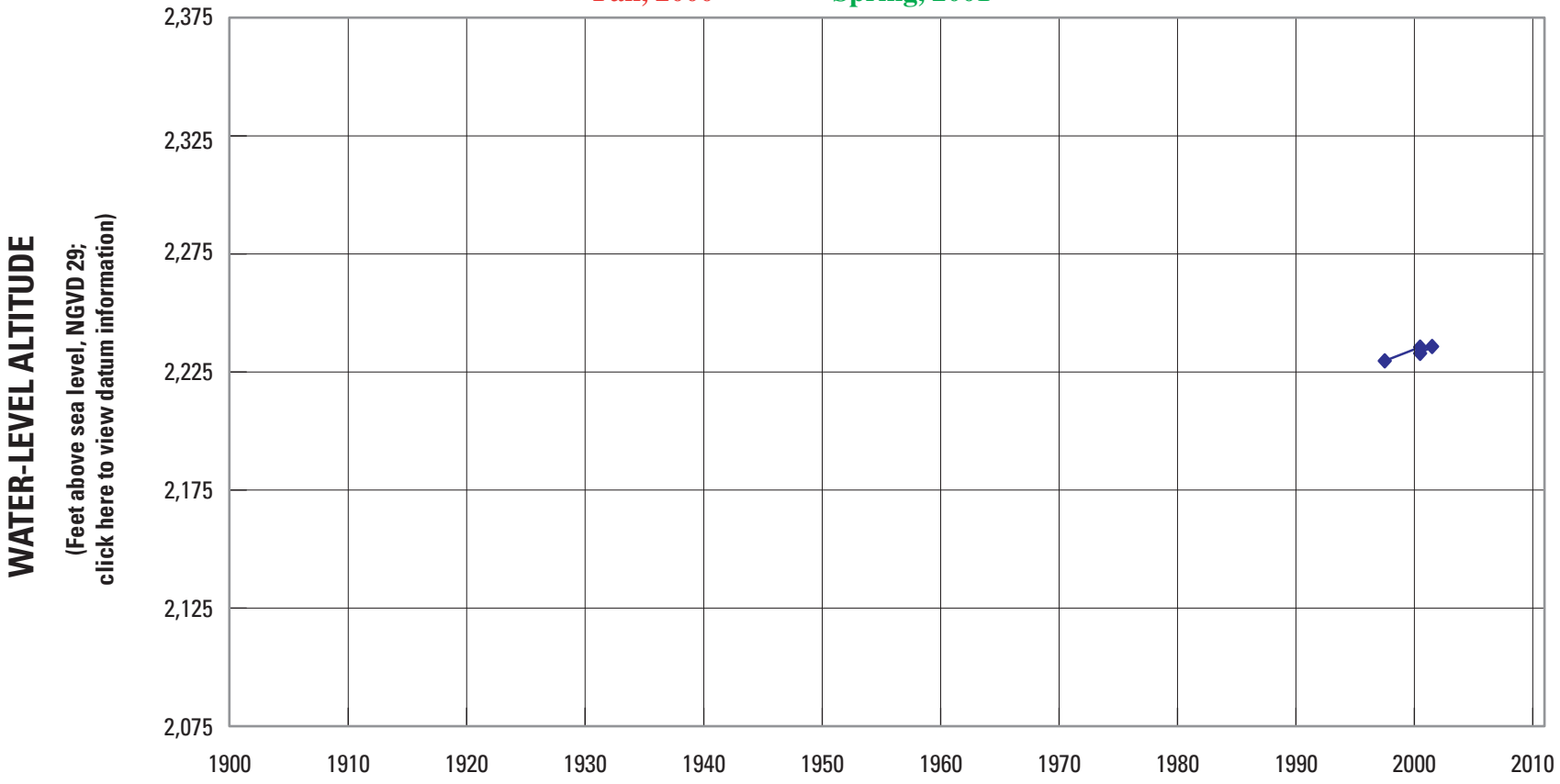
Fall, 2000 Spring, 2001



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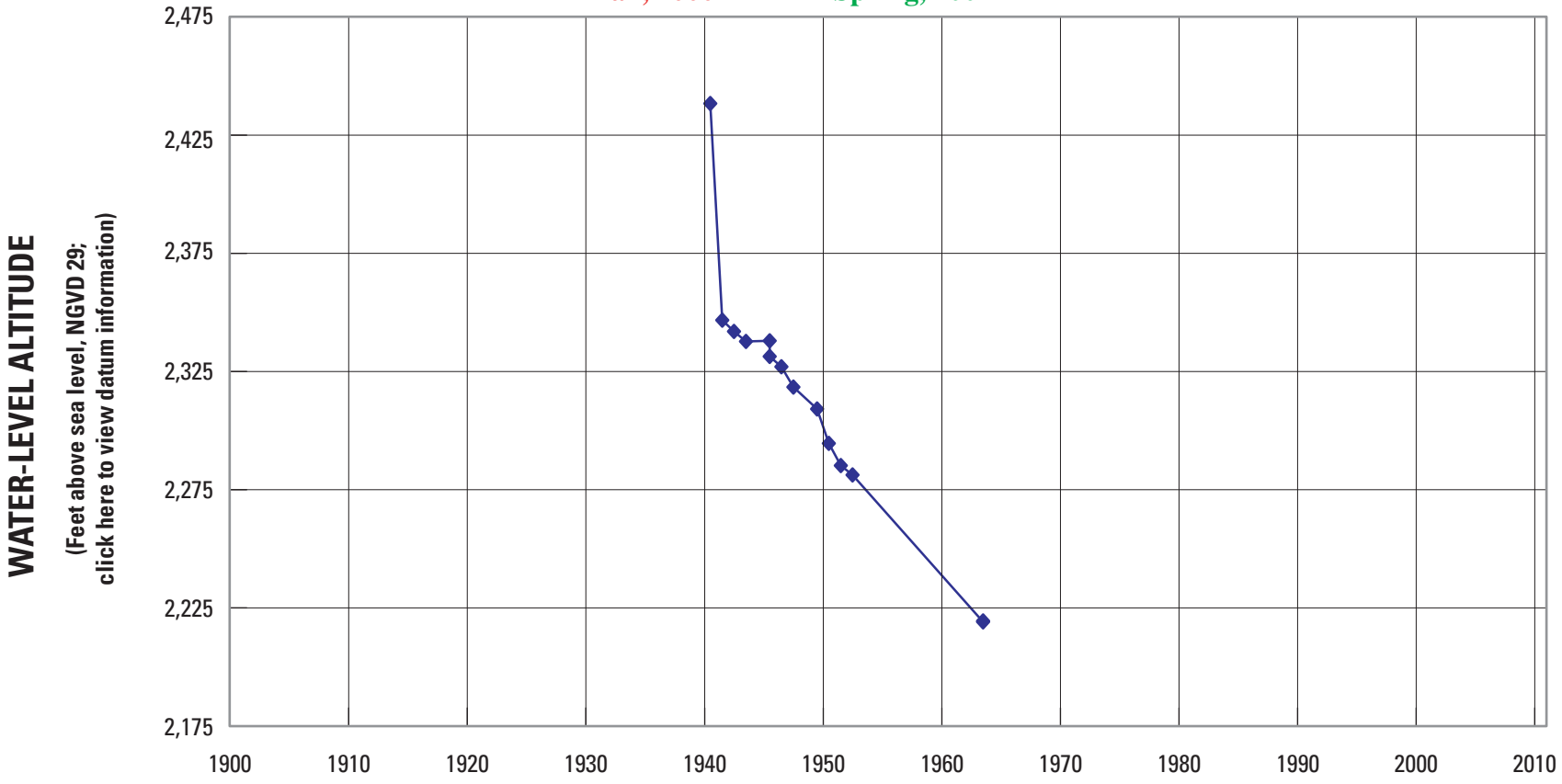

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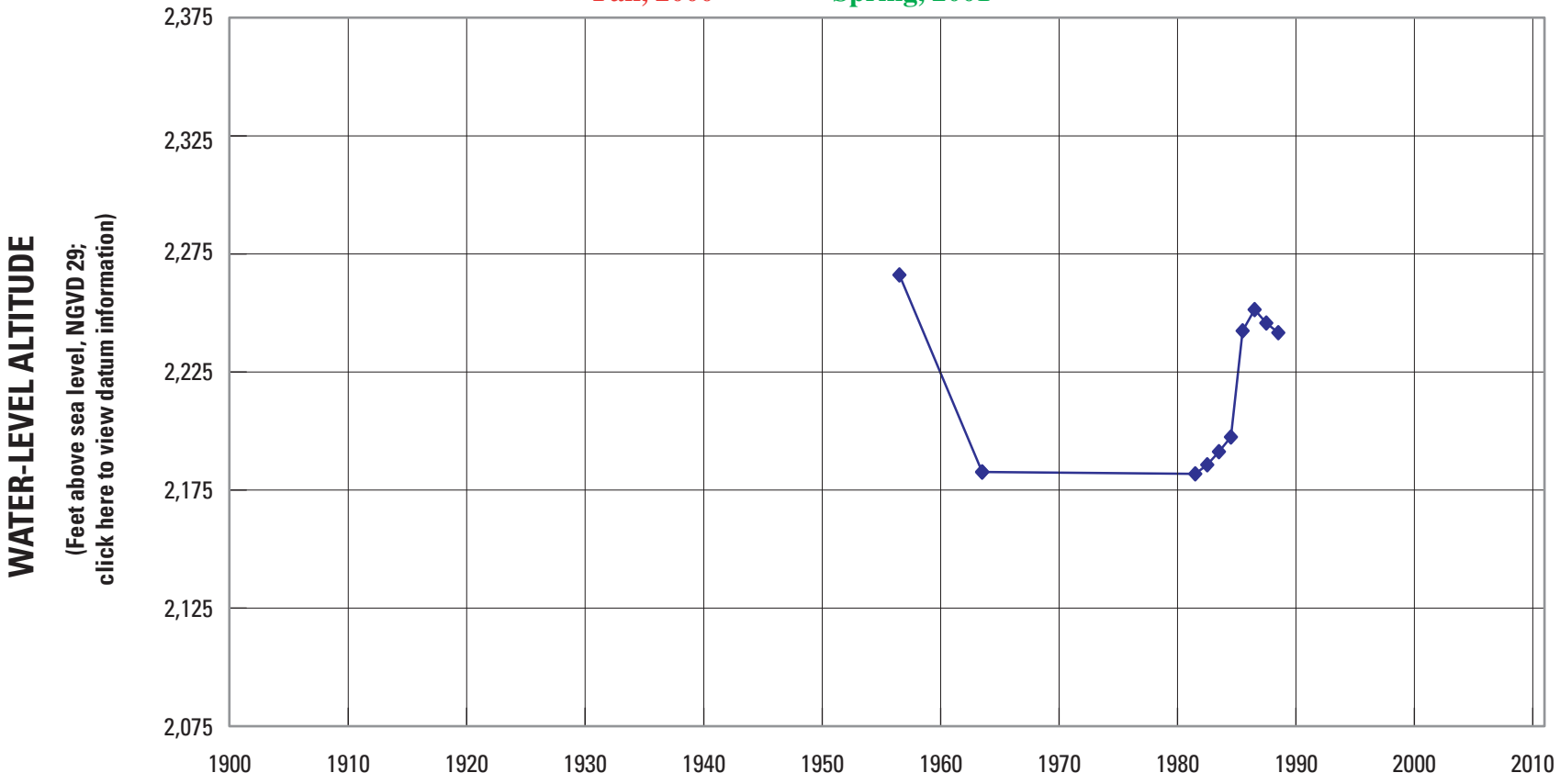

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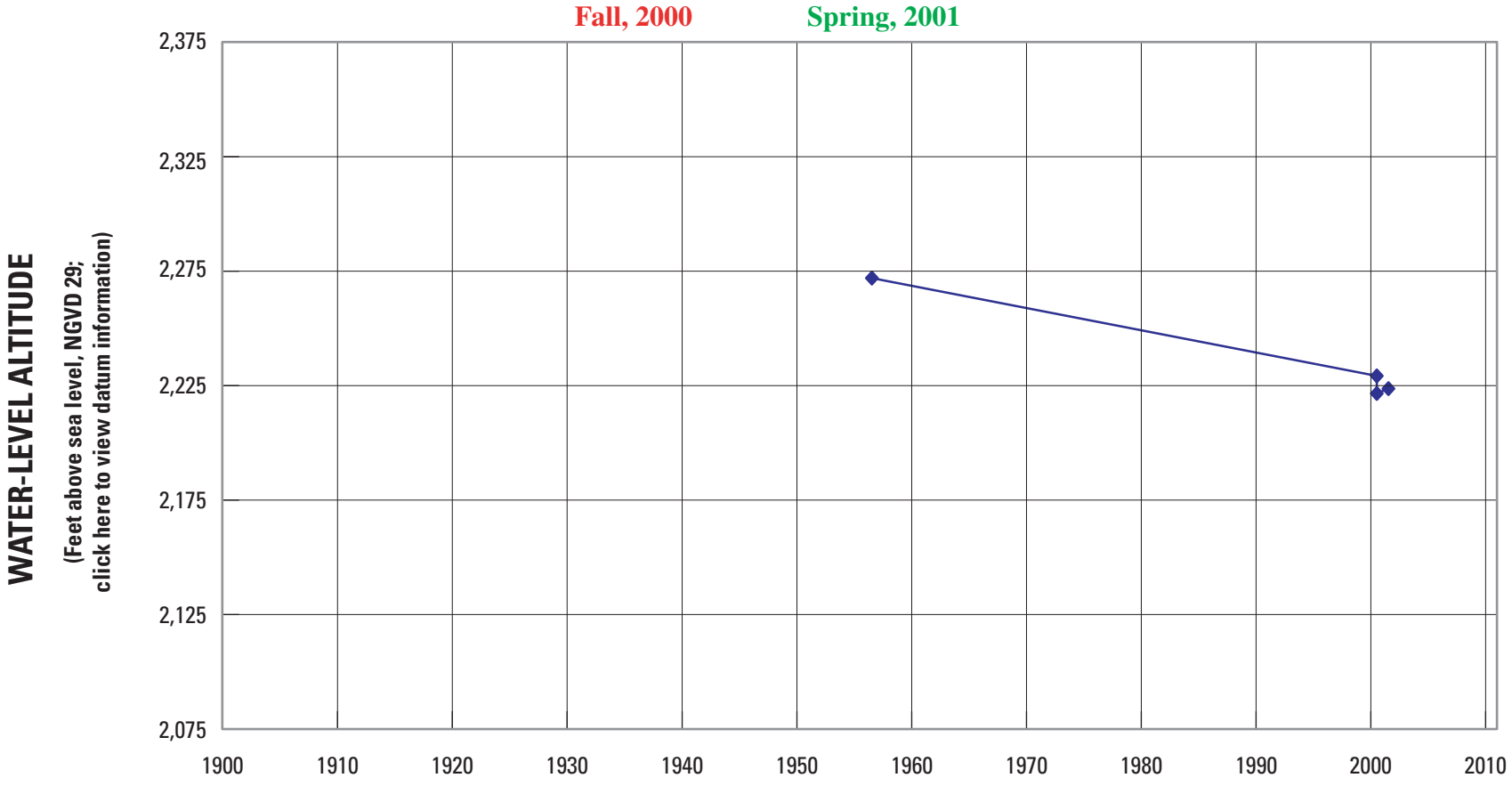

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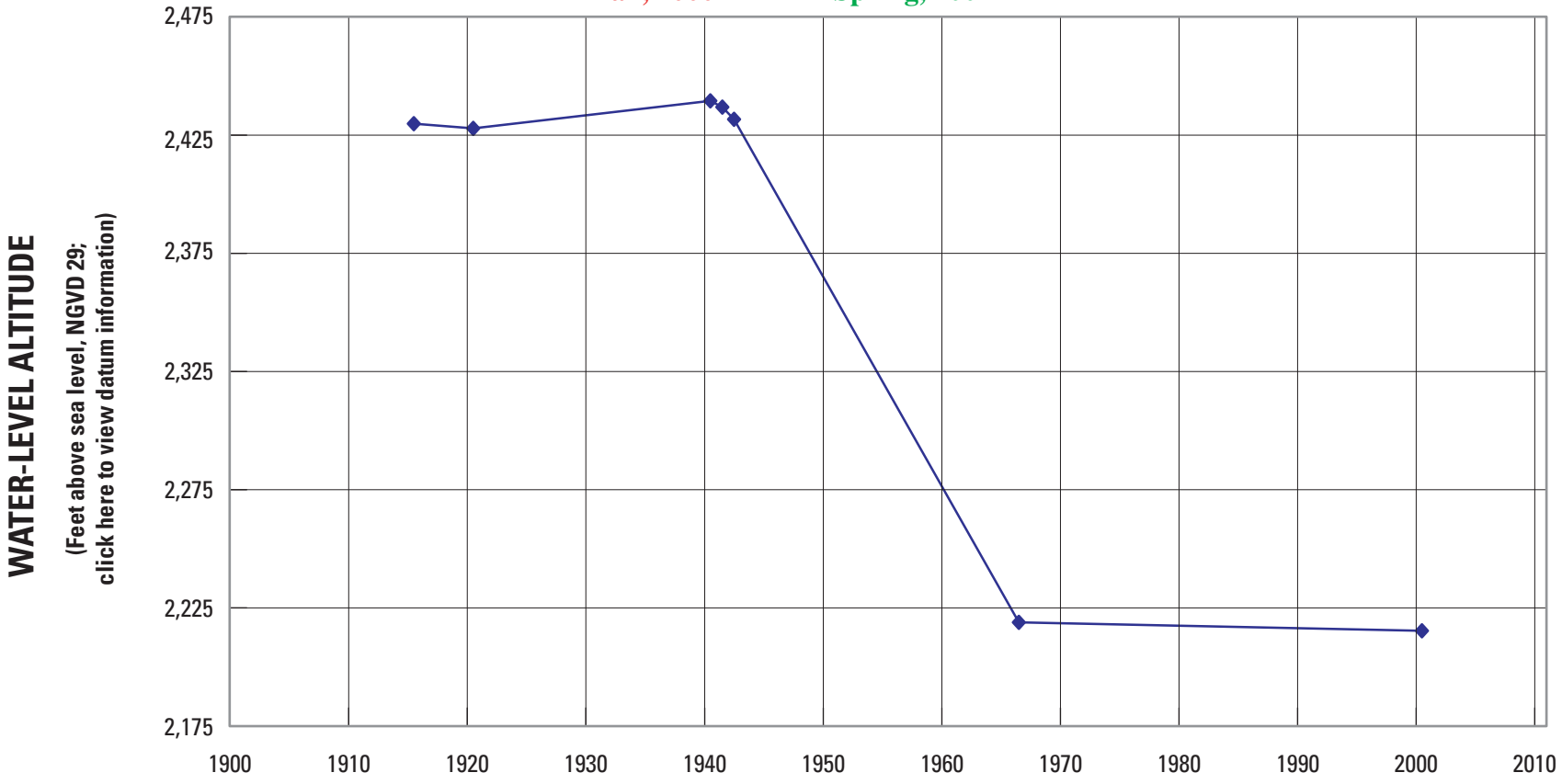

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006N011W11C001S

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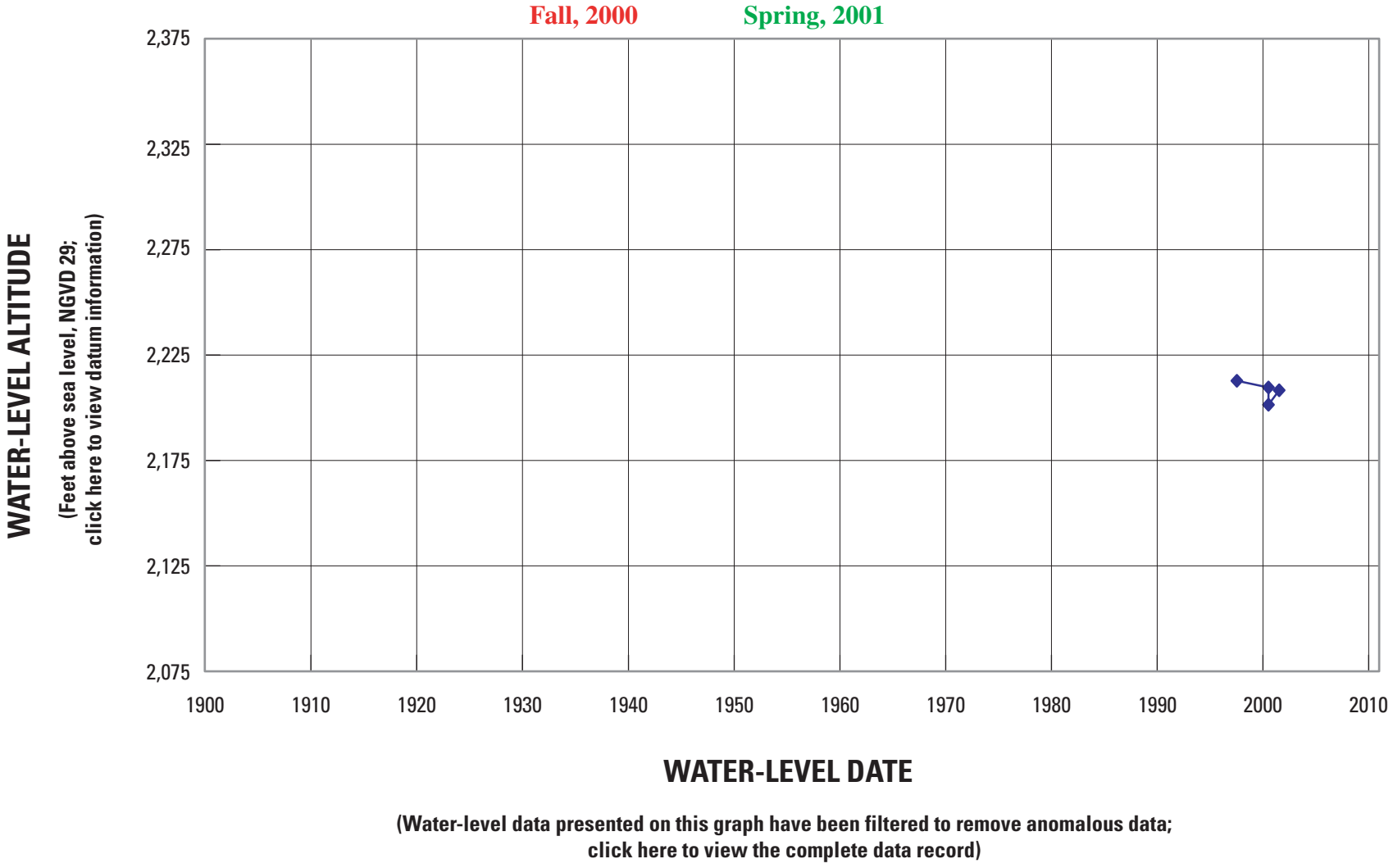

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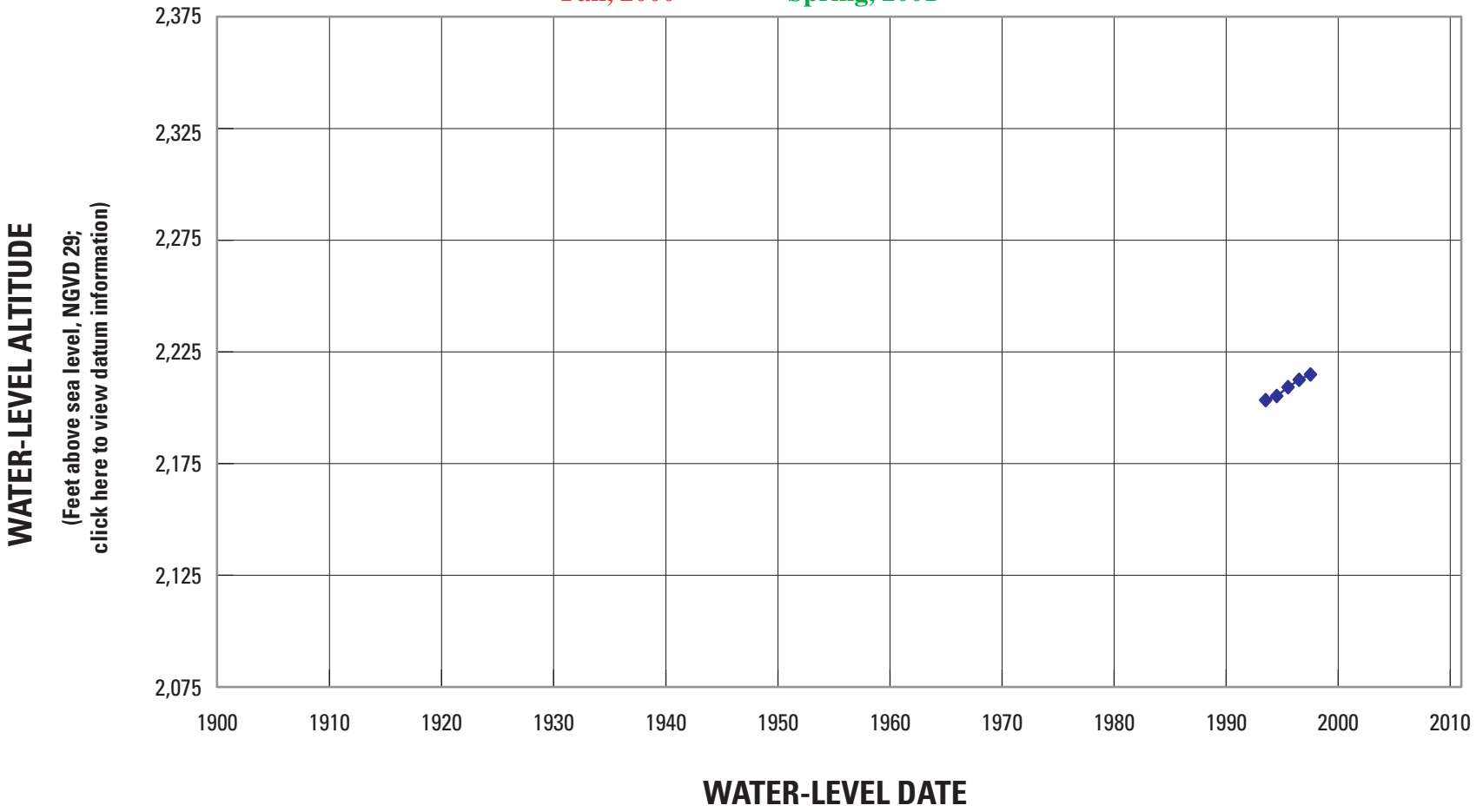

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006N011W11M001S

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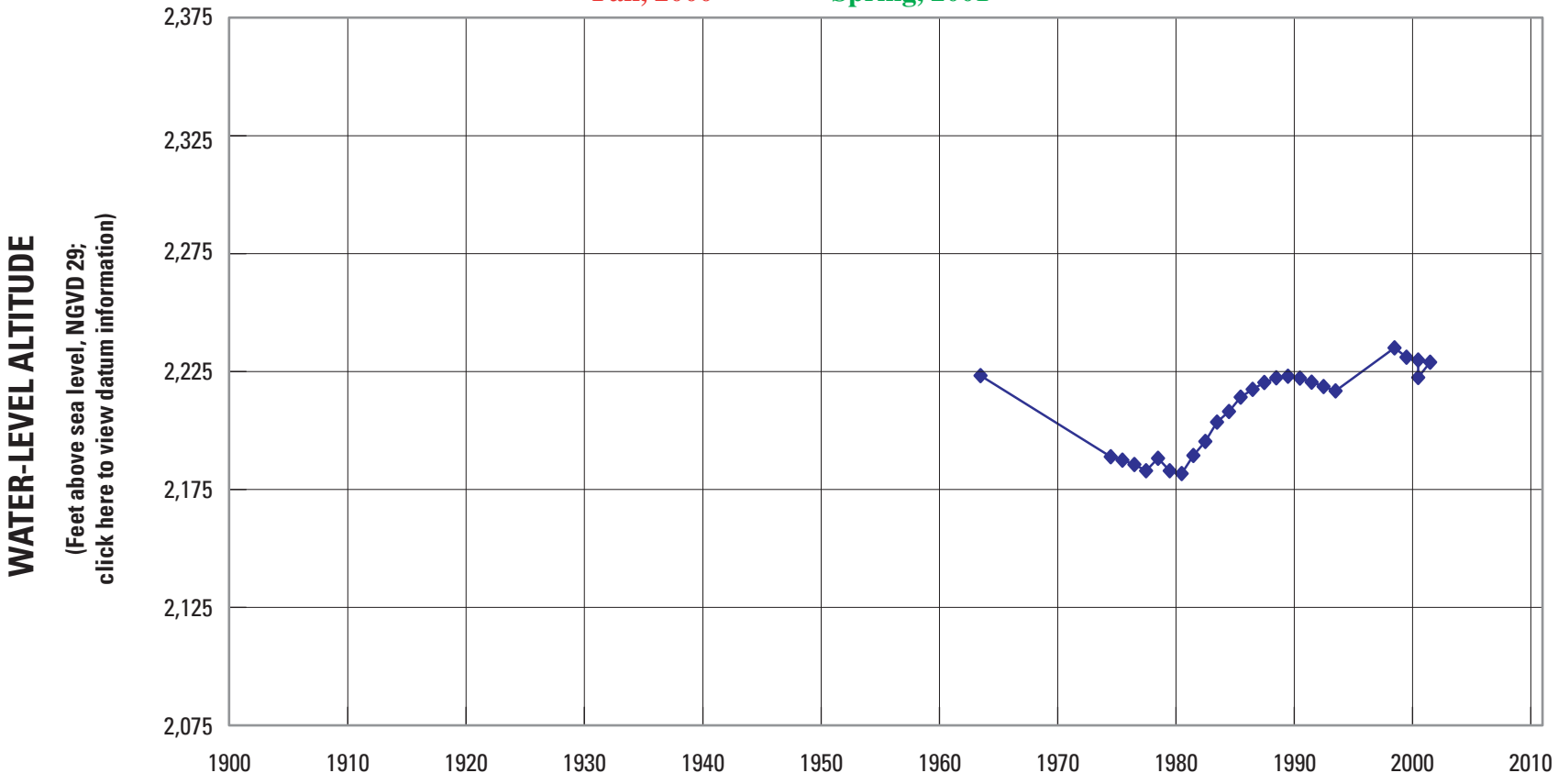
Fall, 2000 Spring, 2001



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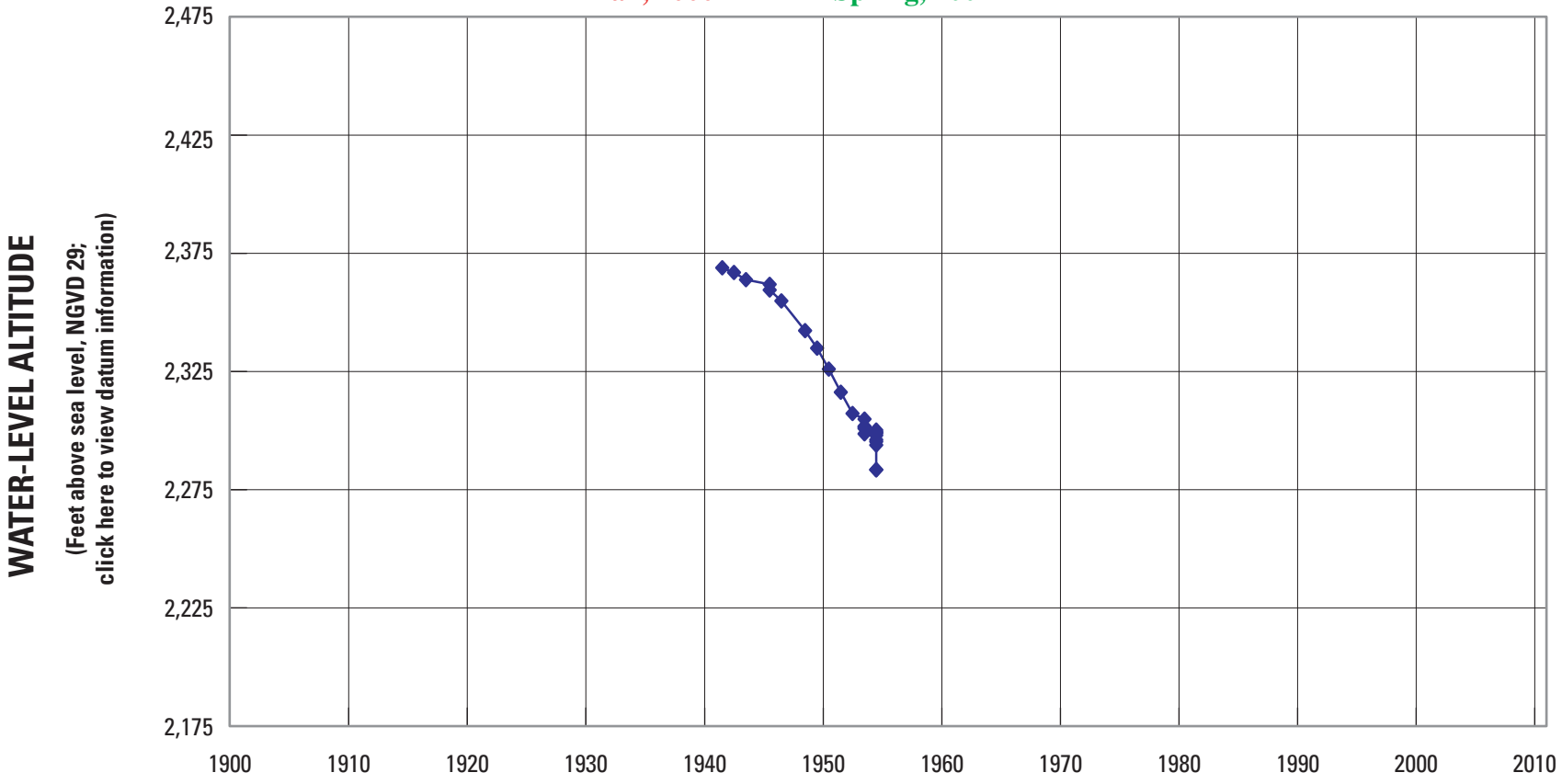
Fall, 2000 Spring, 2001



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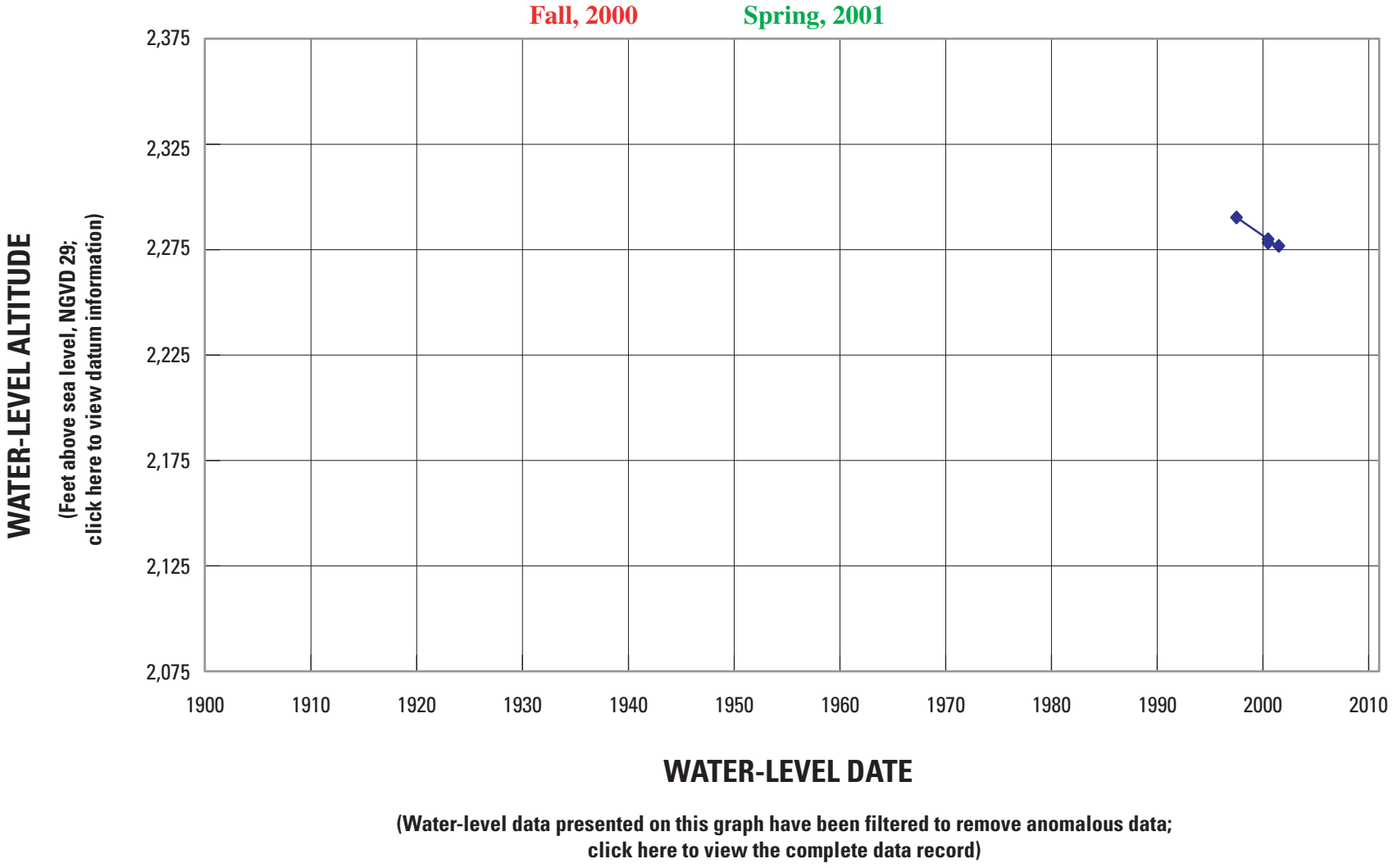

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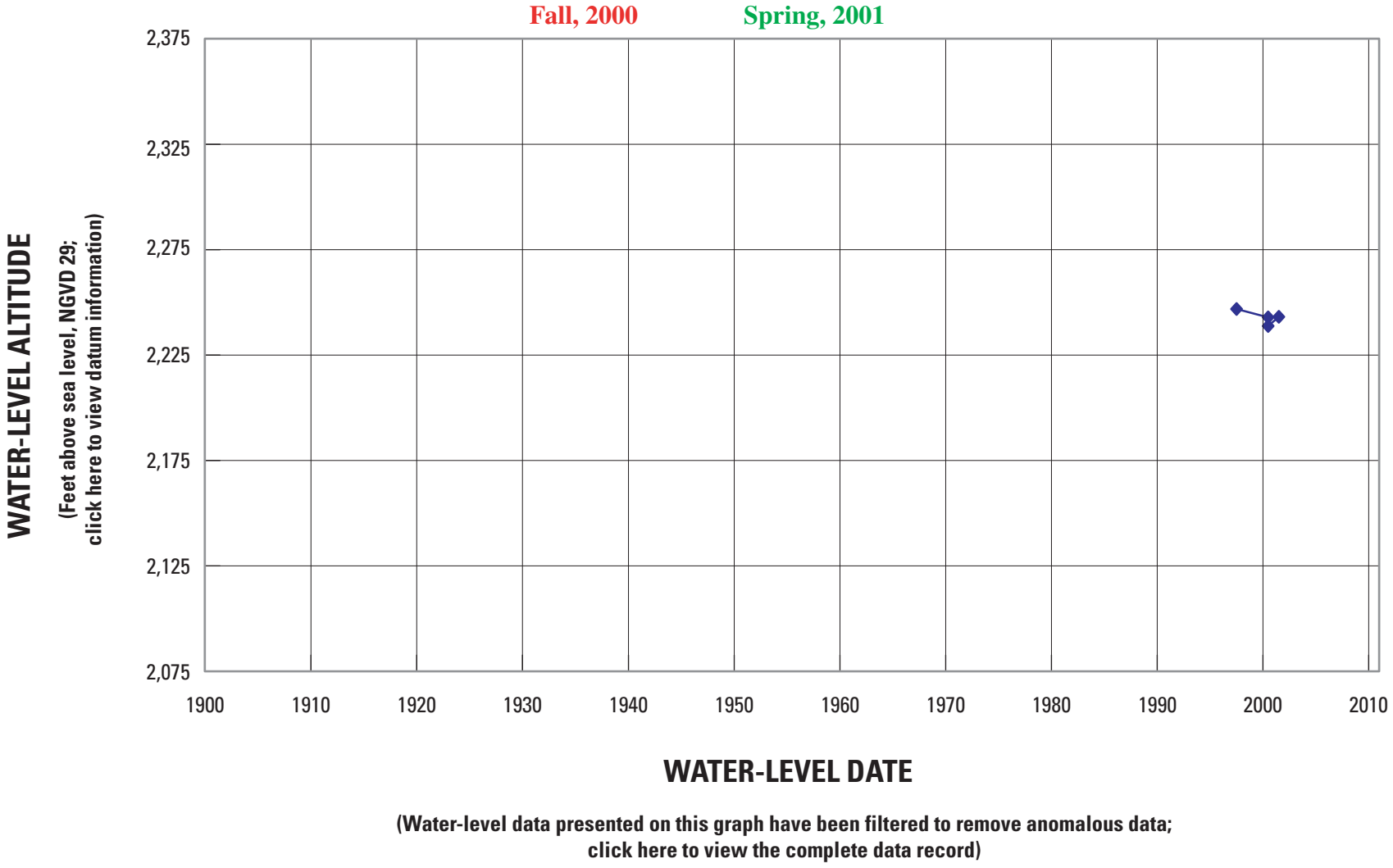
(Click here to view well location)



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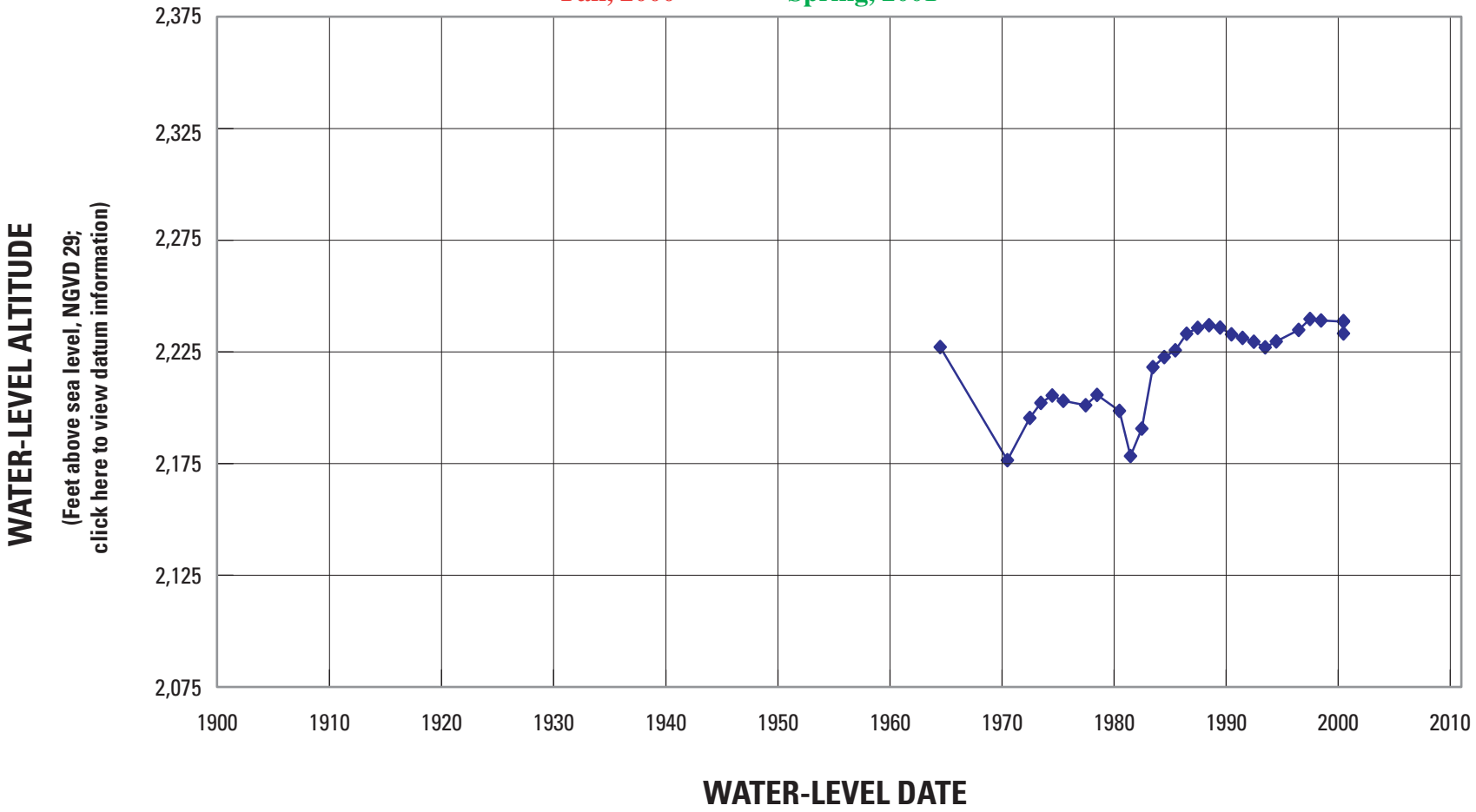
Fall, 2000 Spring, 2001



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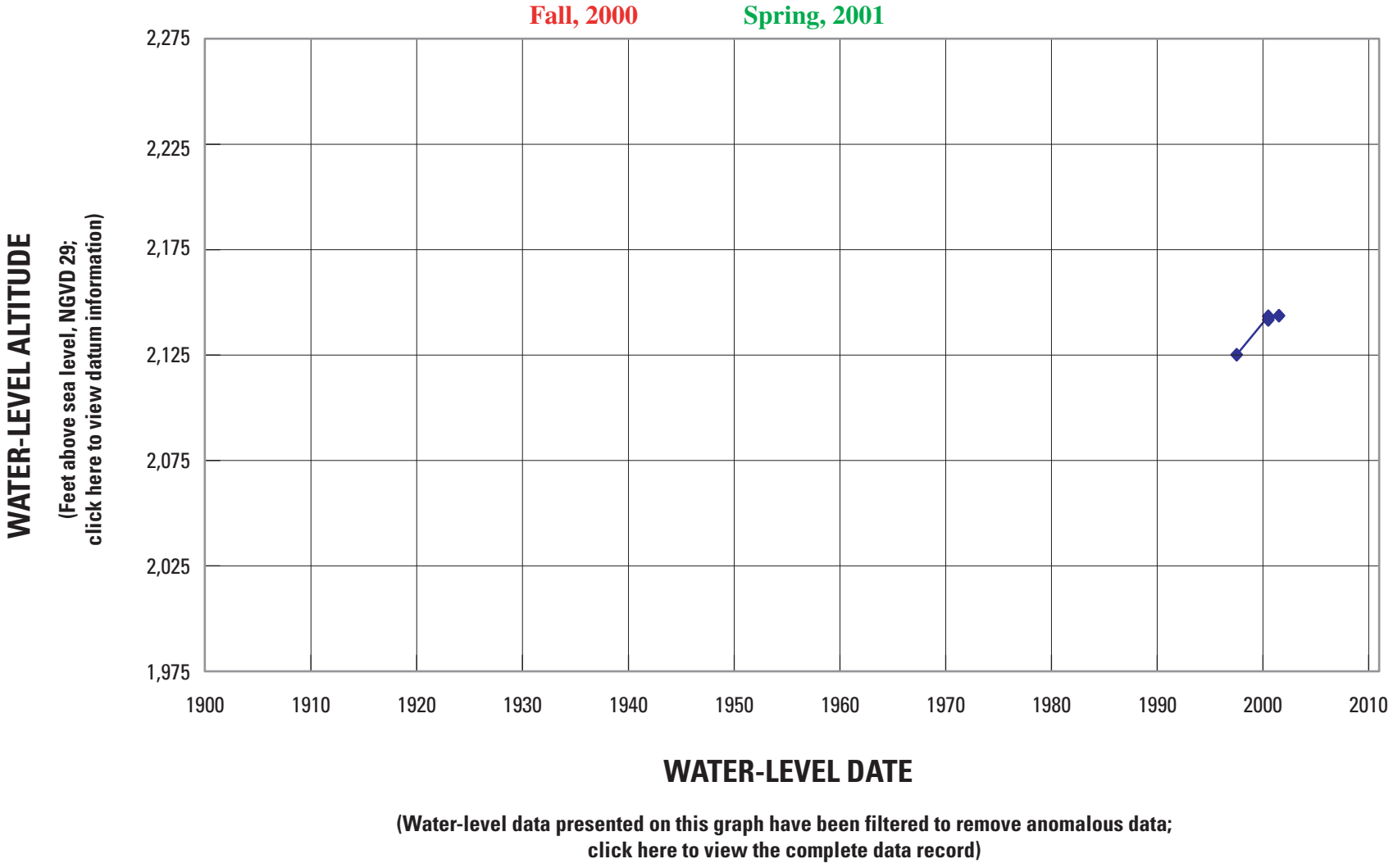

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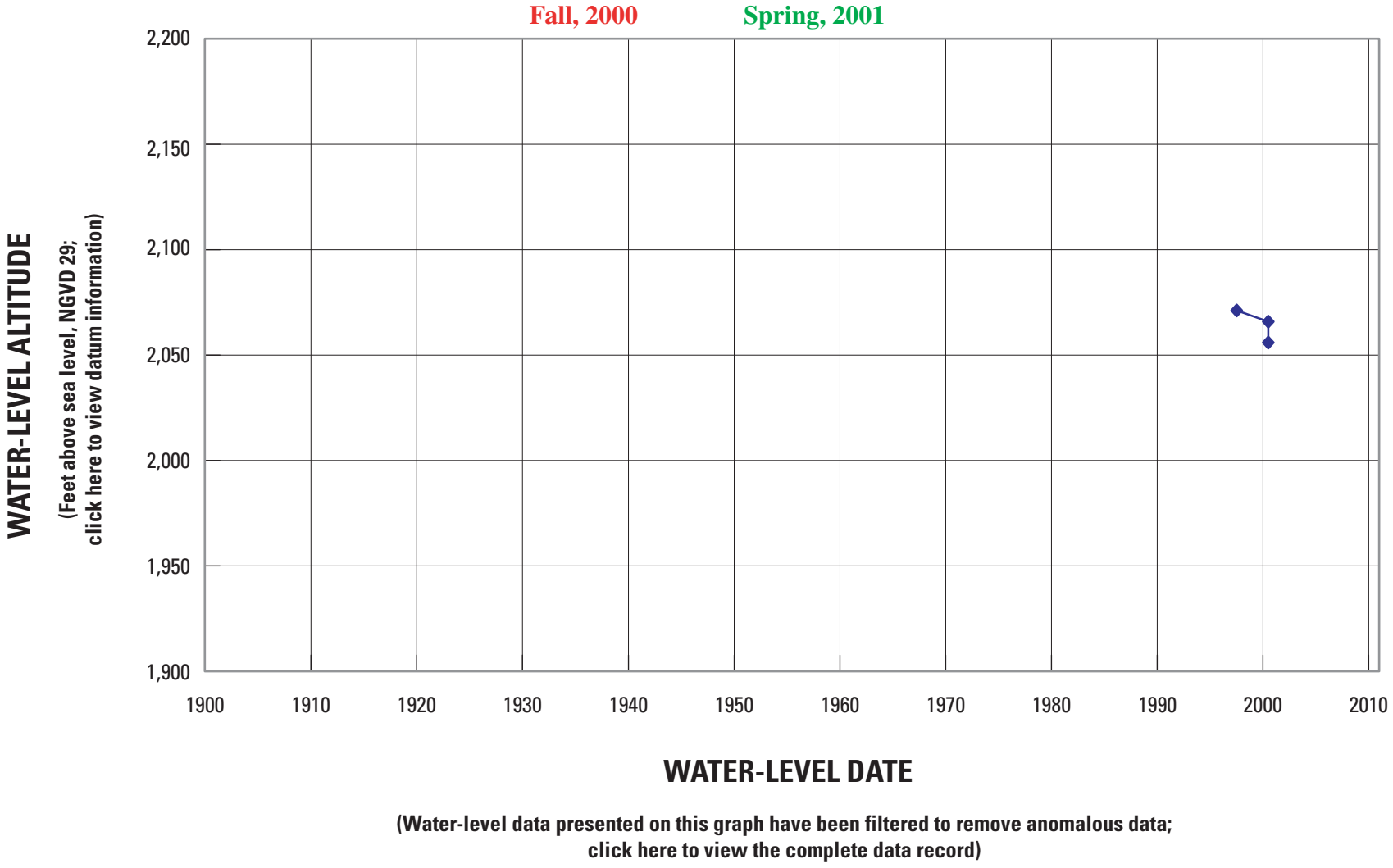

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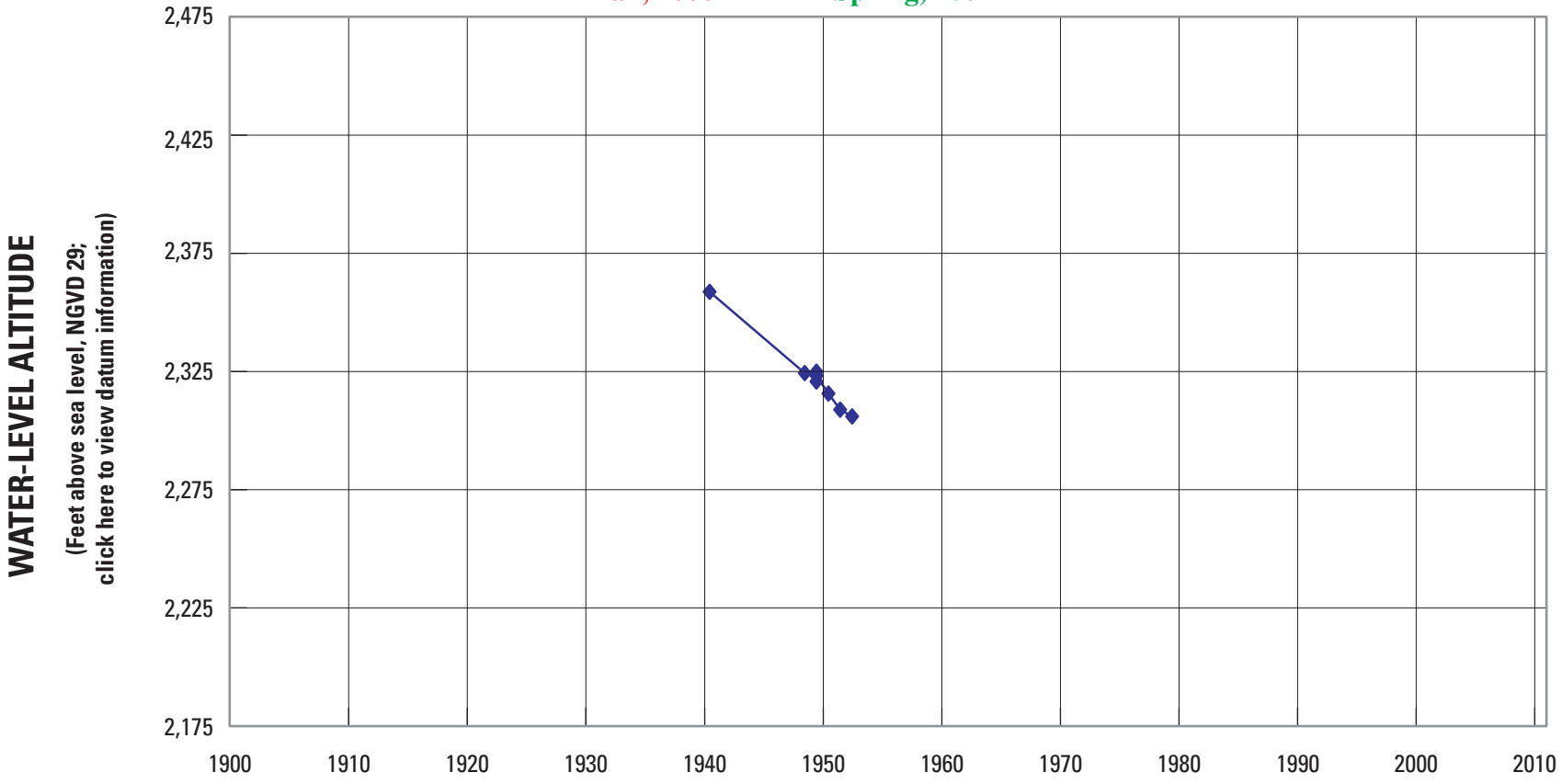

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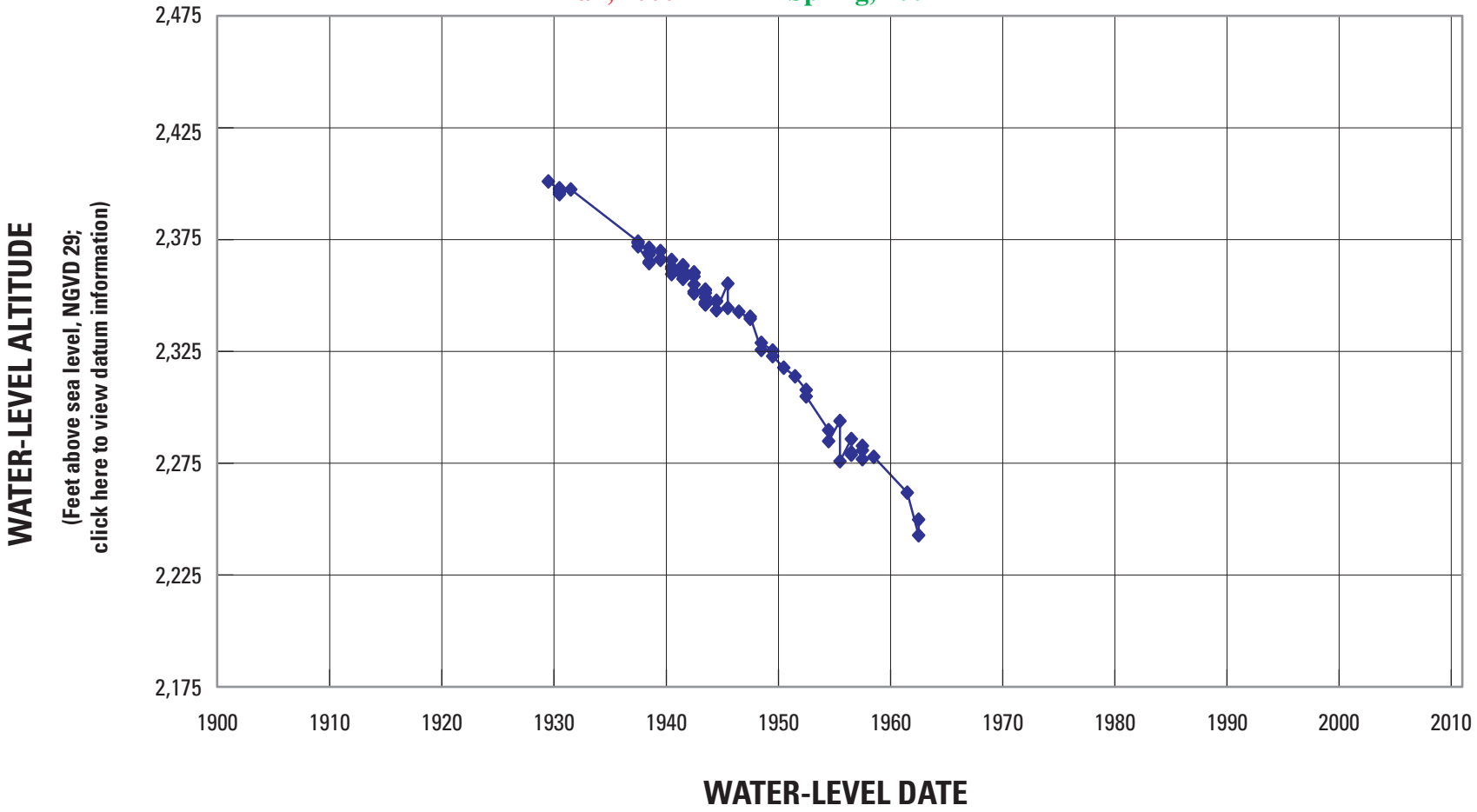
Fall, 2000 Spring, 2001



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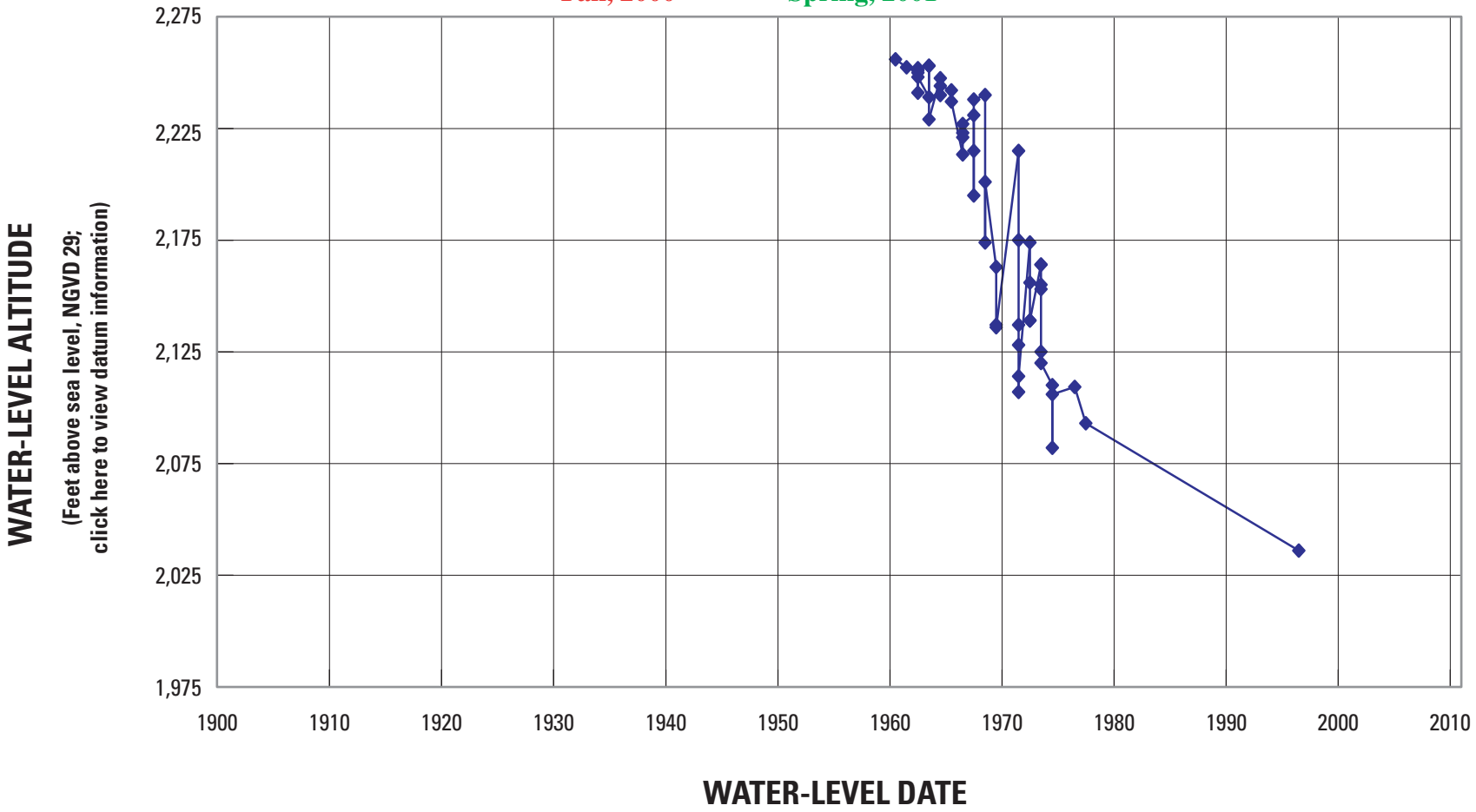
Fall, 2000 Spring, 2001



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006N011W19E003S

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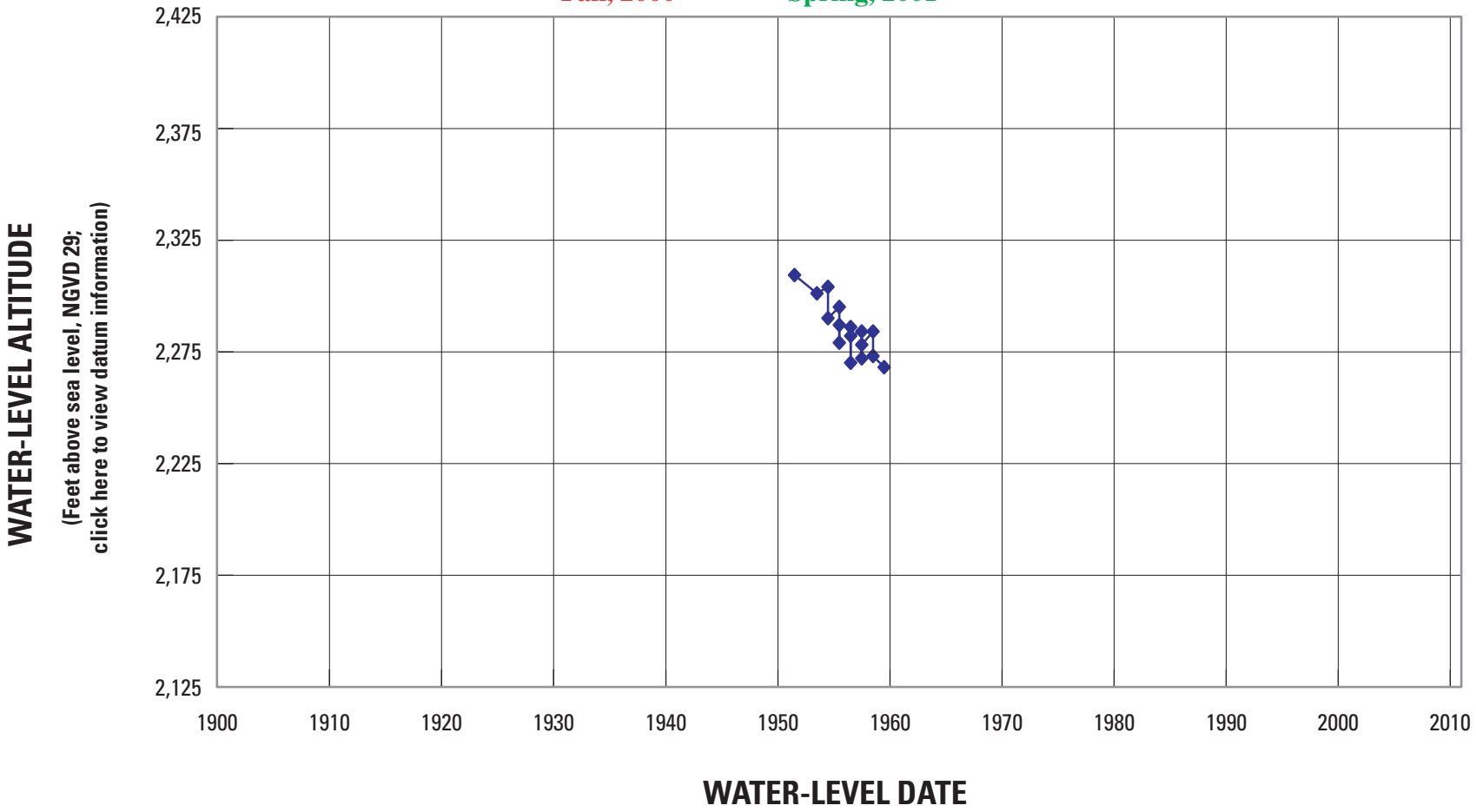
Fall, 2000 Spring, 2001



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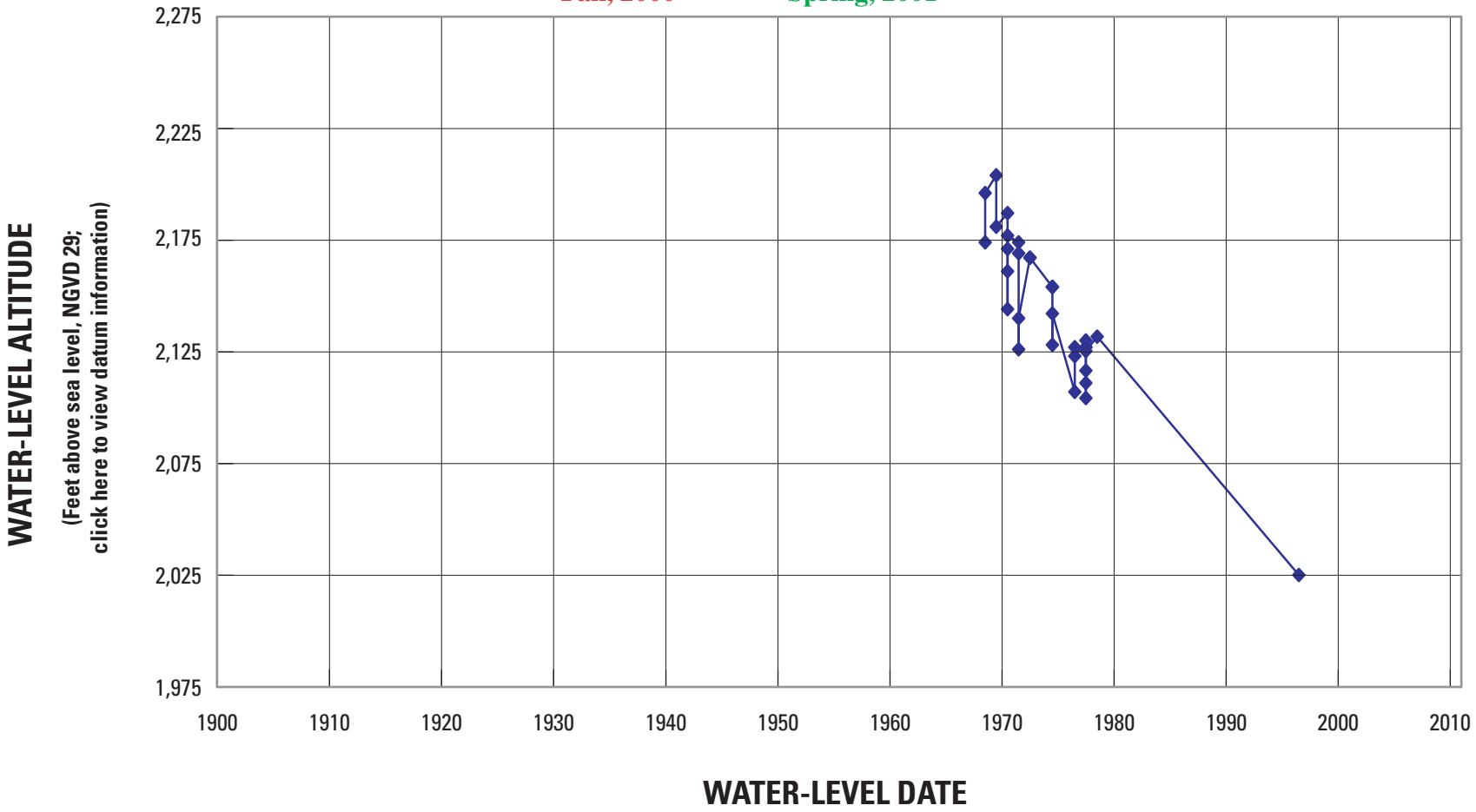

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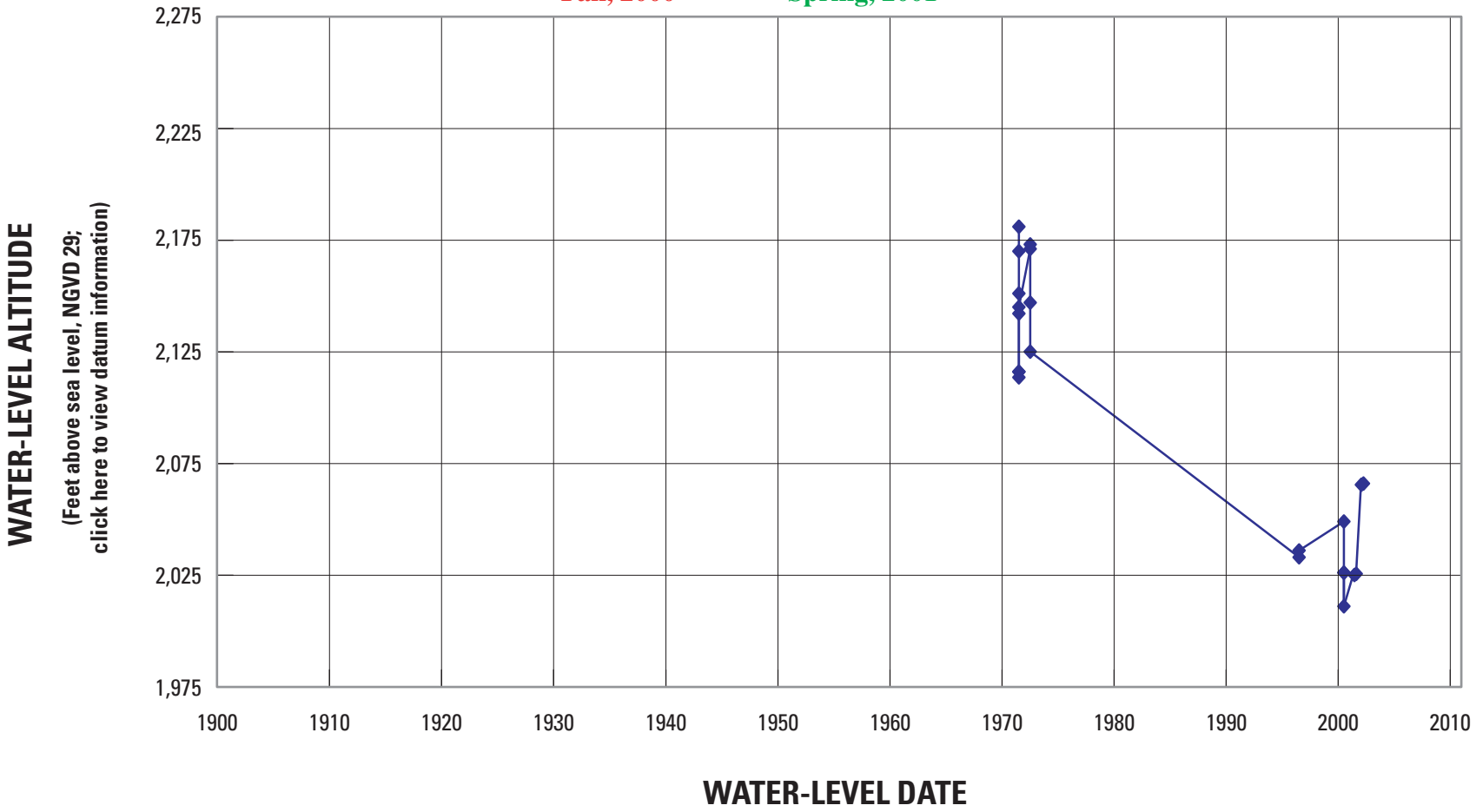
Fall, 2000 Spring, 2001



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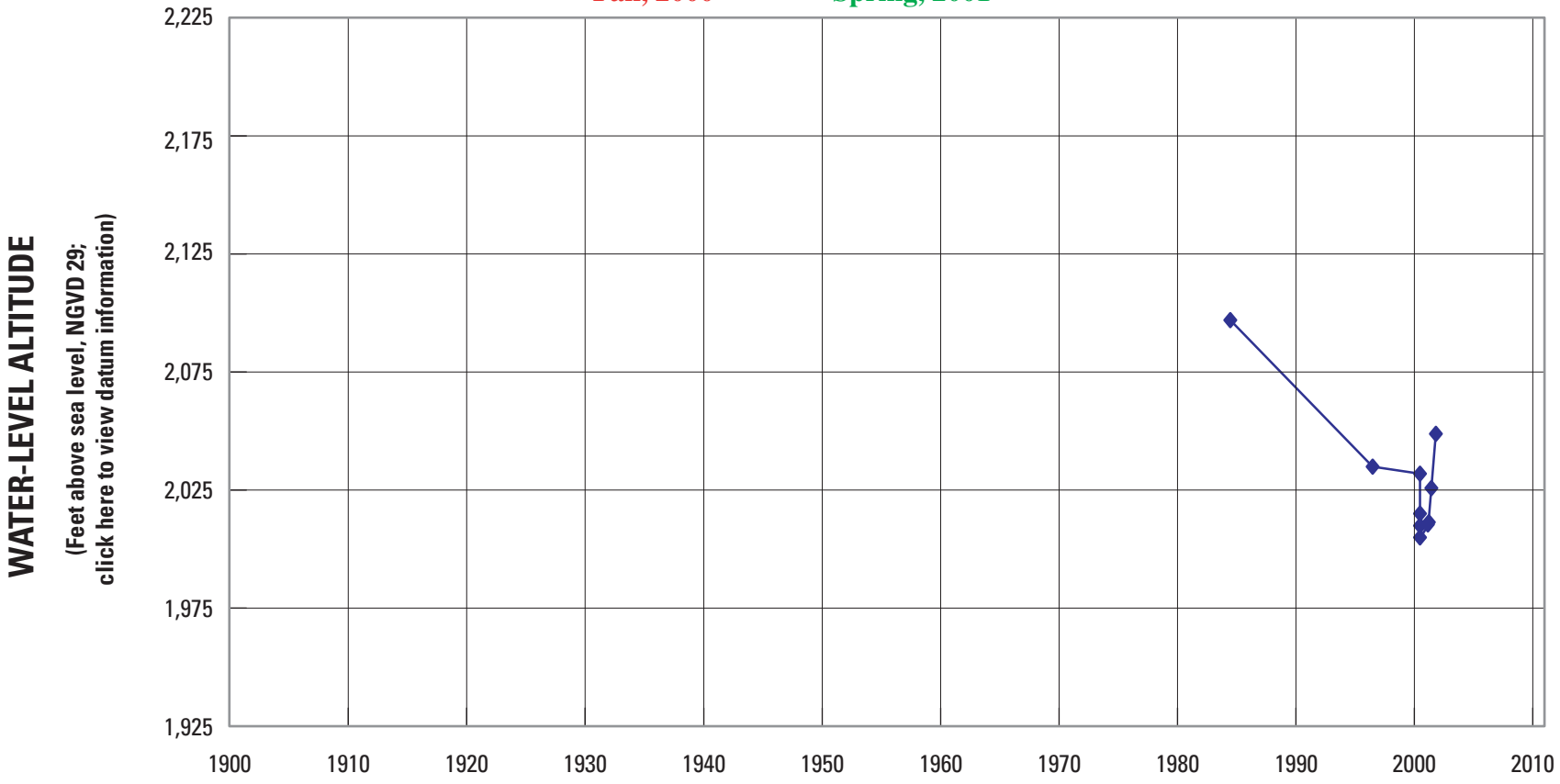

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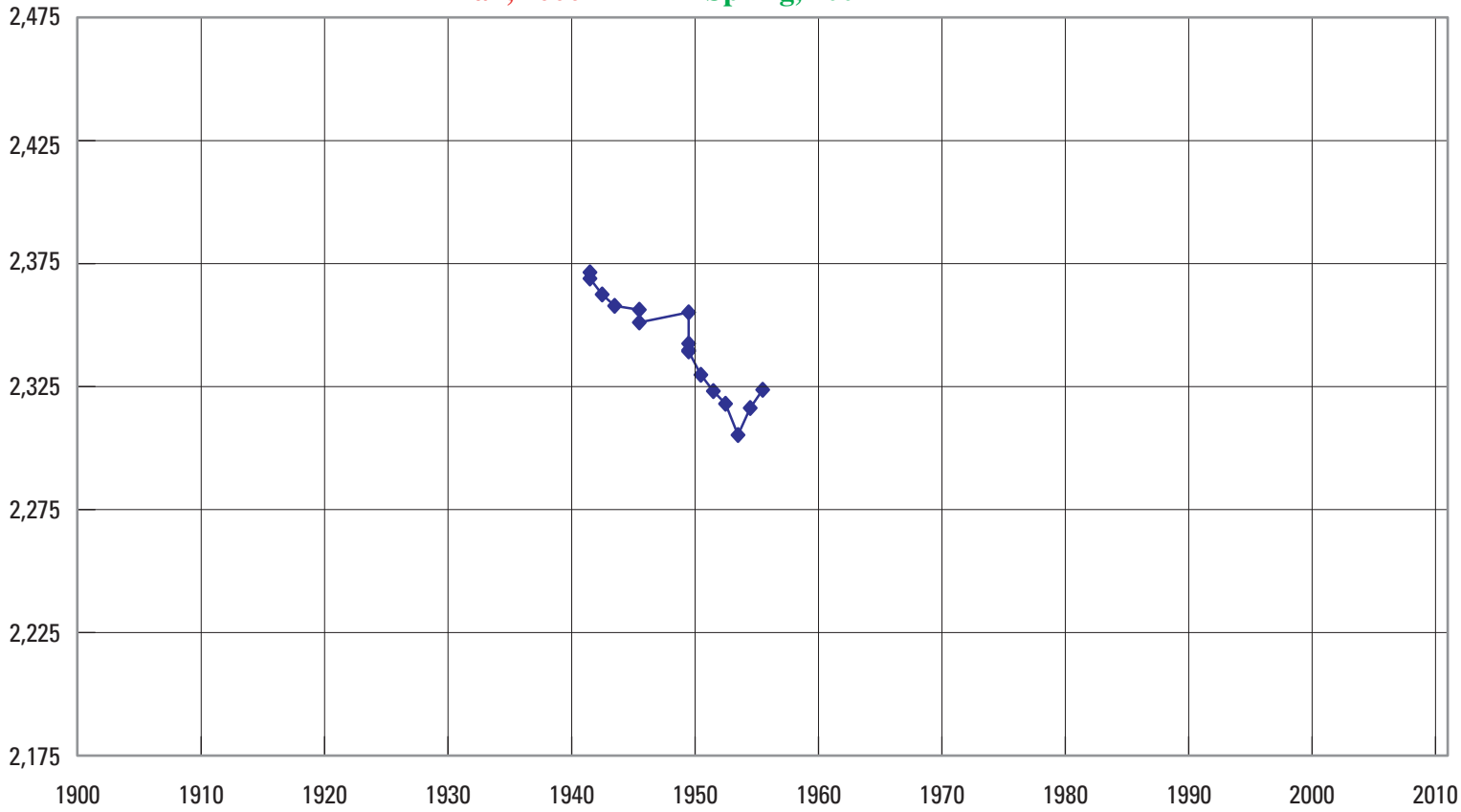


WATER-LEVEL ALTITUDE

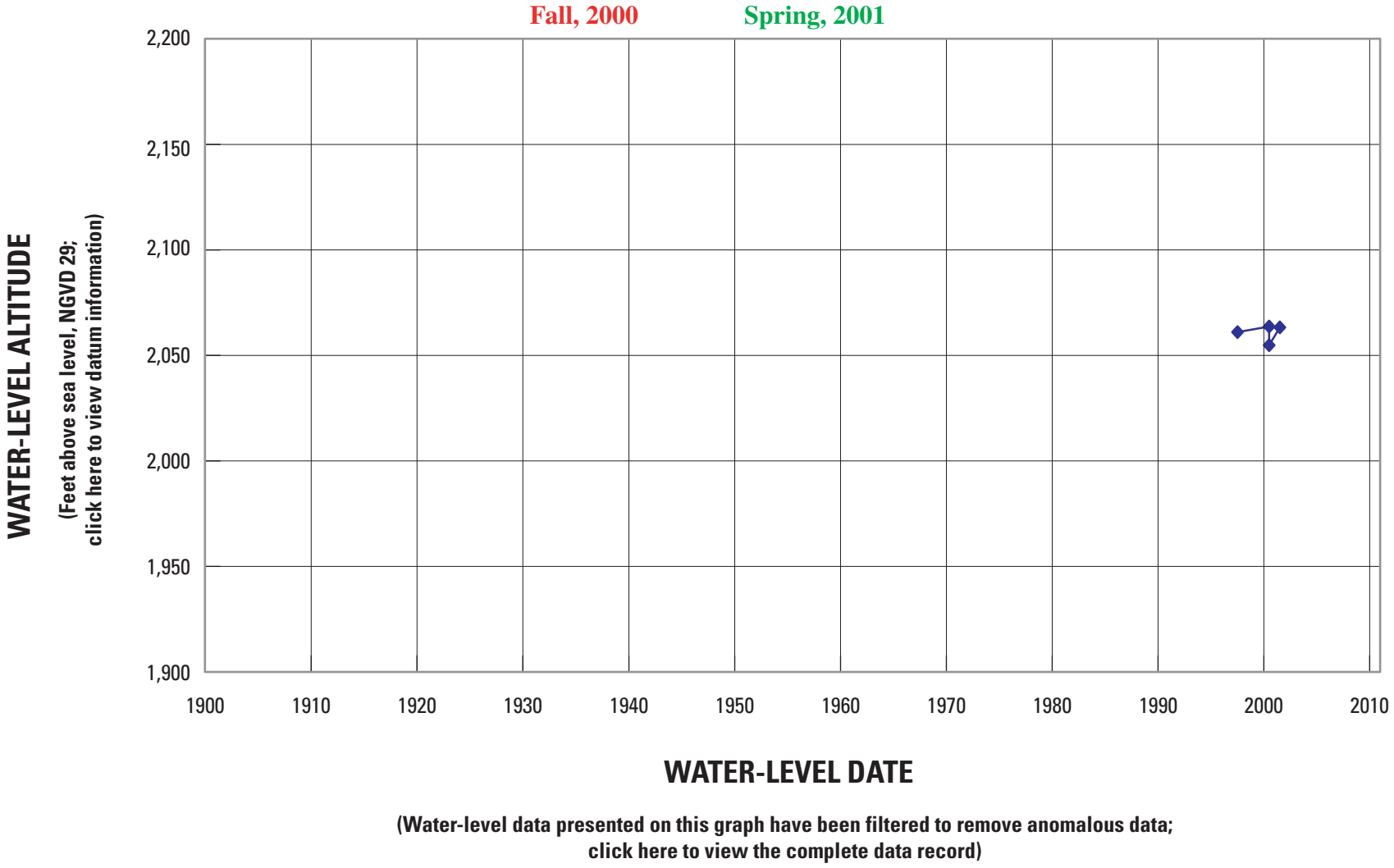
(Feet above sea level, NGVD 29; click here to view datum information)

WATER-LEVEL DATE

(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

006N011W20D001S

(Click here to view well location)



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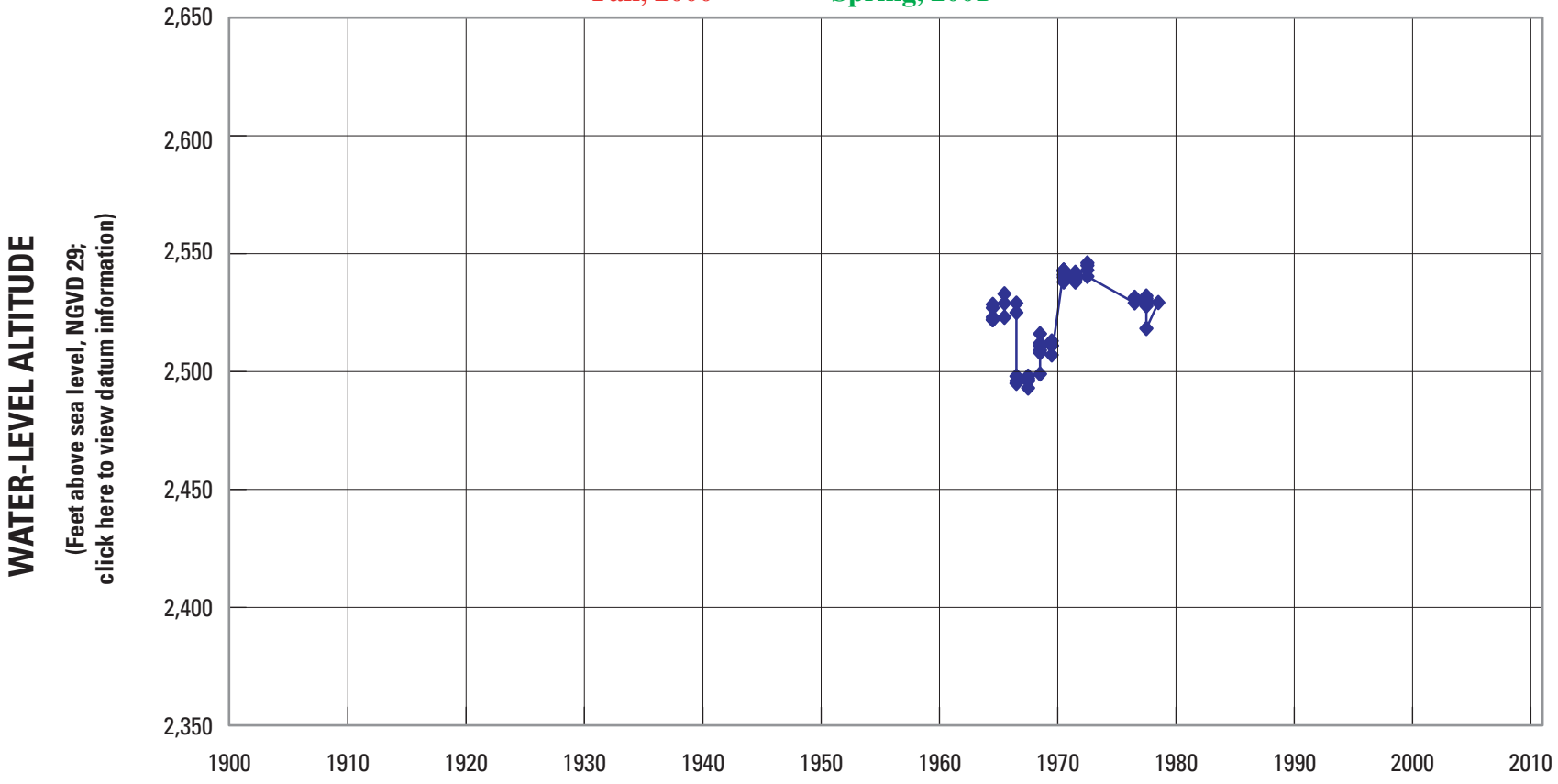
Fall, 2000 Spring, 2001



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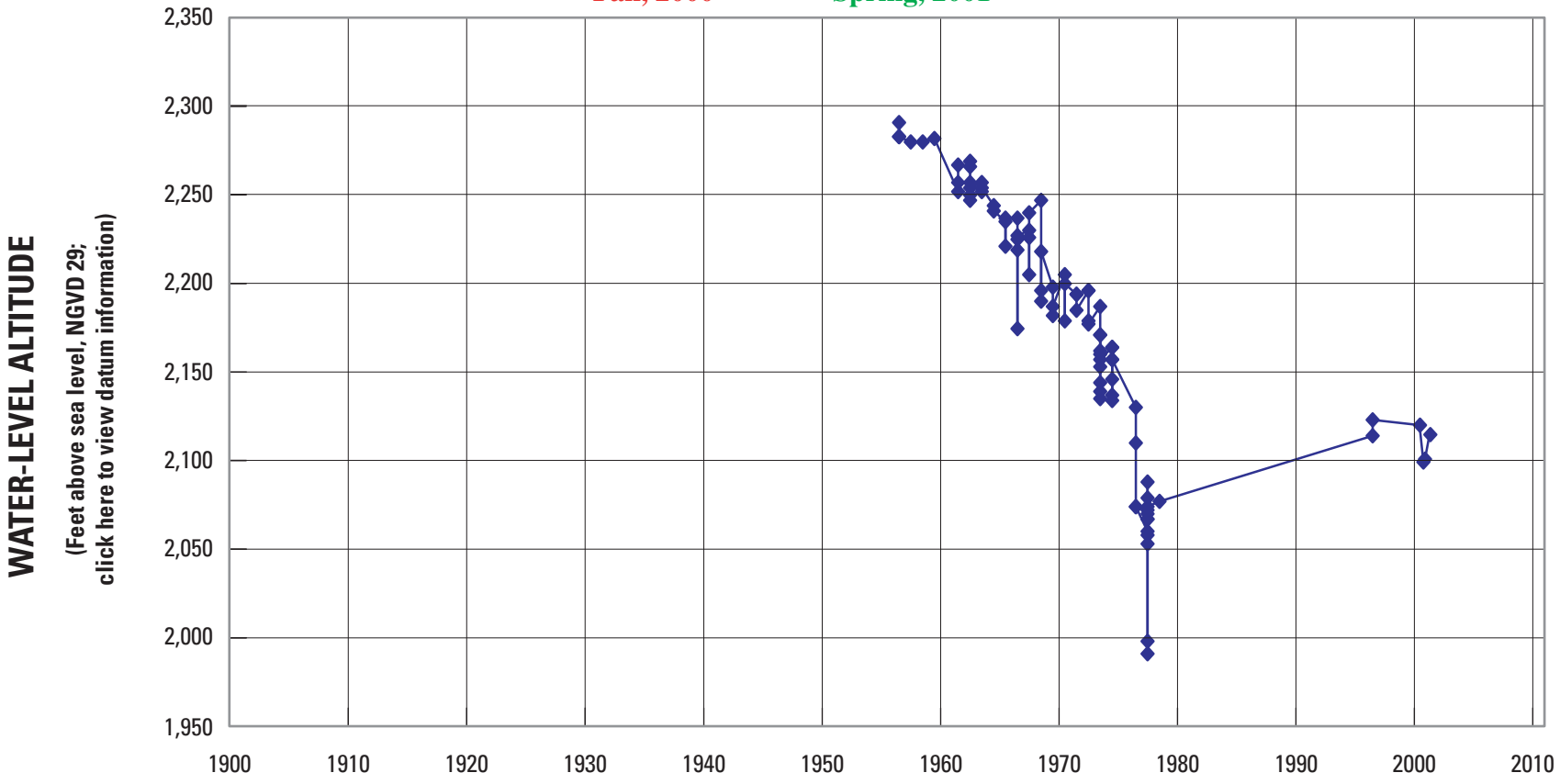

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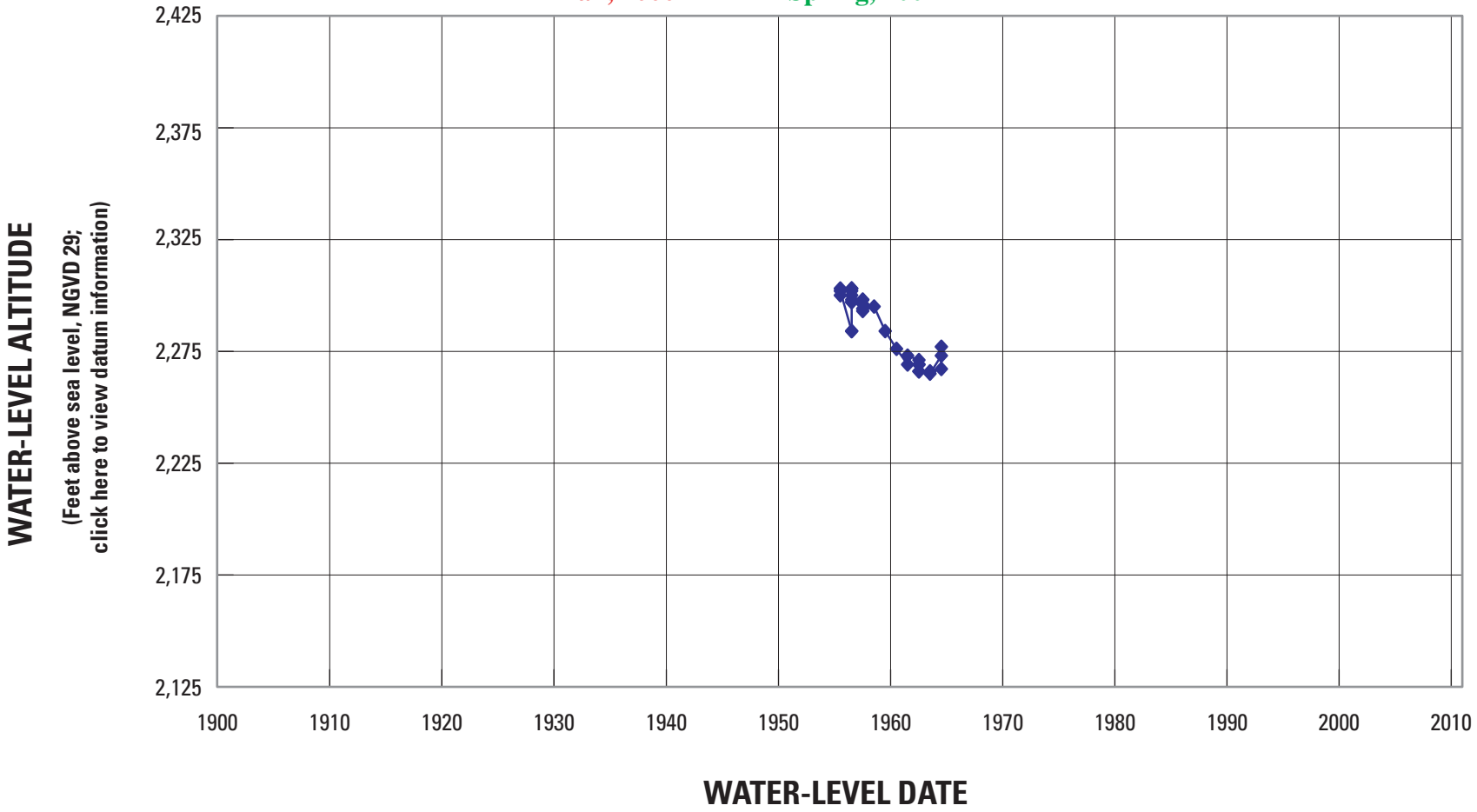

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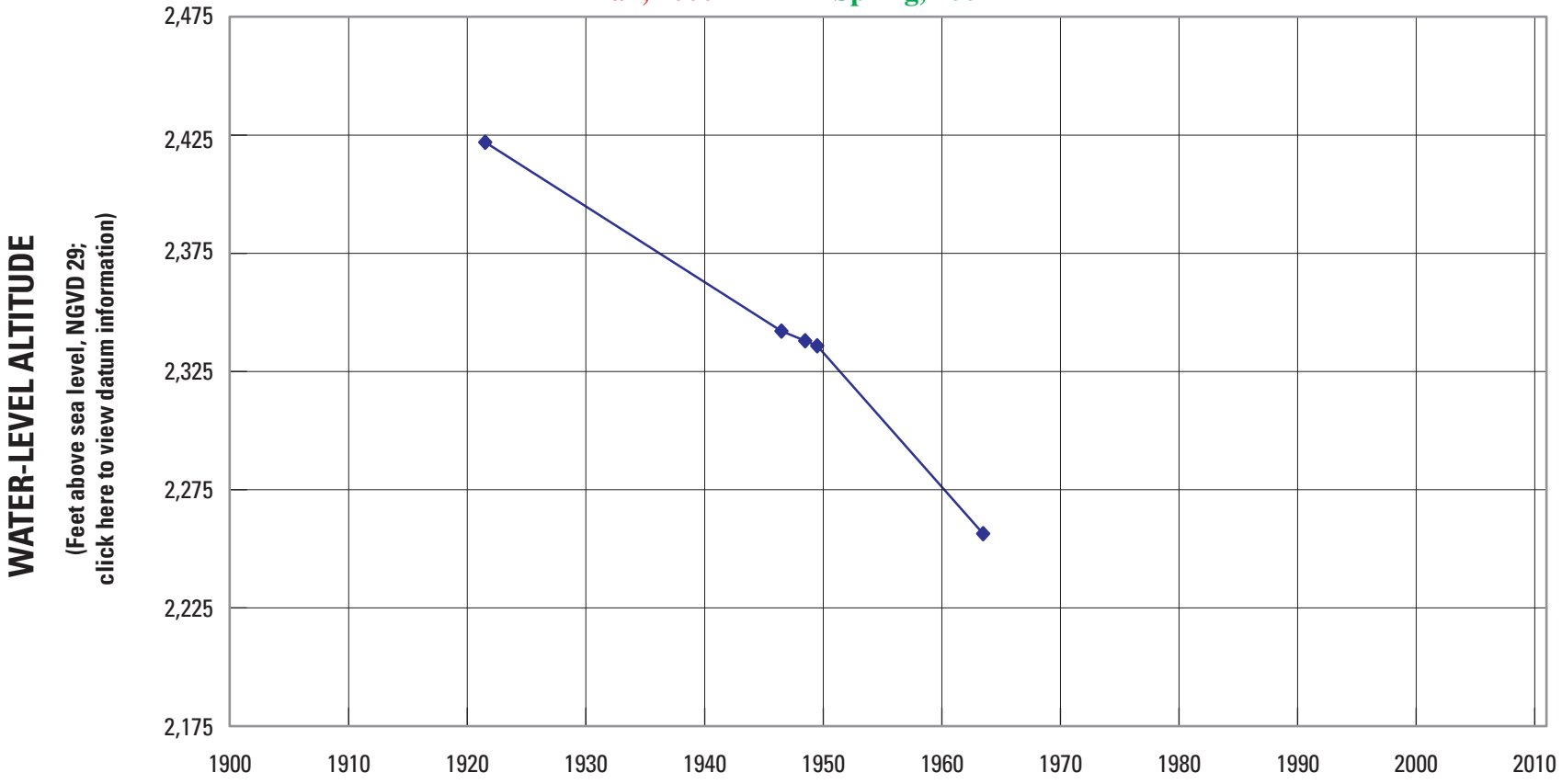
006N011W21C001S

(Click here to view well location)

Fall, 2000 Spring, 2001

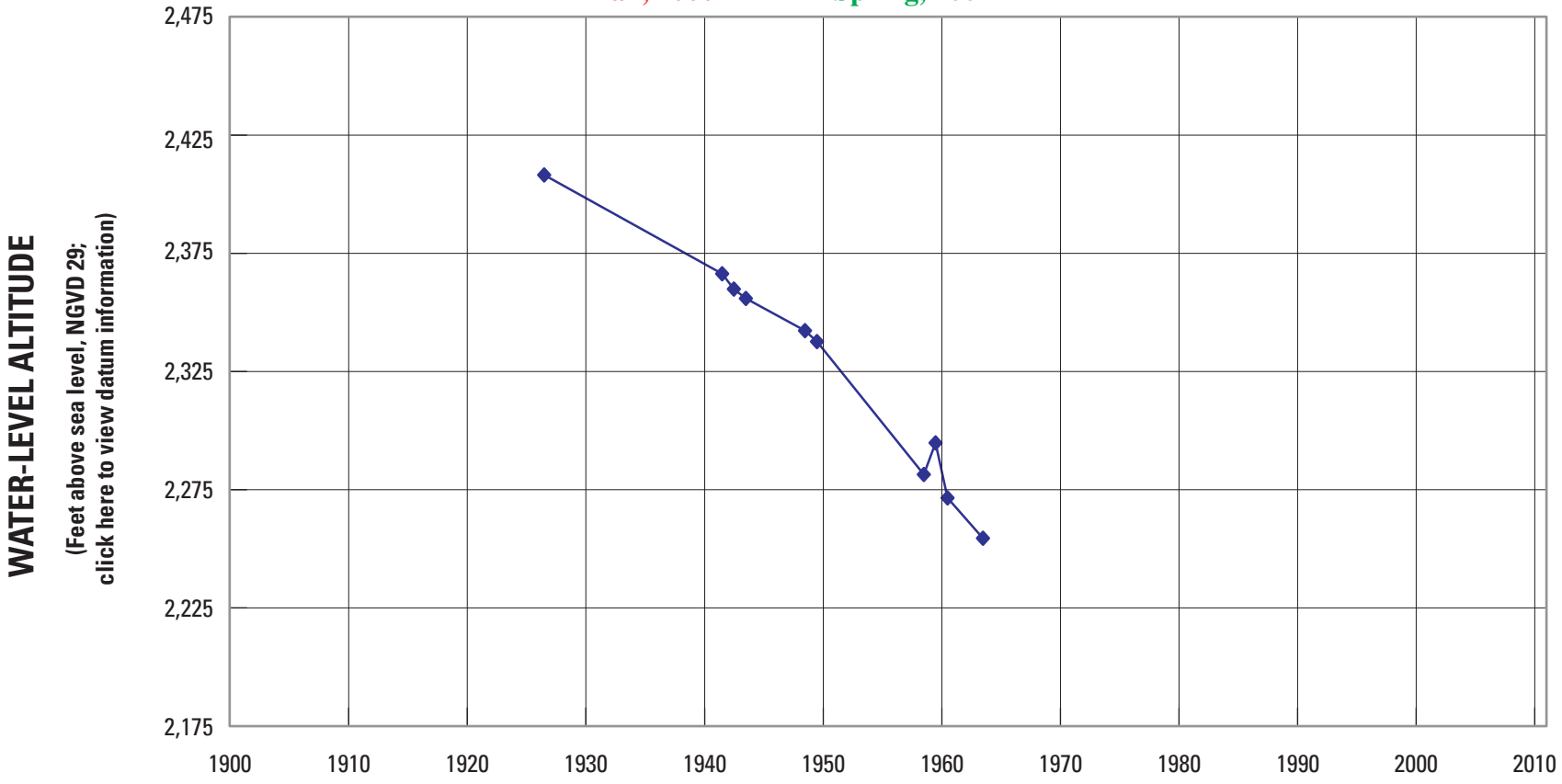


(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

006N011W21E001S

(Click here to view well location)

Fall, 2000 Spring, 2001



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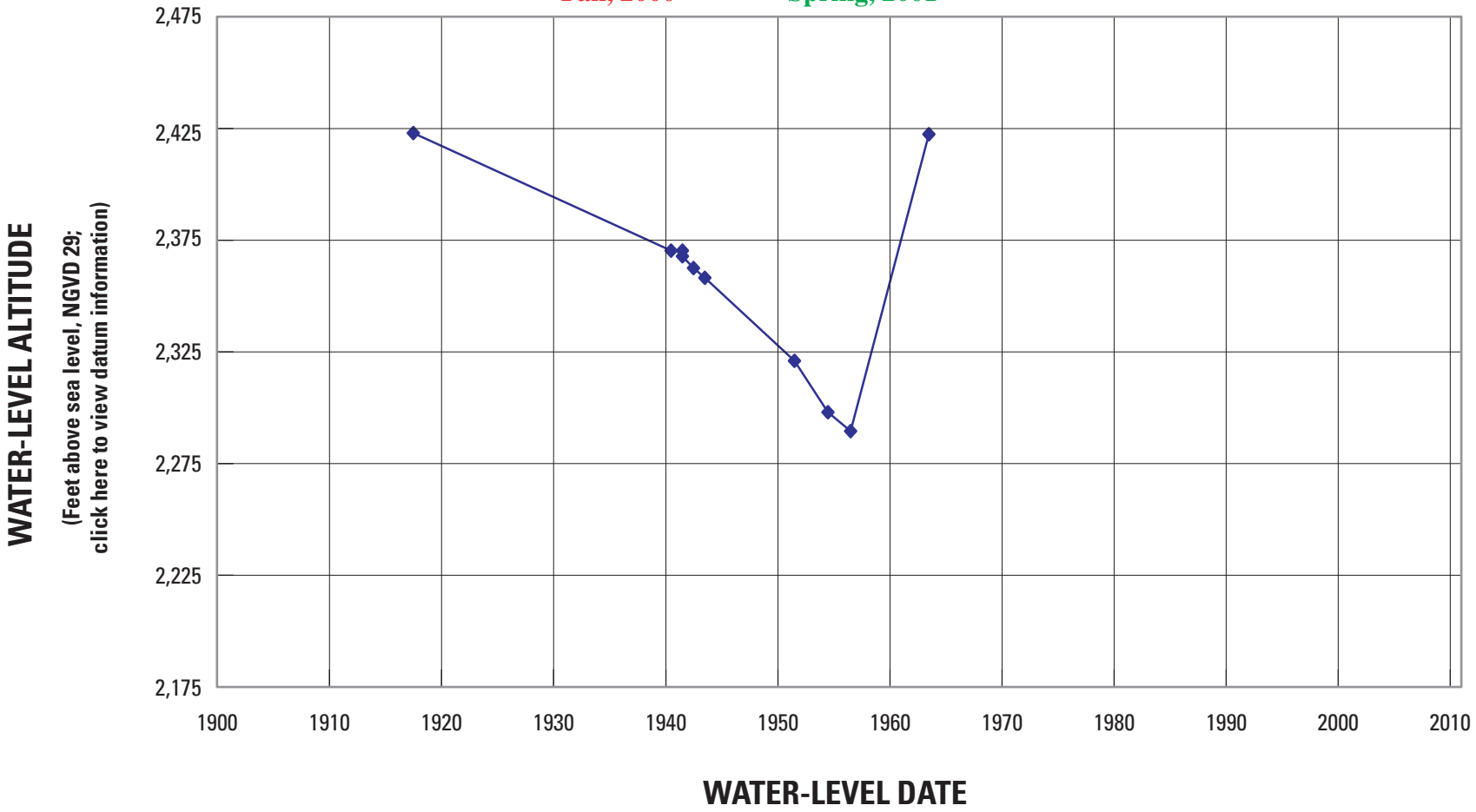
006N011W21N001S

(Click here to view well location)

Fall, 2000 Spring, 2001



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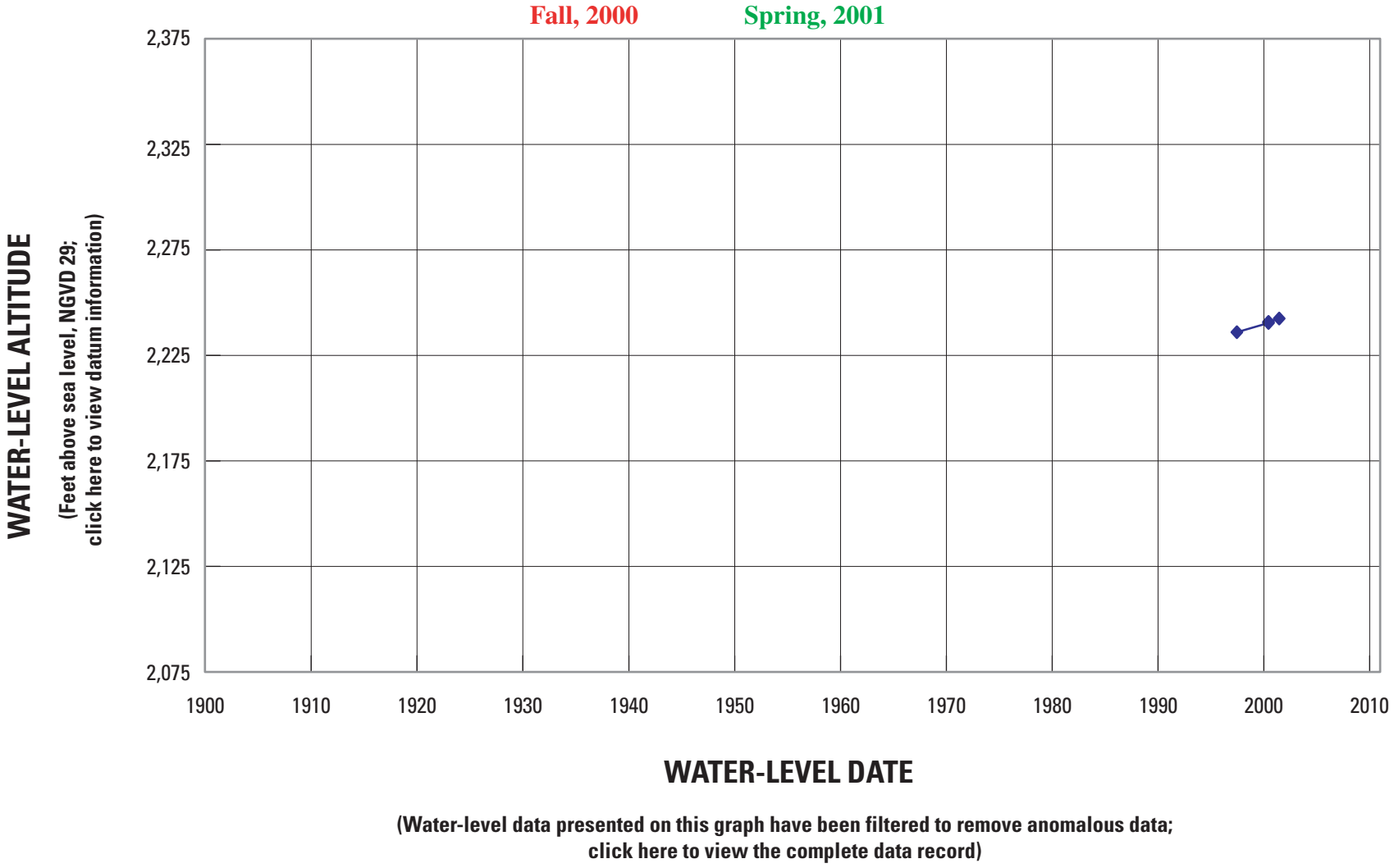

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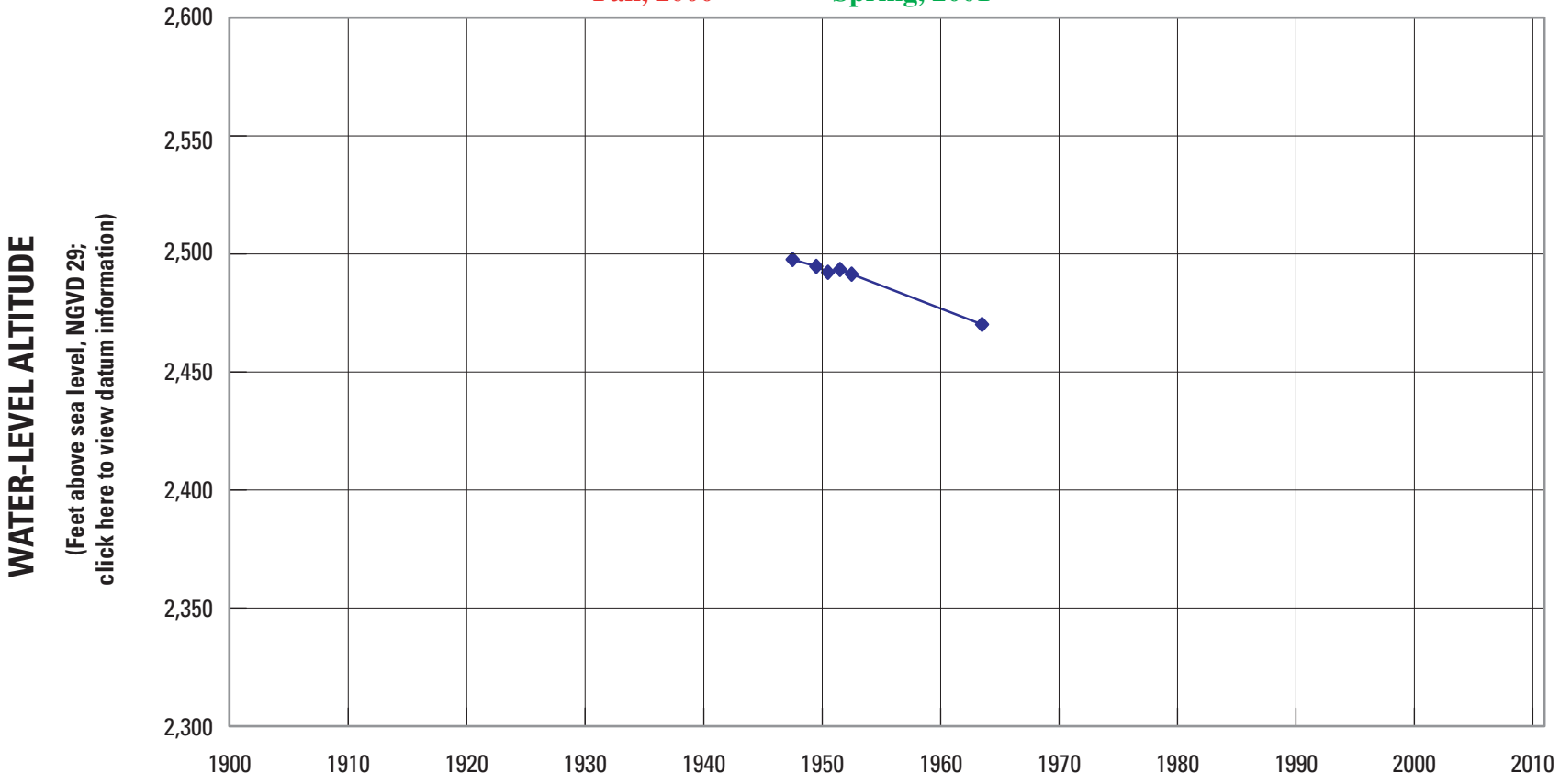
(Click here to view well location)

Fall, 2000 Spring, 2001



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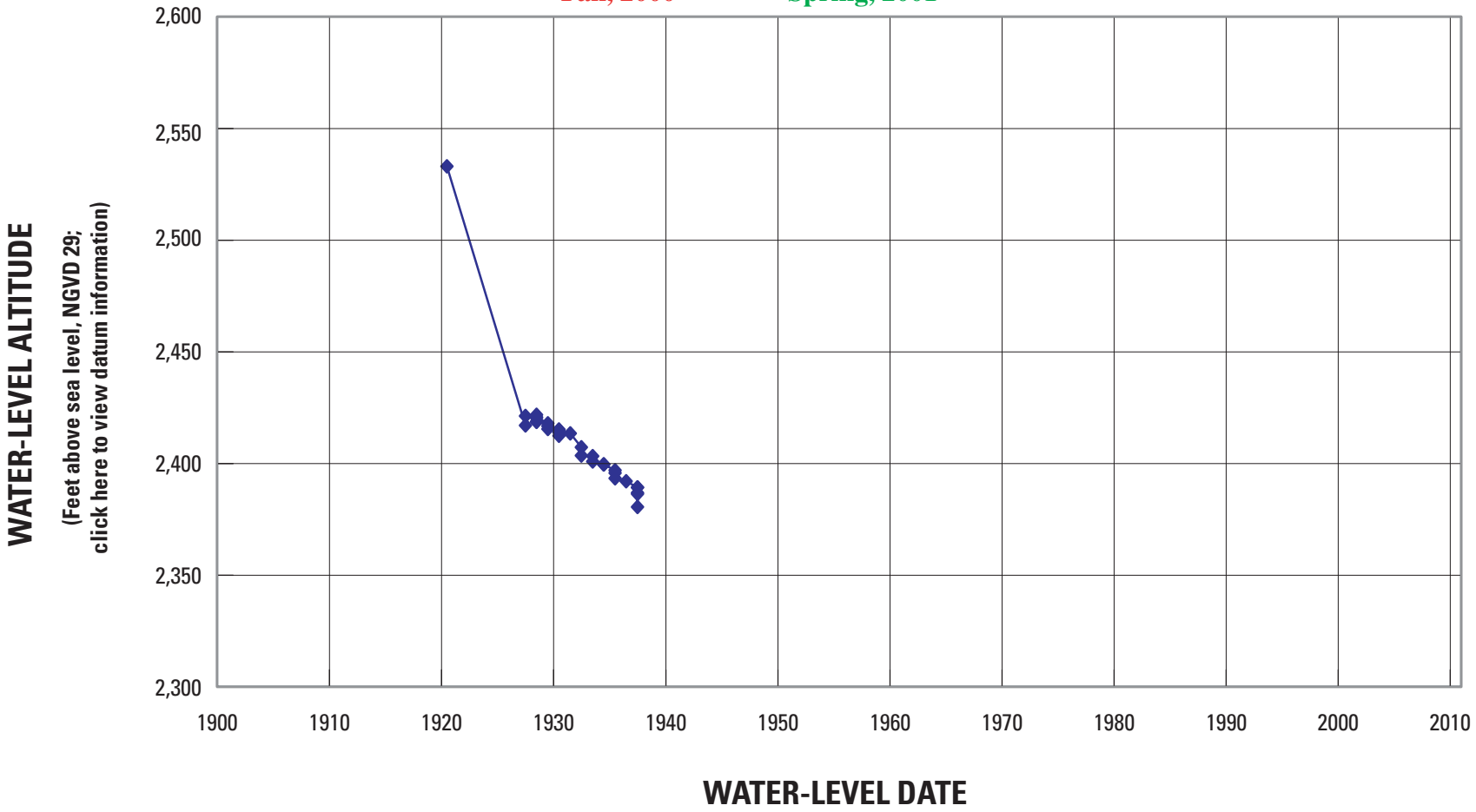
Fall, 2000 Spring, 2001



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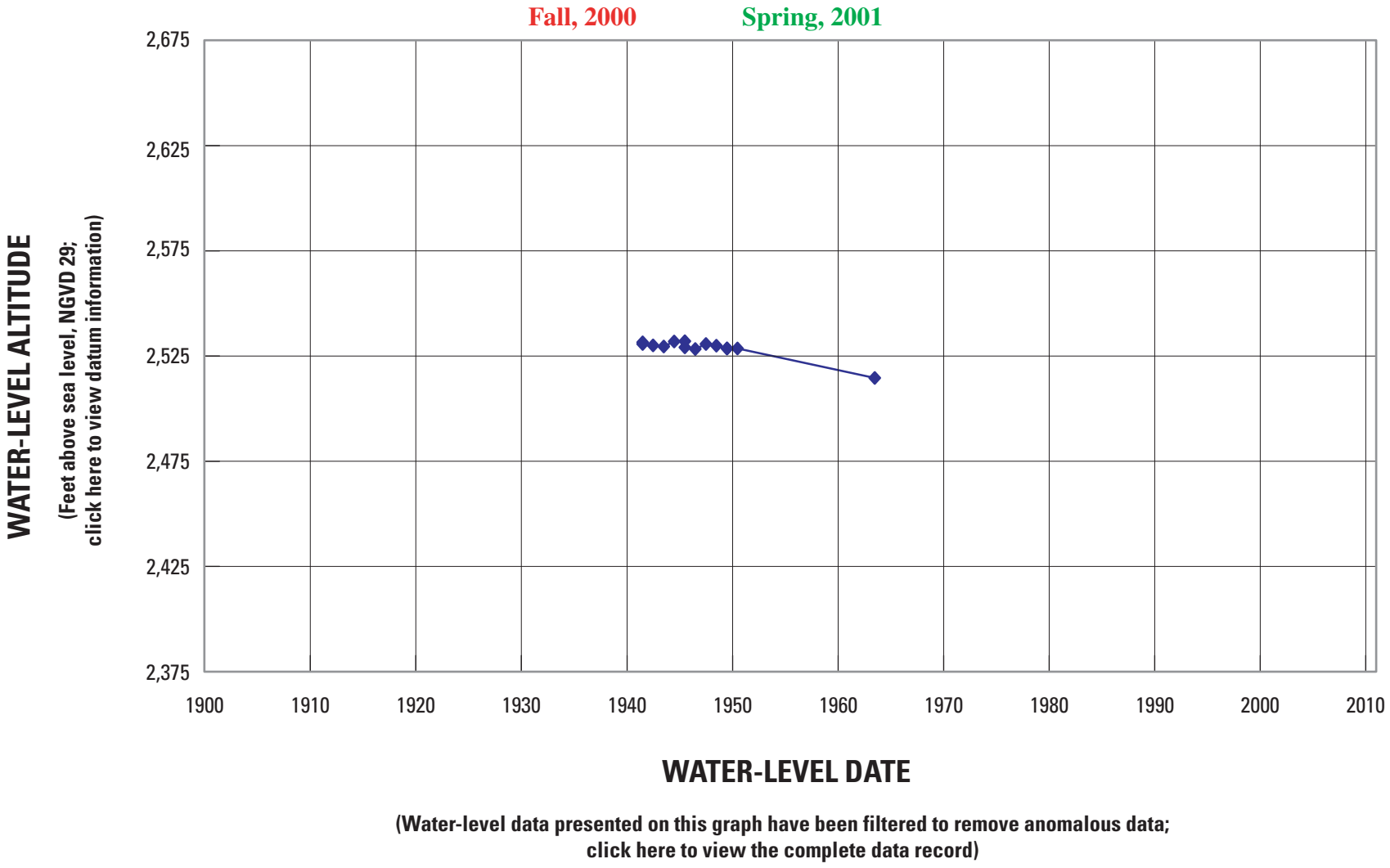

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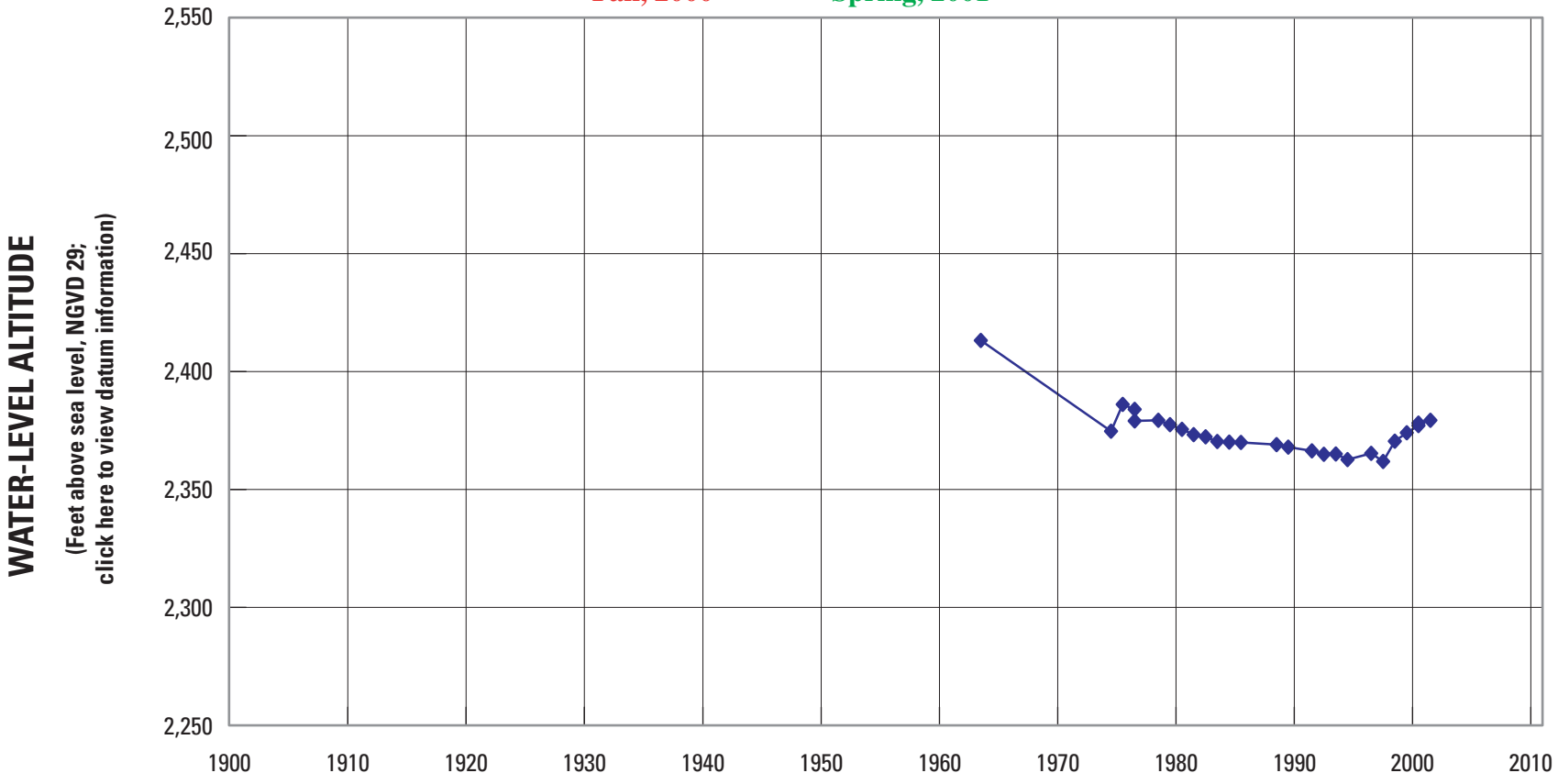
Fall, 2000 Spring, 2001



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006N012W01J001S

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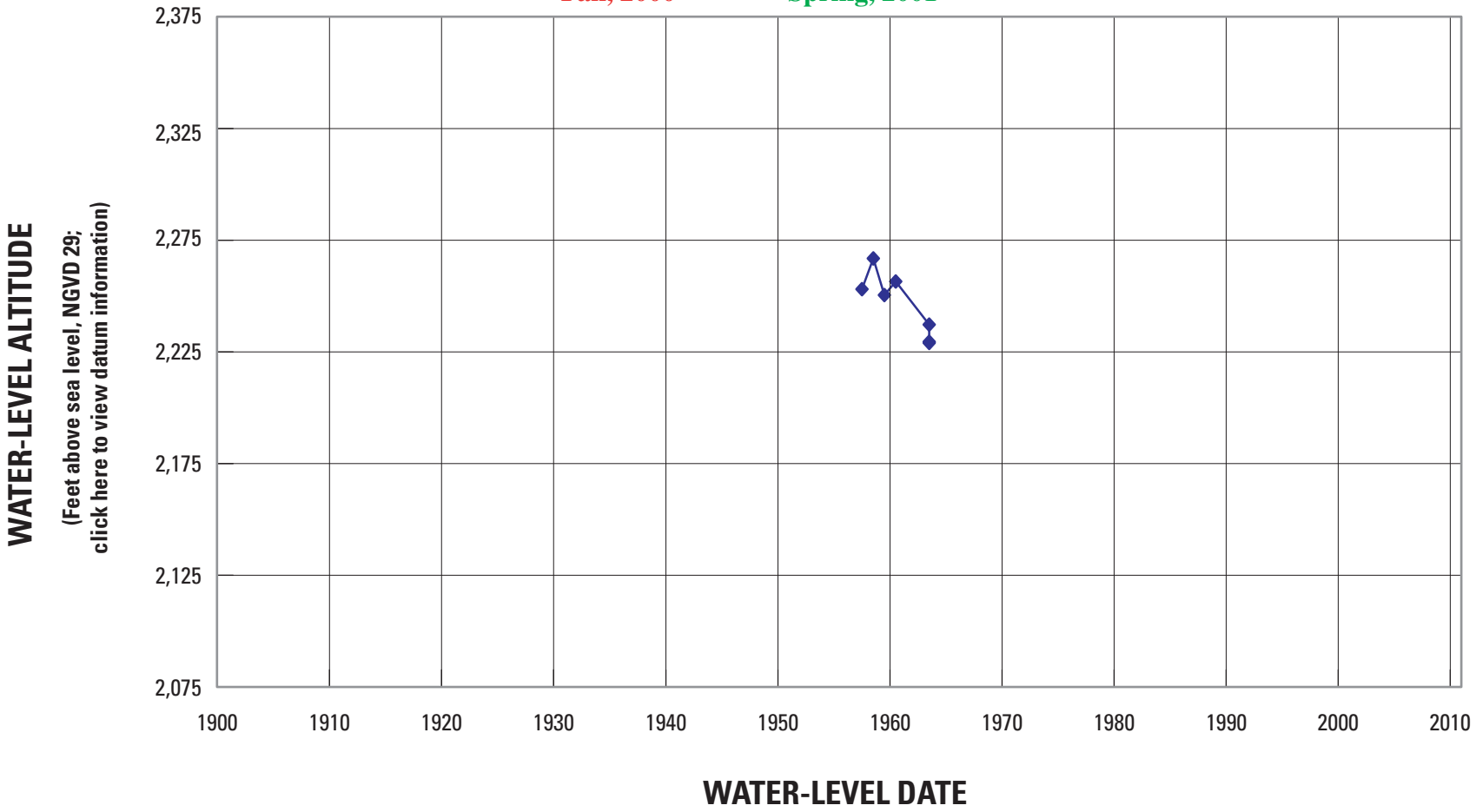
Fall, 2000 Spring, 2001



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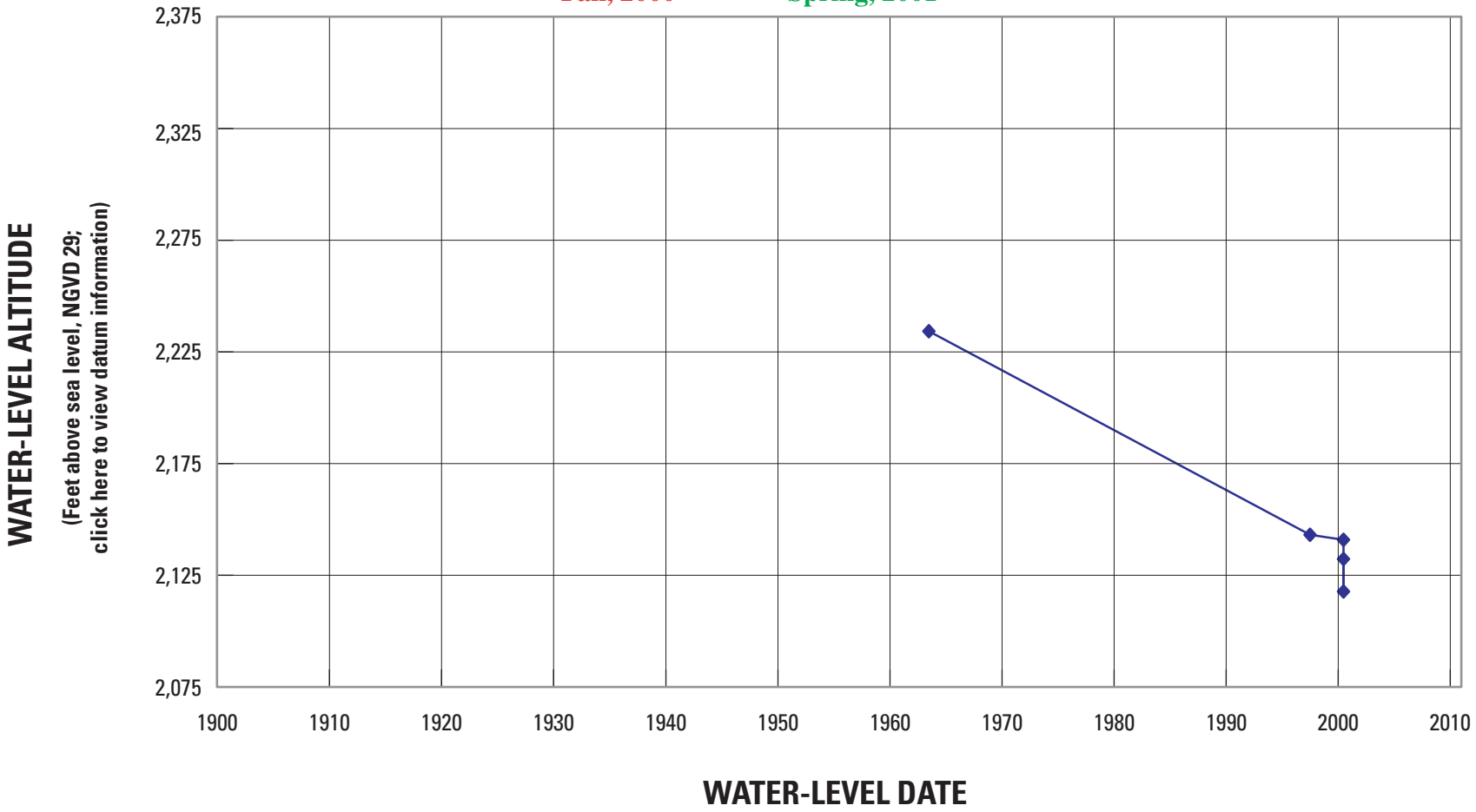

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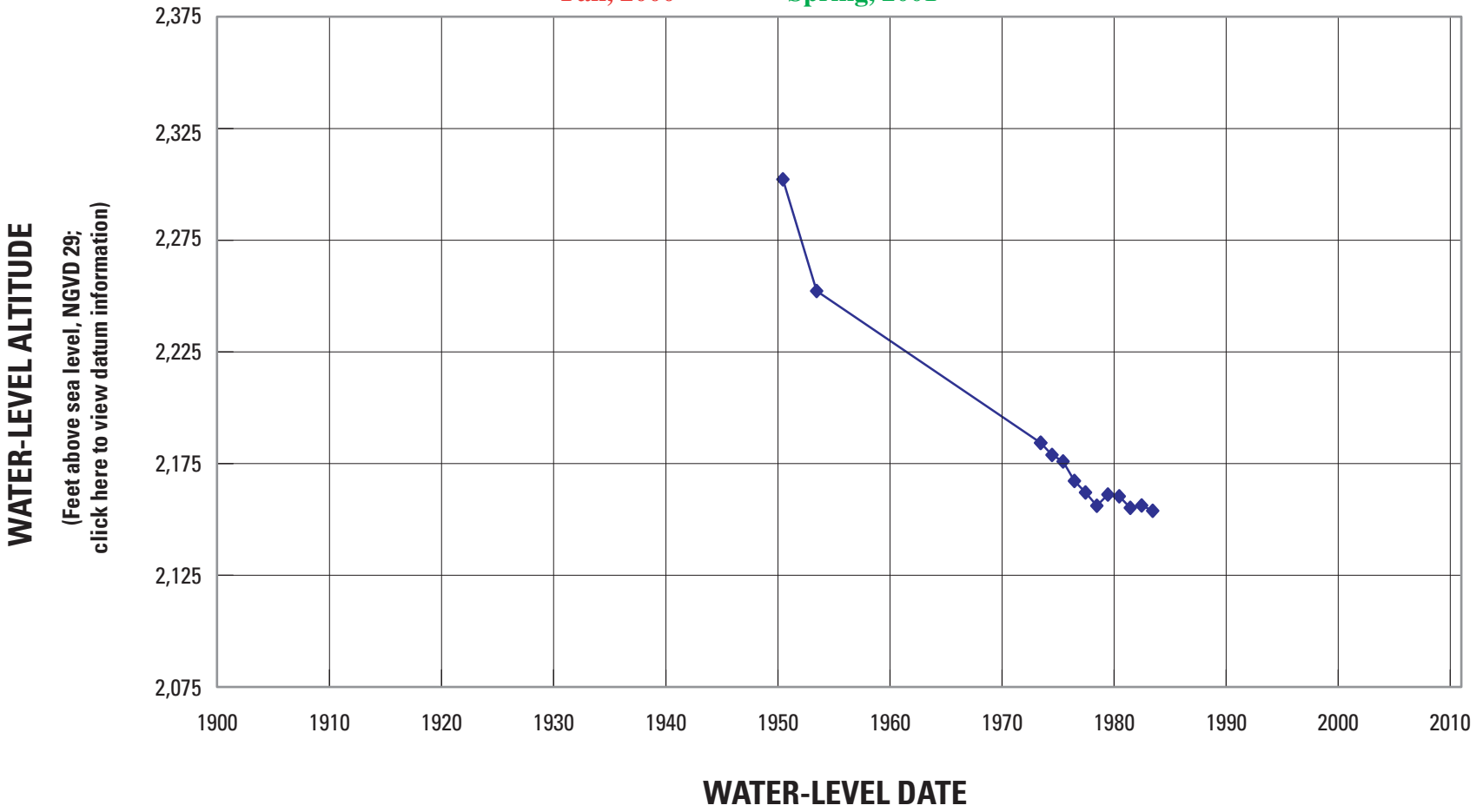
Fall, 2000 Spring, 2001



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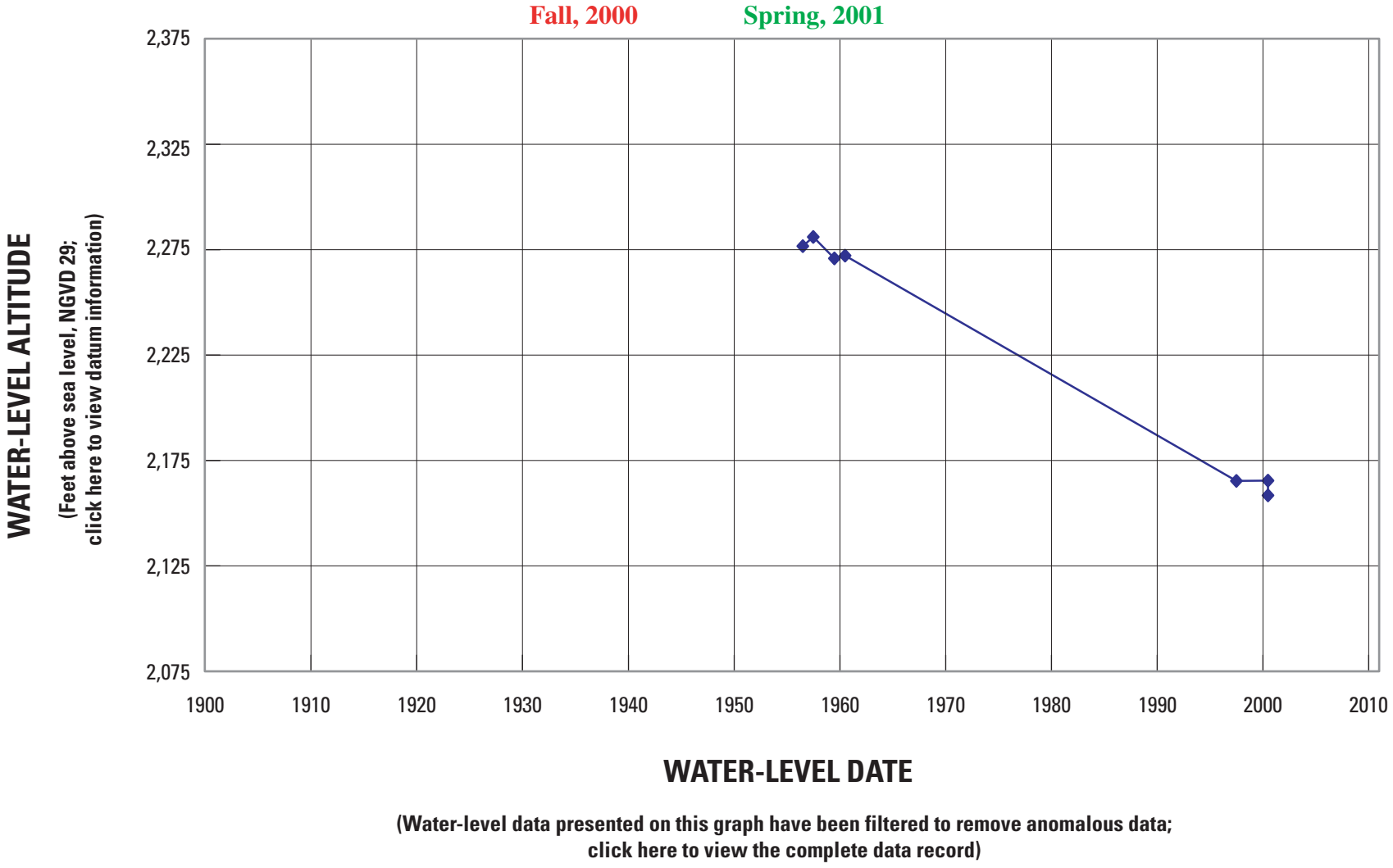

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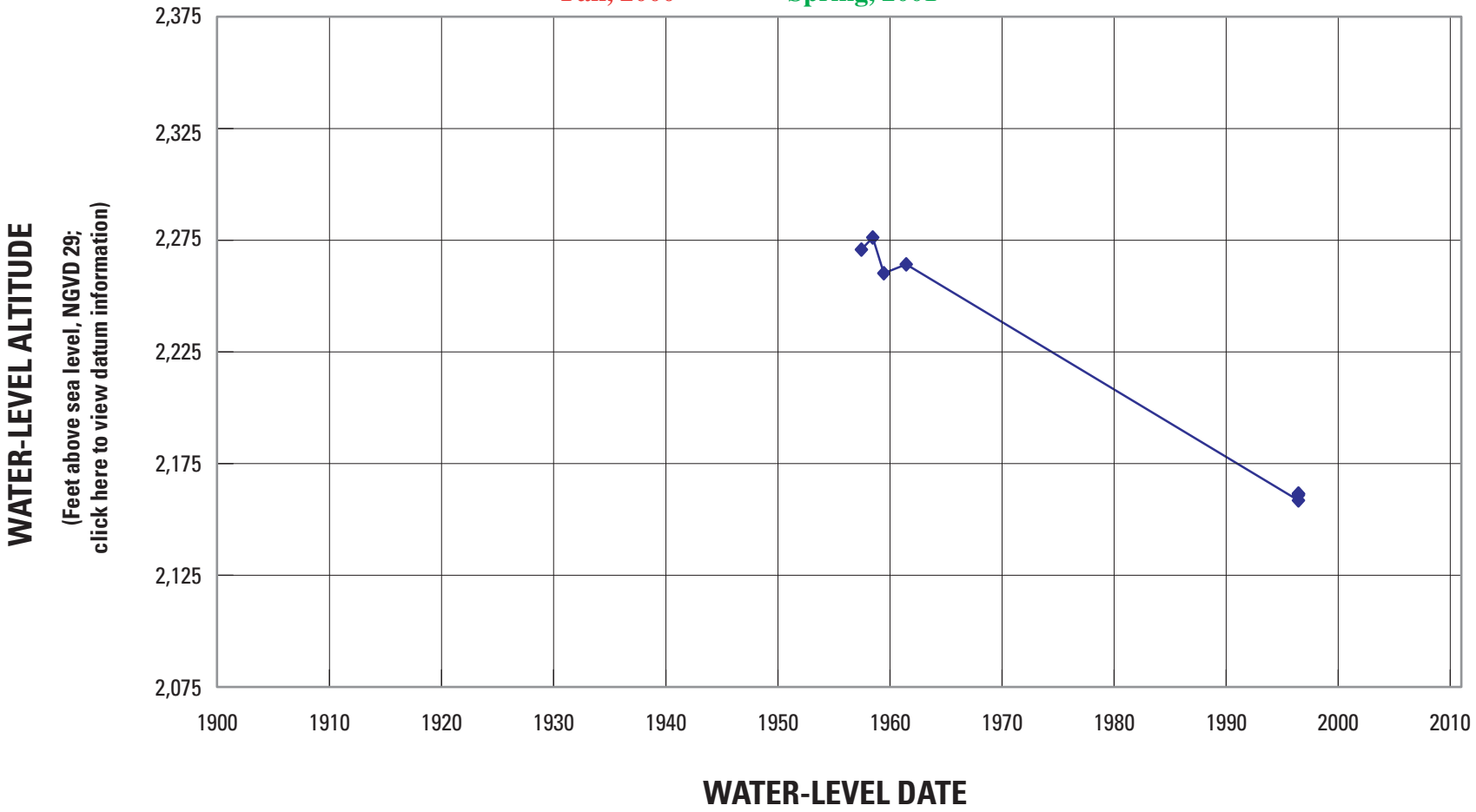

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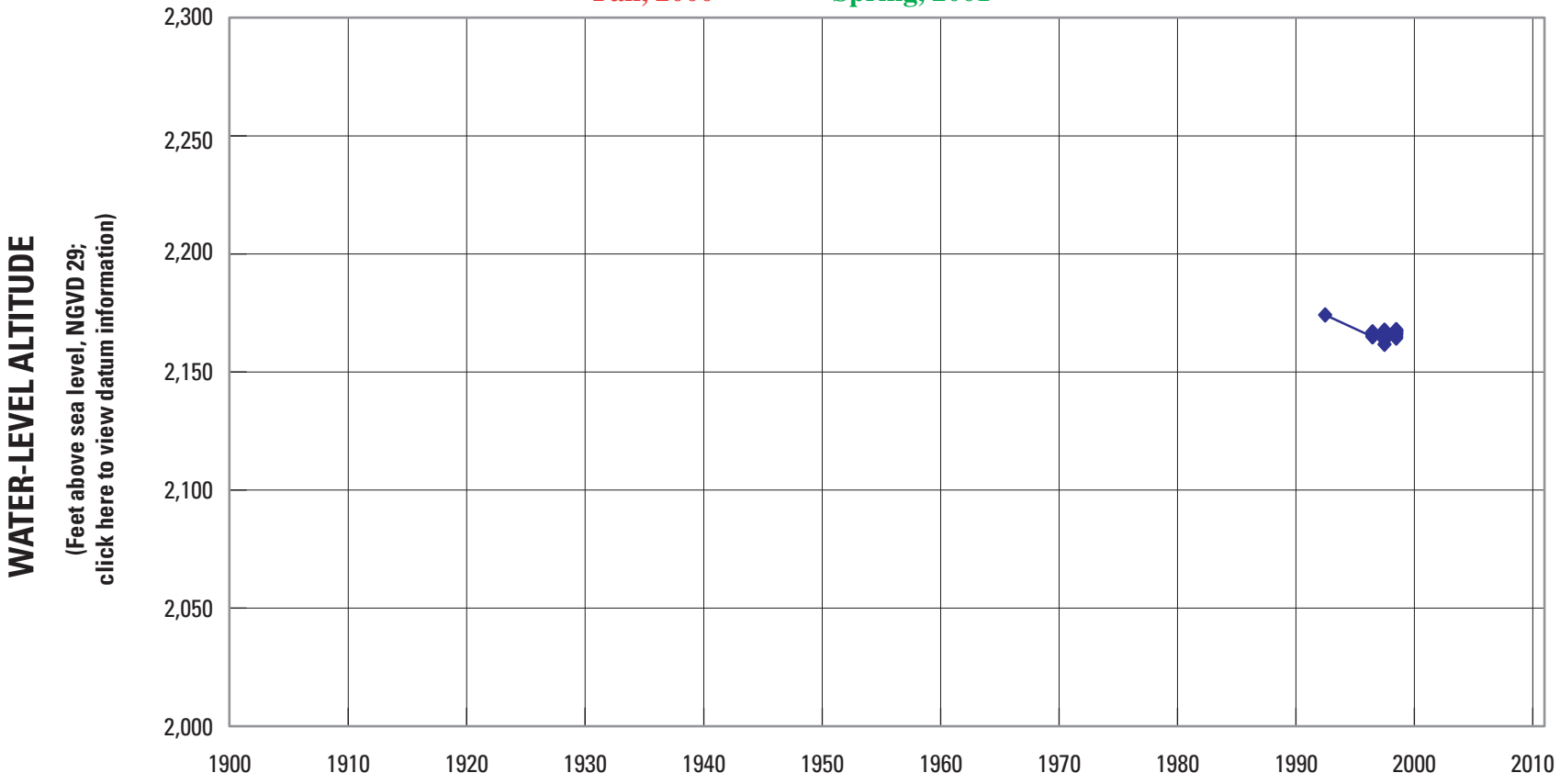
006N012W09H003S

(Click here to view well location)

Fall, 2000 Spring, 2001



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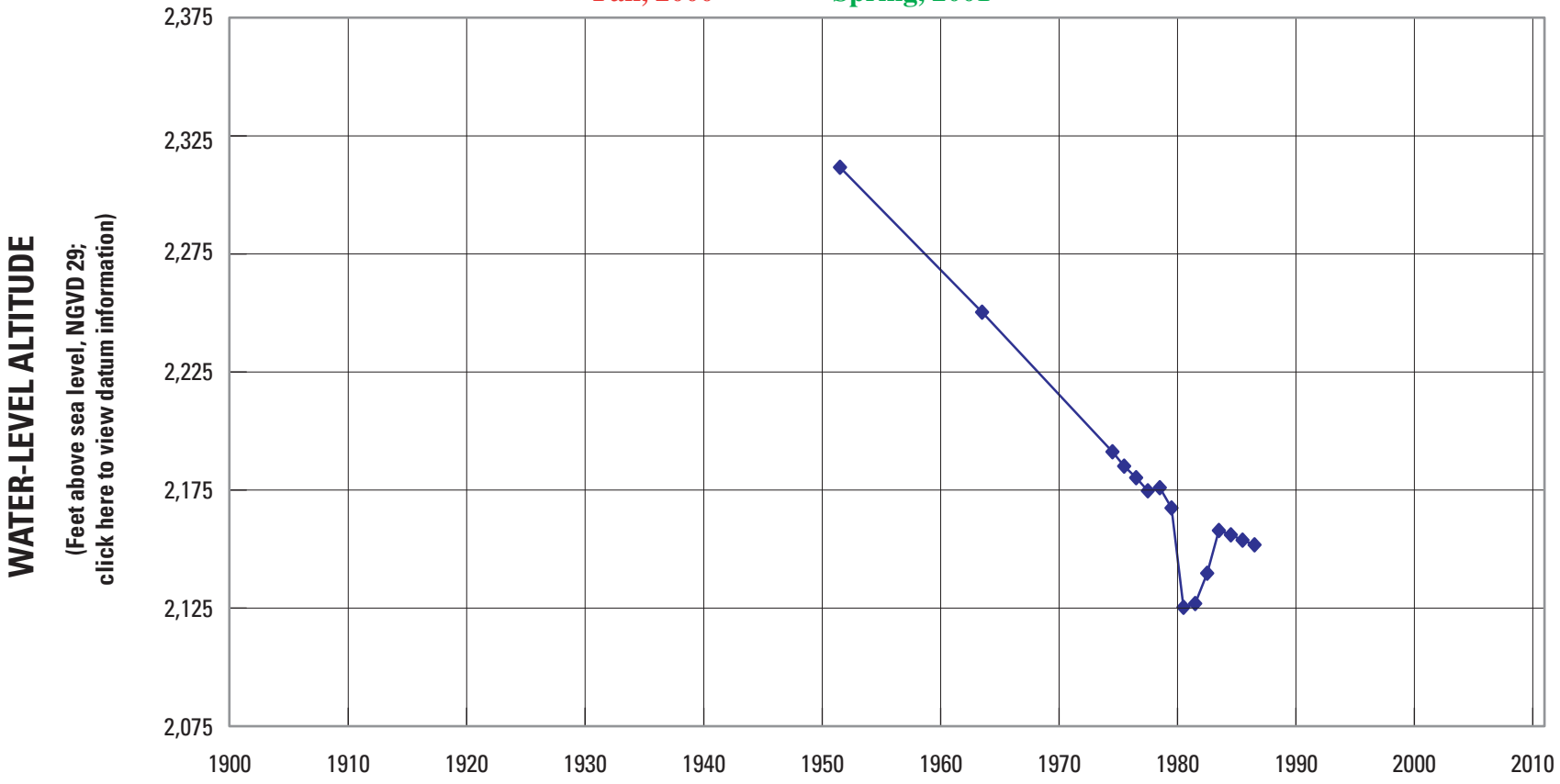
Fall, 2000 Spring, 2001



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006N012W12M001S

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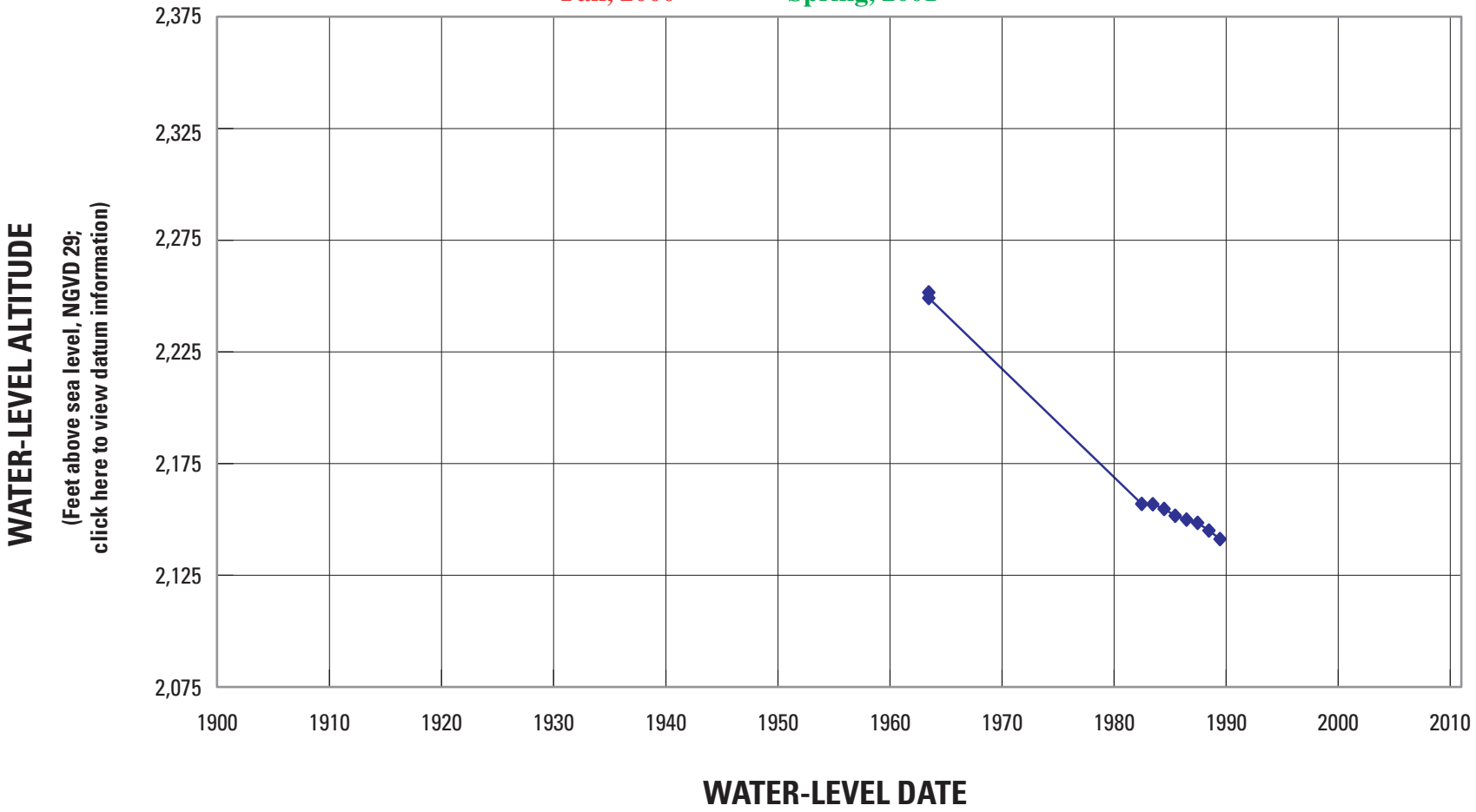
Fall, 2000 Spring, 2001



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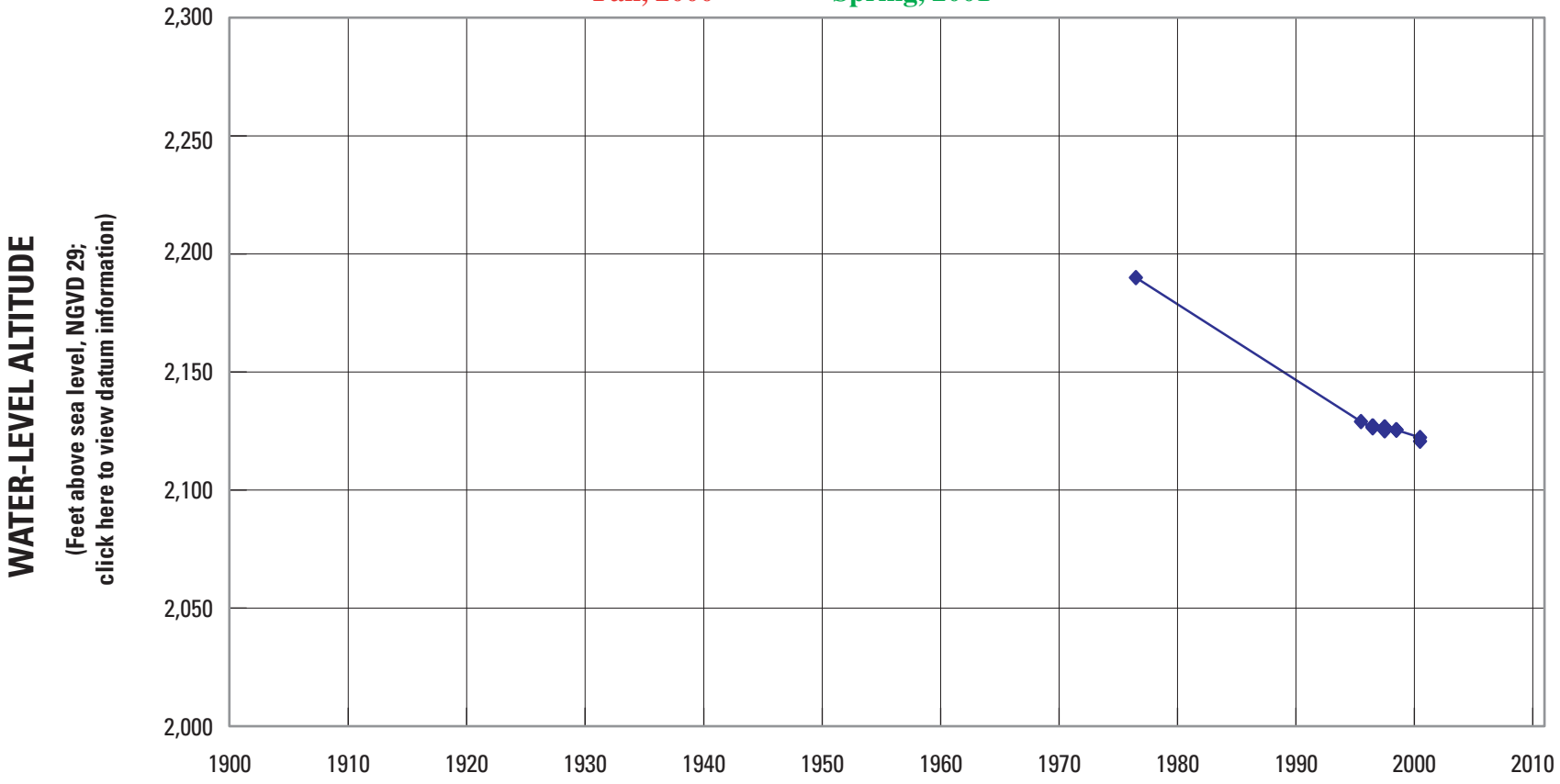
Fall, 2000 Spring, 2001



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006N012W12R001S

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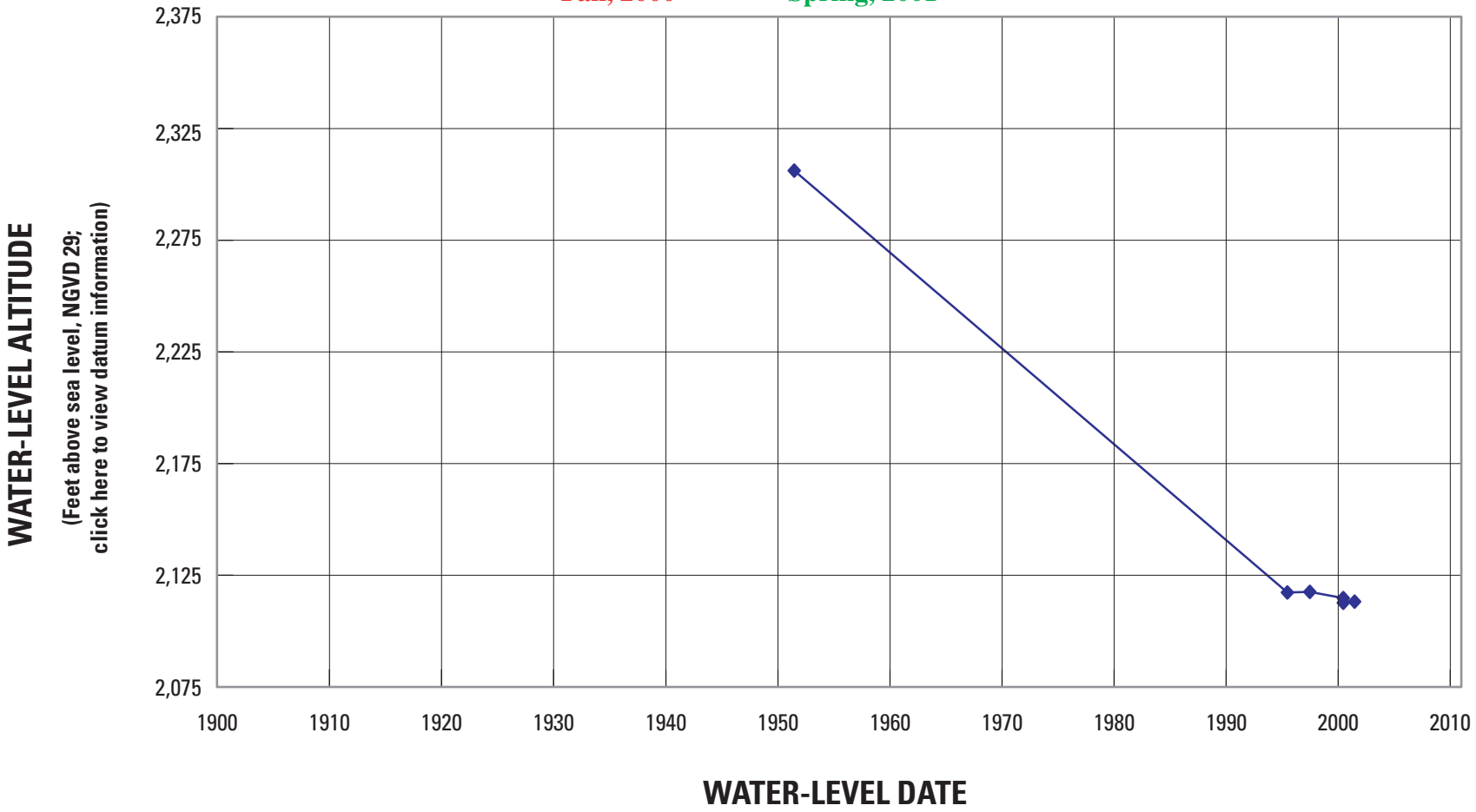
Fall, 2000 Spring, 2001



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006N012W13N001S

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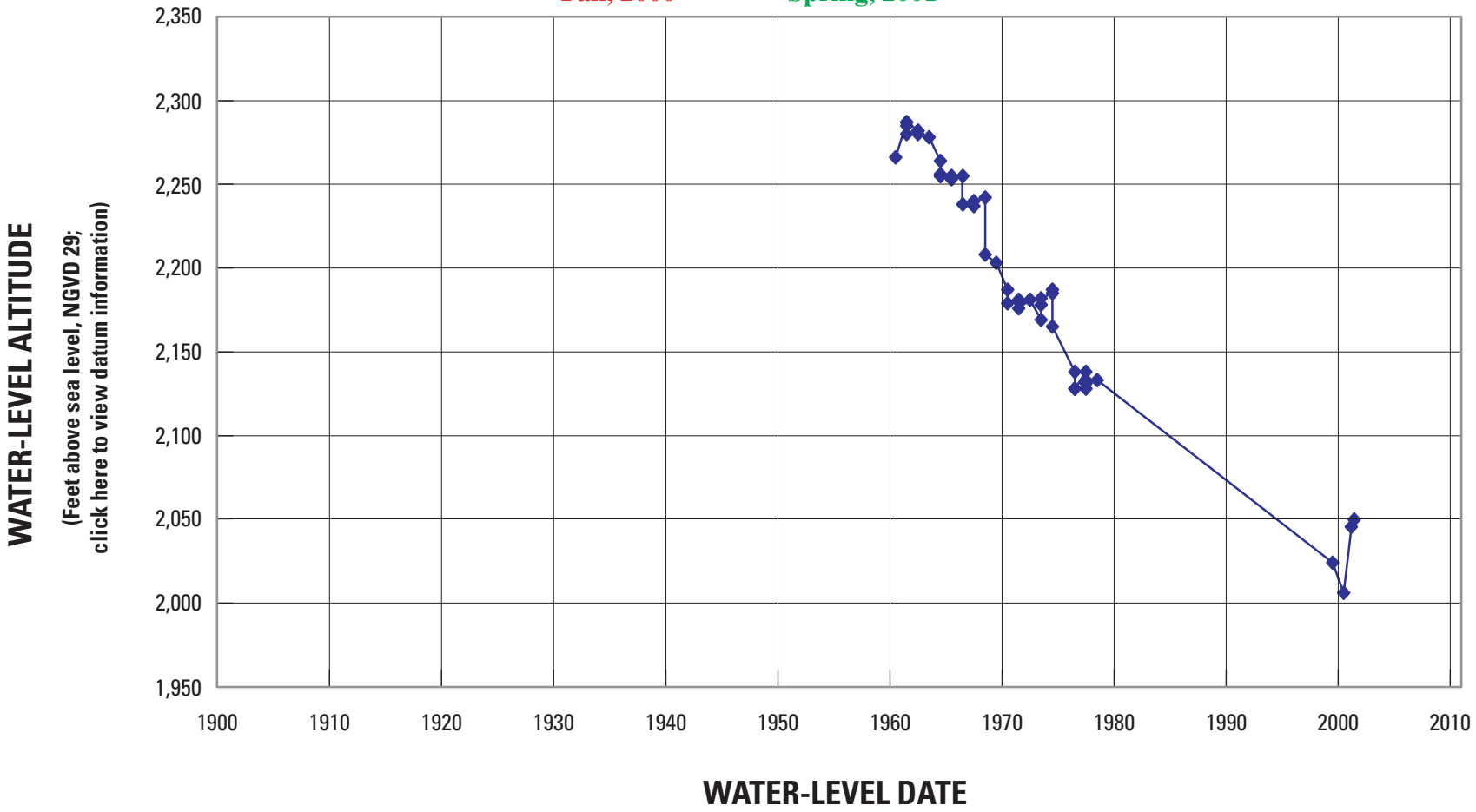
Fall, 2000 Spring, 2001



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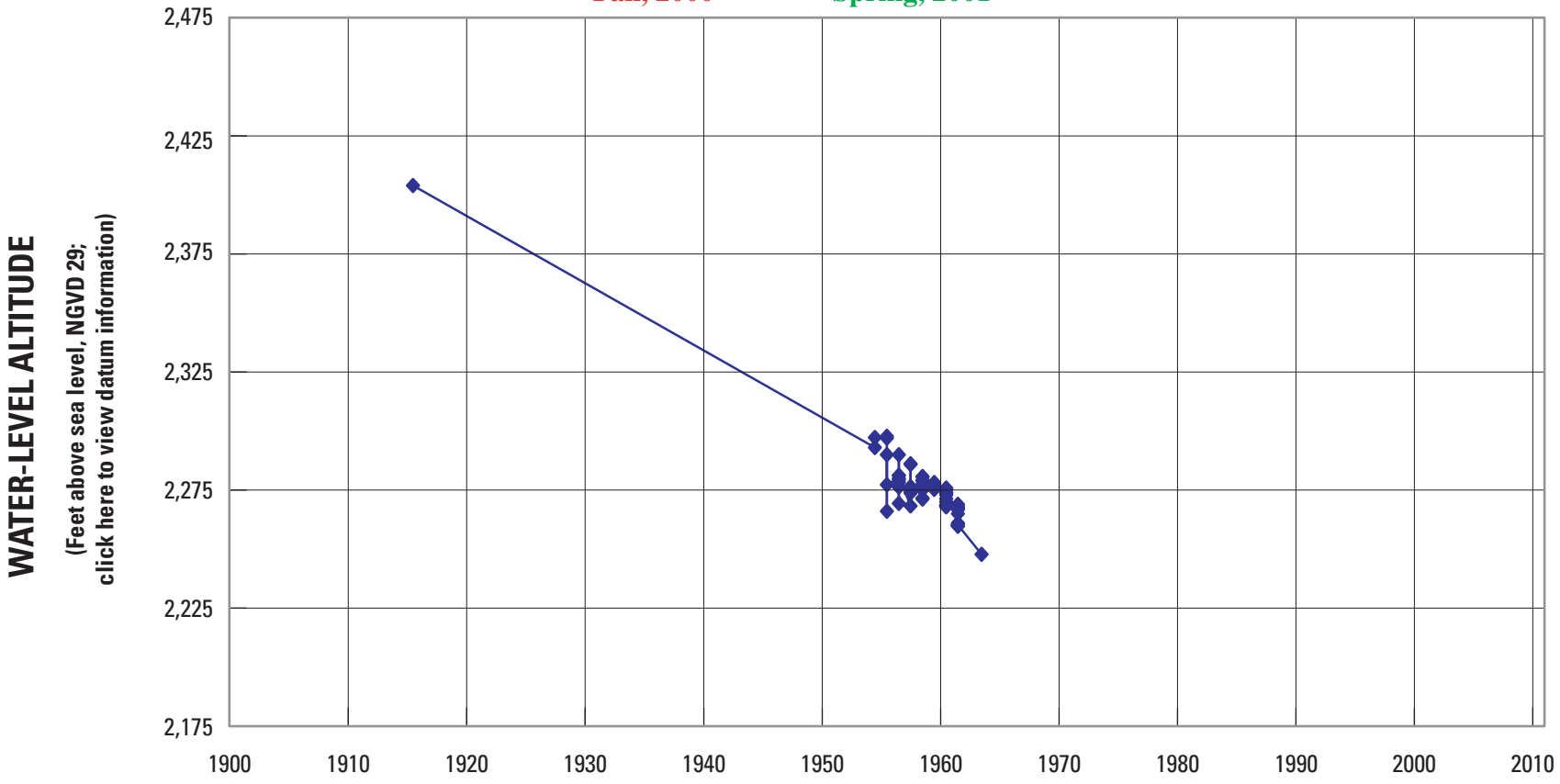
(Click here to view well location)

Fall, 2000 Spring, 2001



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006N012W14H001S

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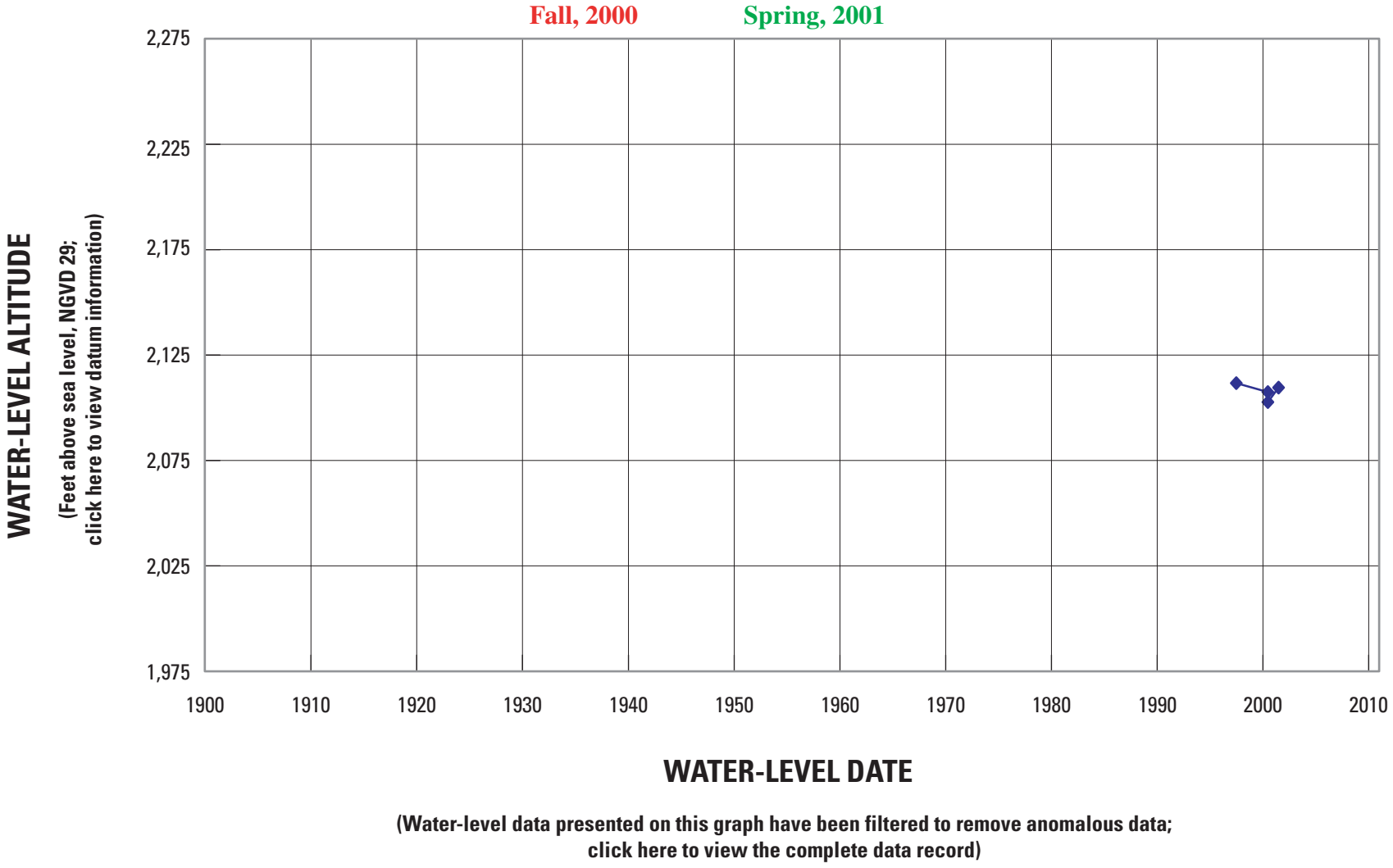

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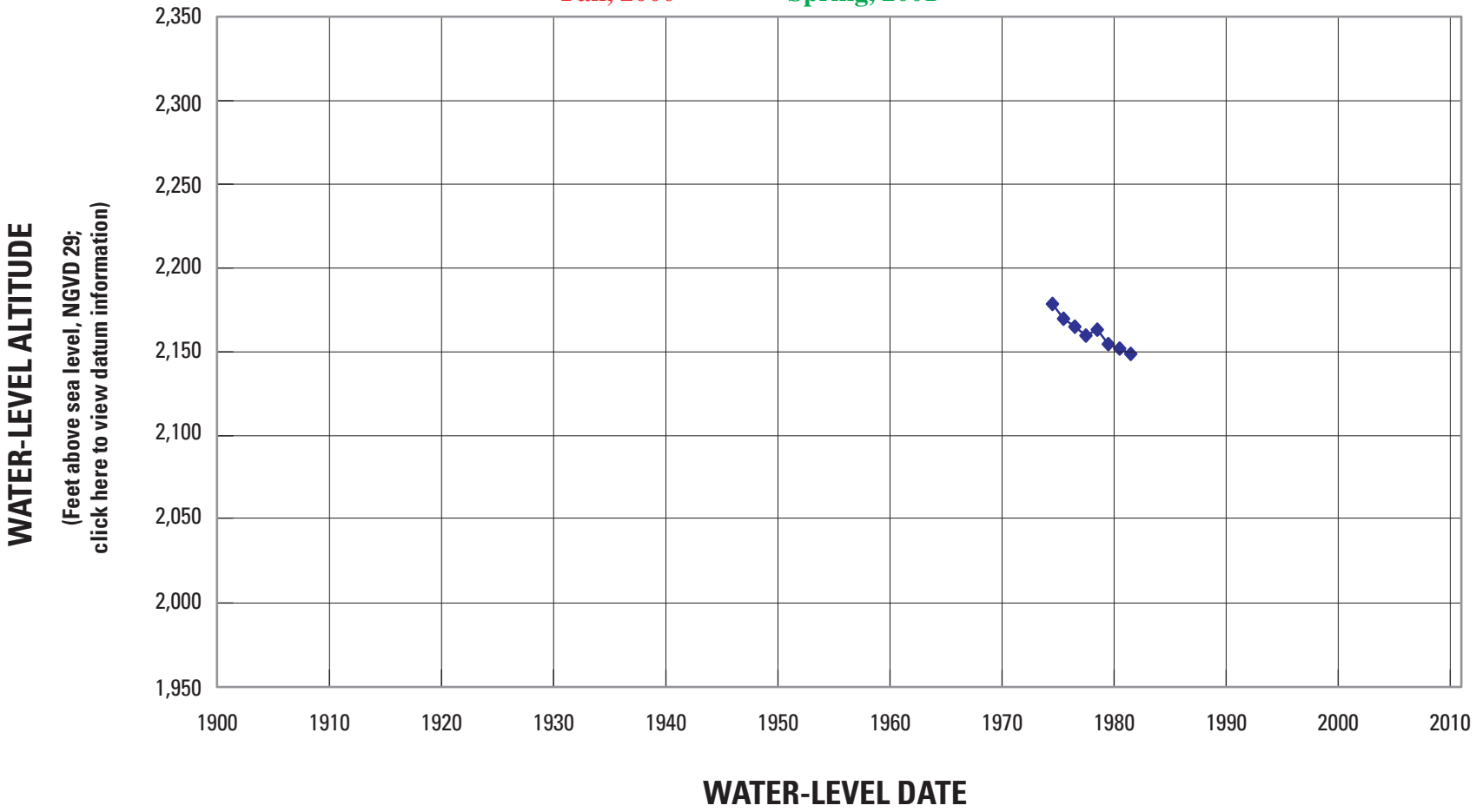
Fall, 2000 Spring, 2001



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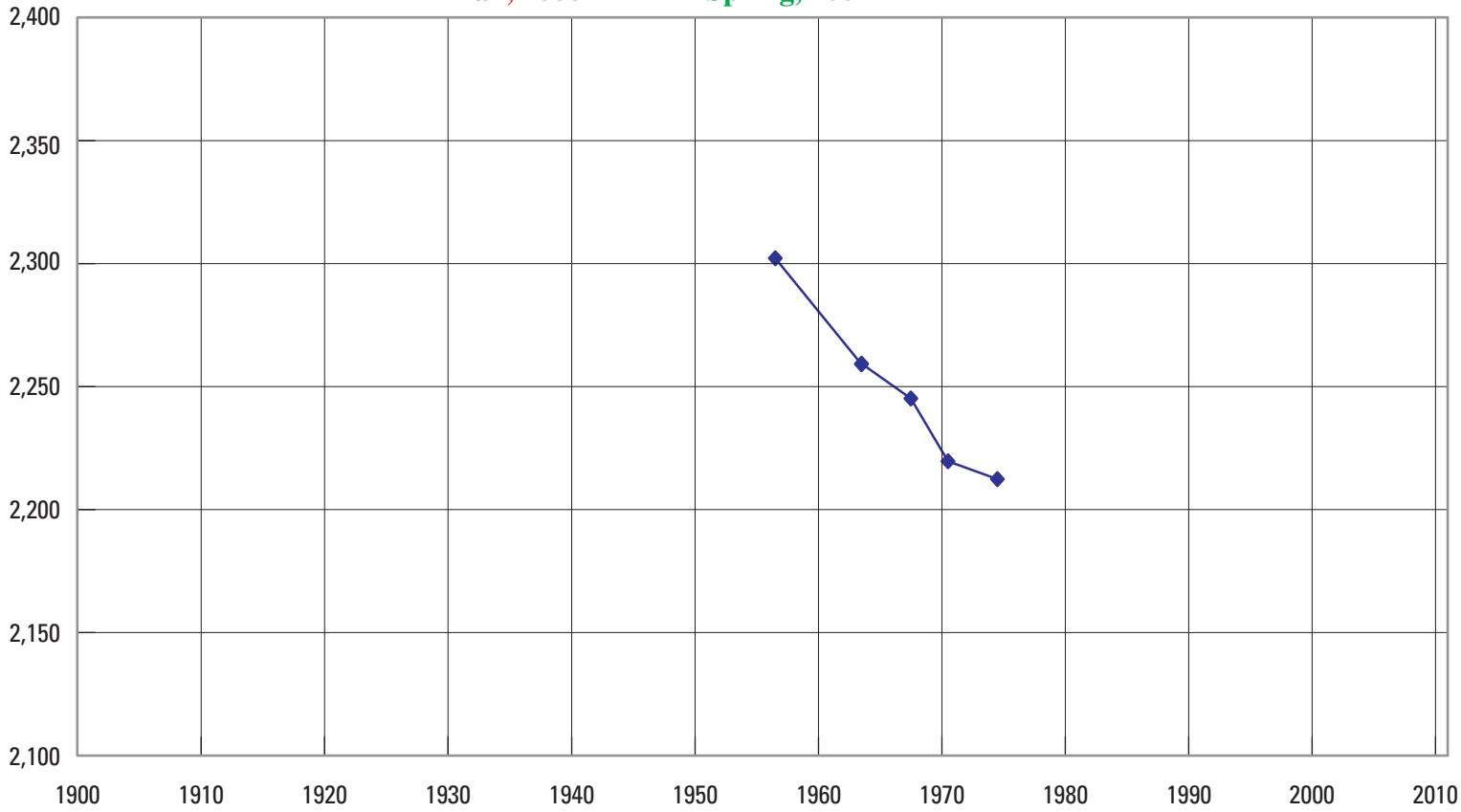
Fall, 2000 Spring, 2001



WATER-LEVEL ALTITUDE

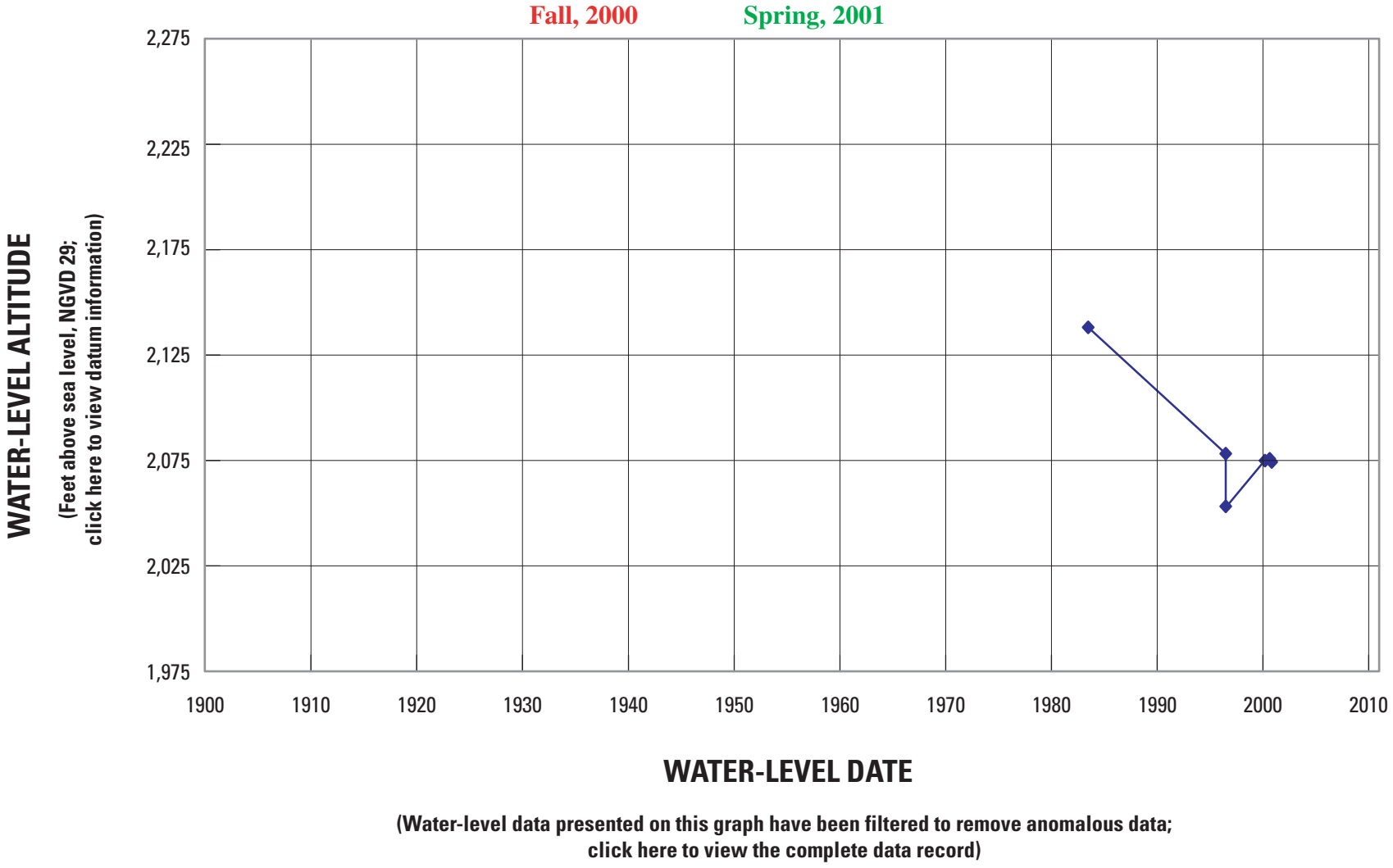
(Feet above sea level, NGVD 29; click here to view datum information)

WATER-LEVEL DATE

(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

006N012W23A001S

(Click here to view well location)



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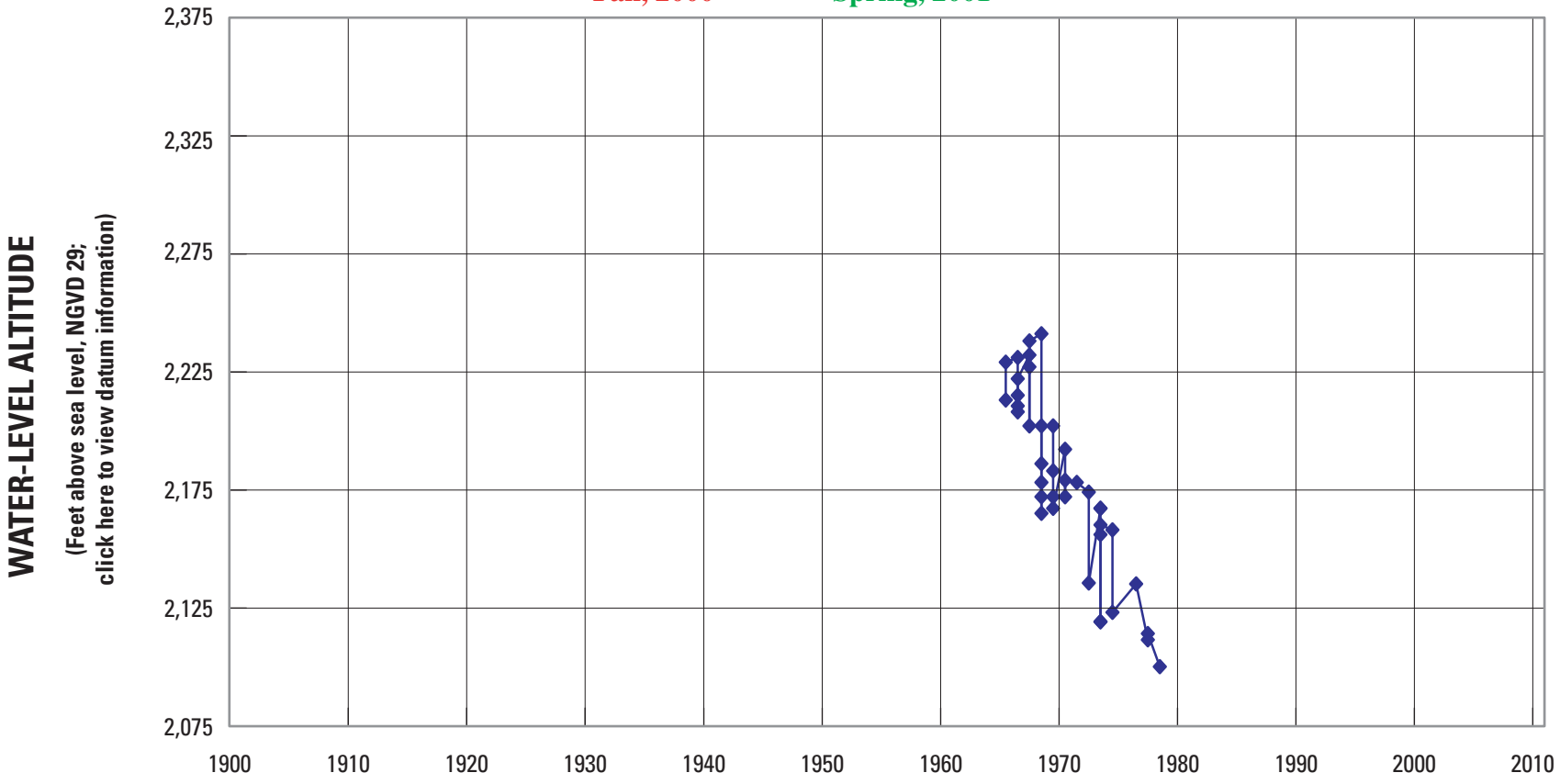
006N012W24A002S

(Click here to view well location)

Fall, 2000 Spring, 2001



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006N012W24C001S

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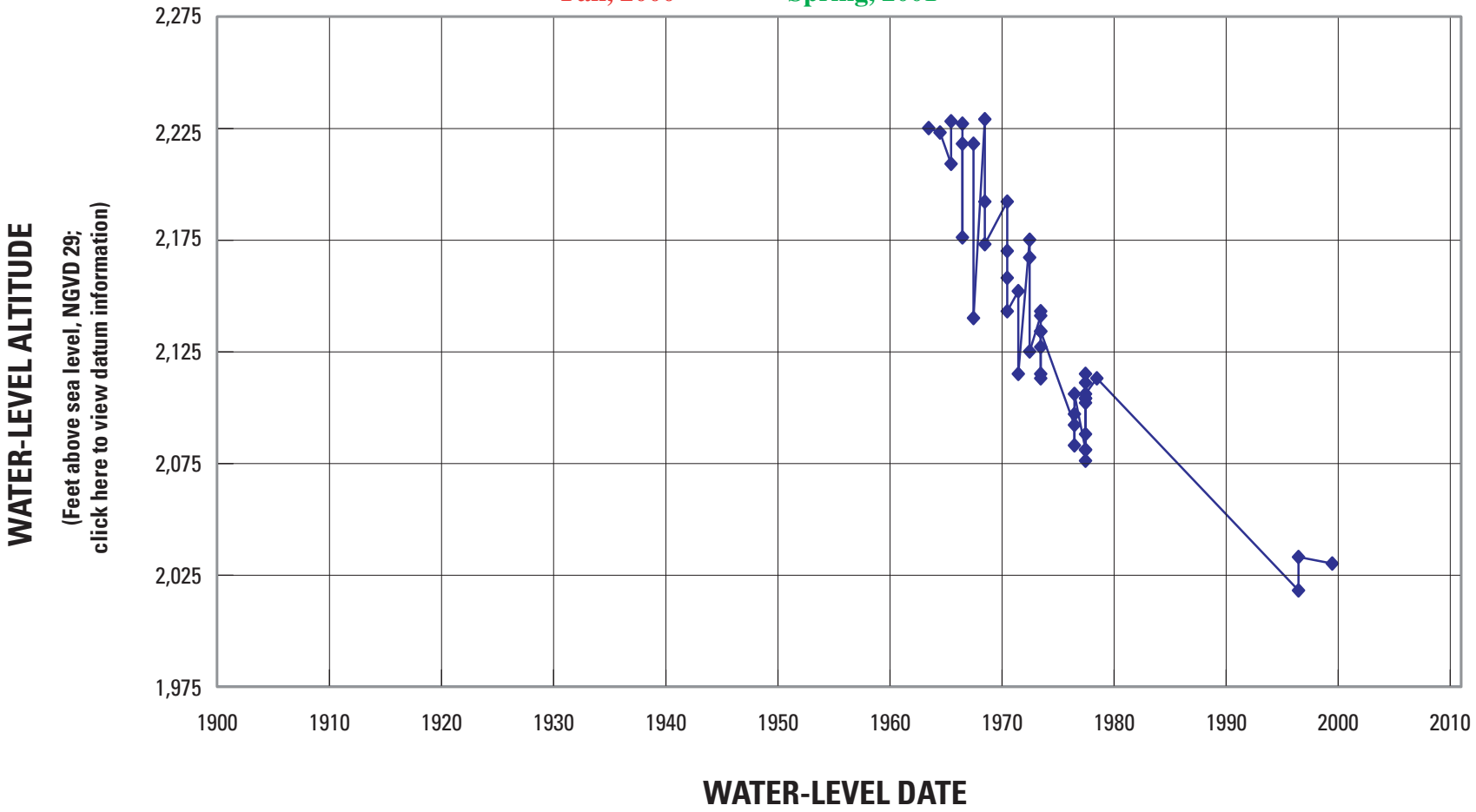
Fall, 2000 Spring, 2001



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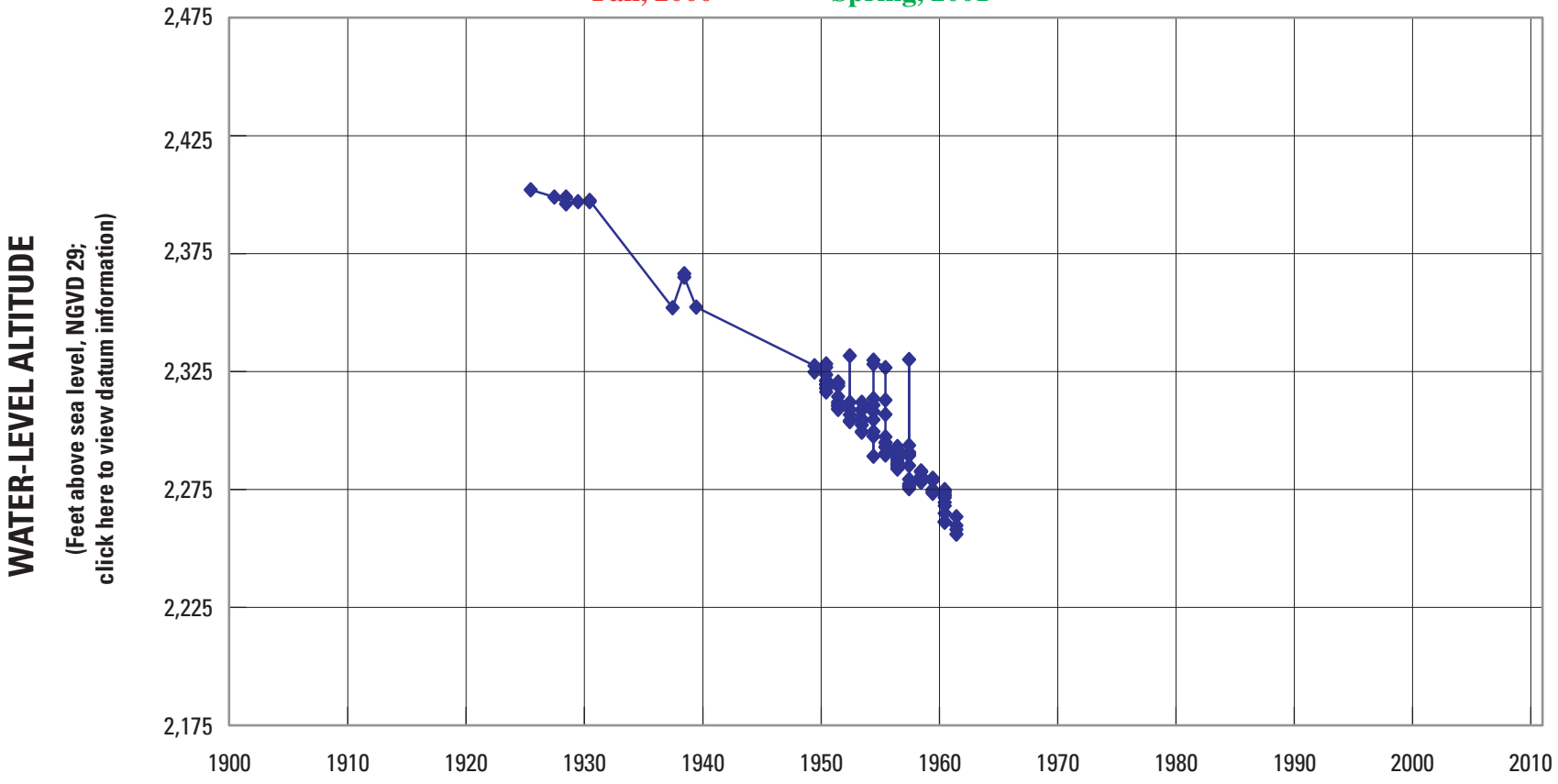
Fall, 2000 Spring, 2001



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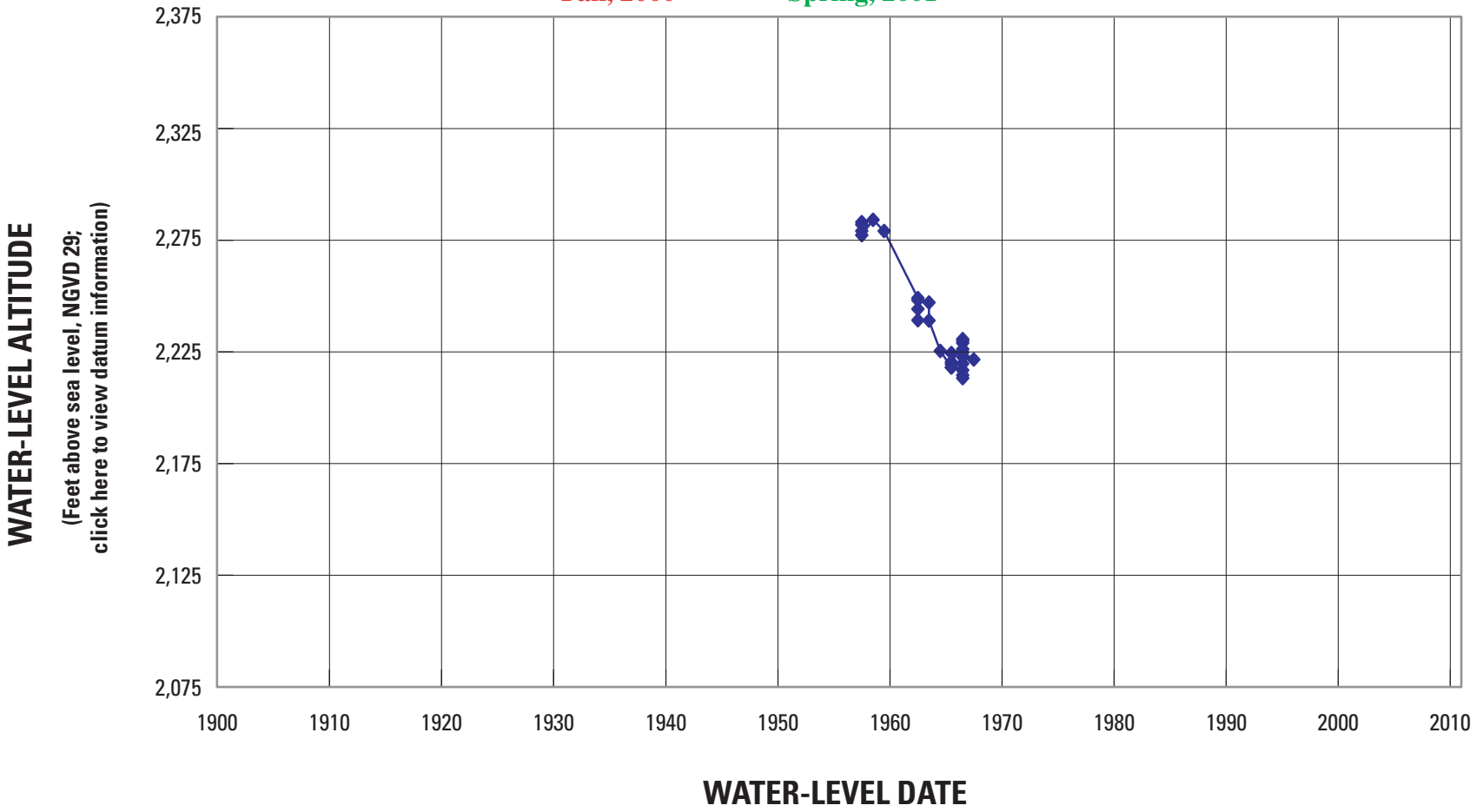
Fall, 2000 Spring, 2001



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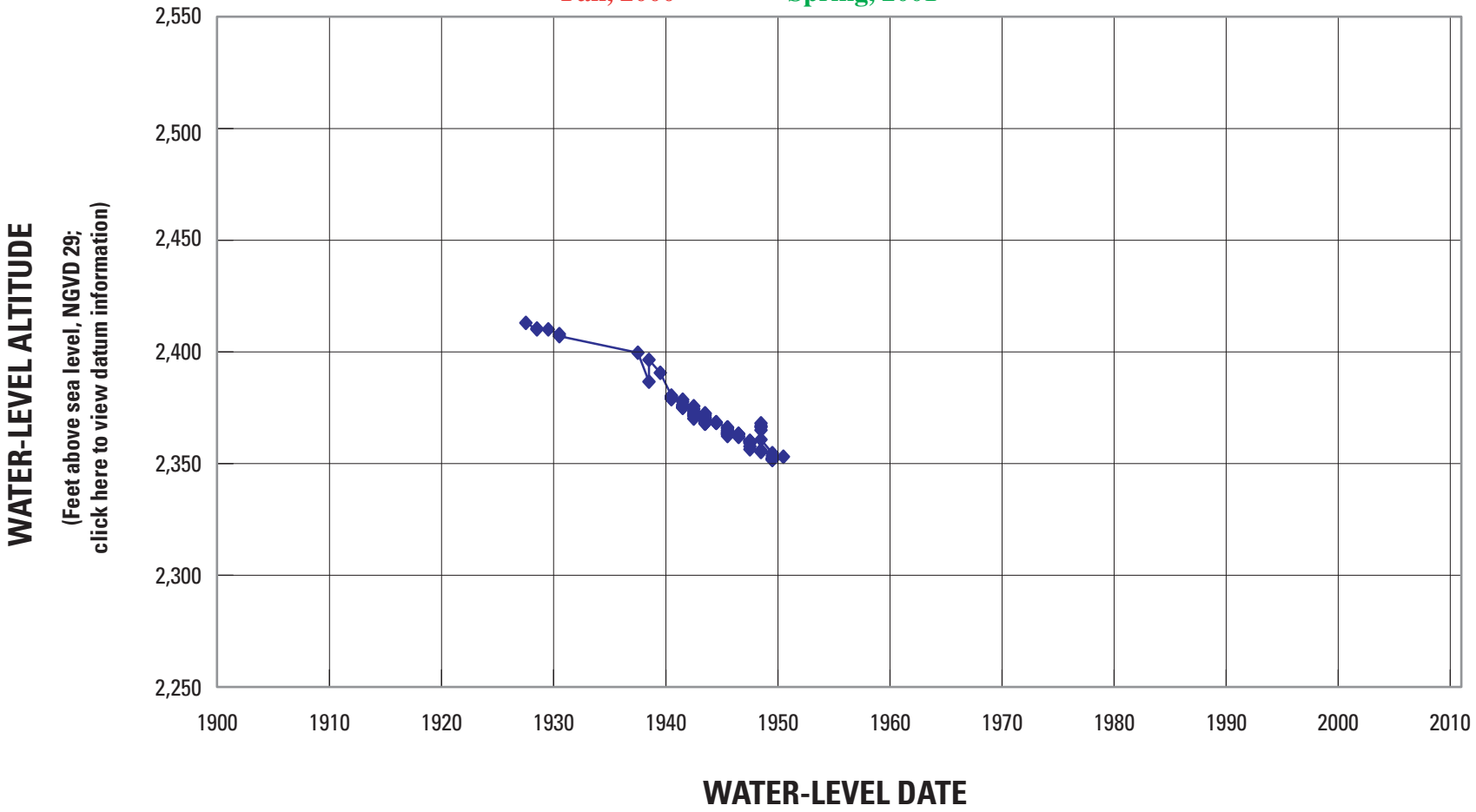

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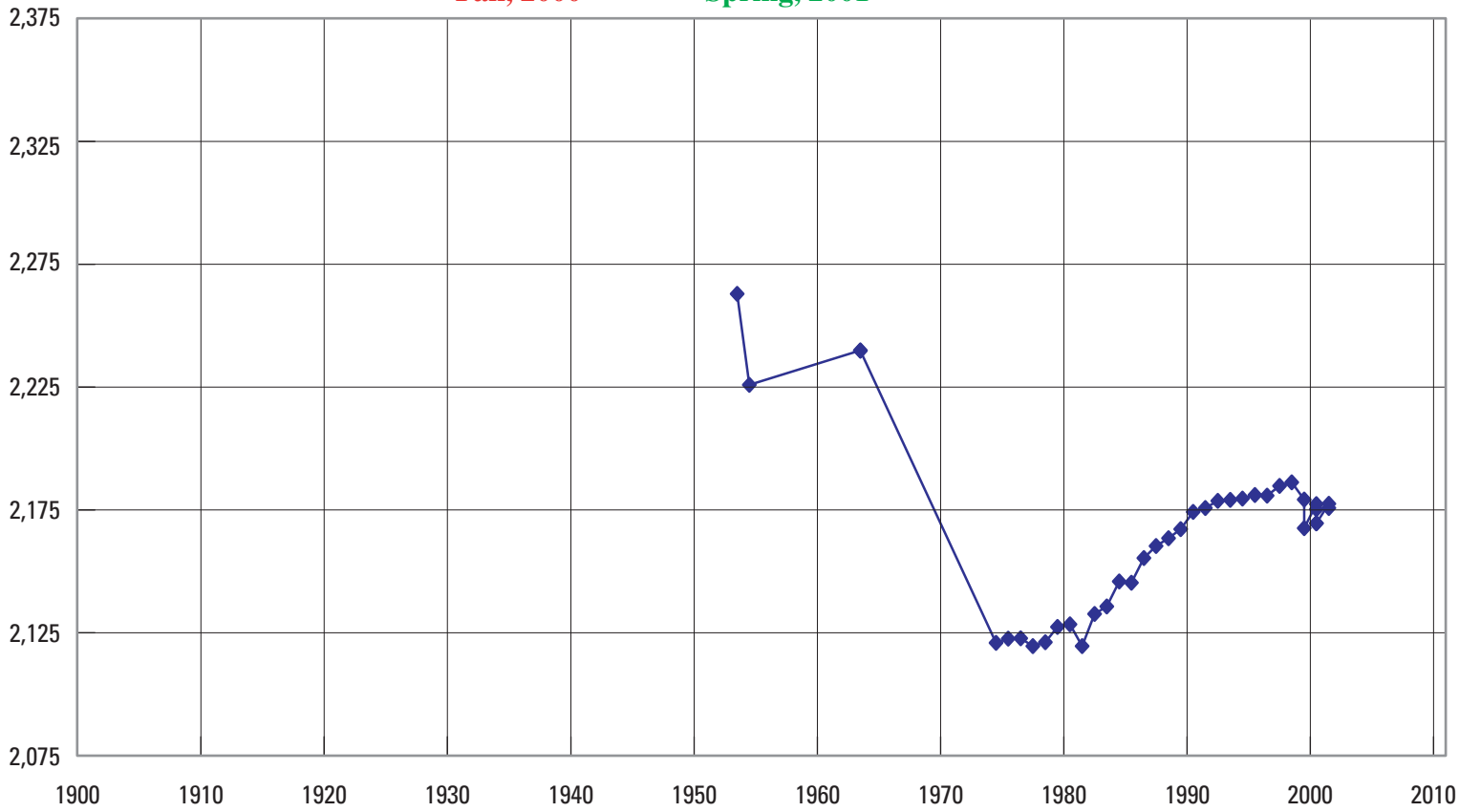


WATER-LEVEL ALTITUDE

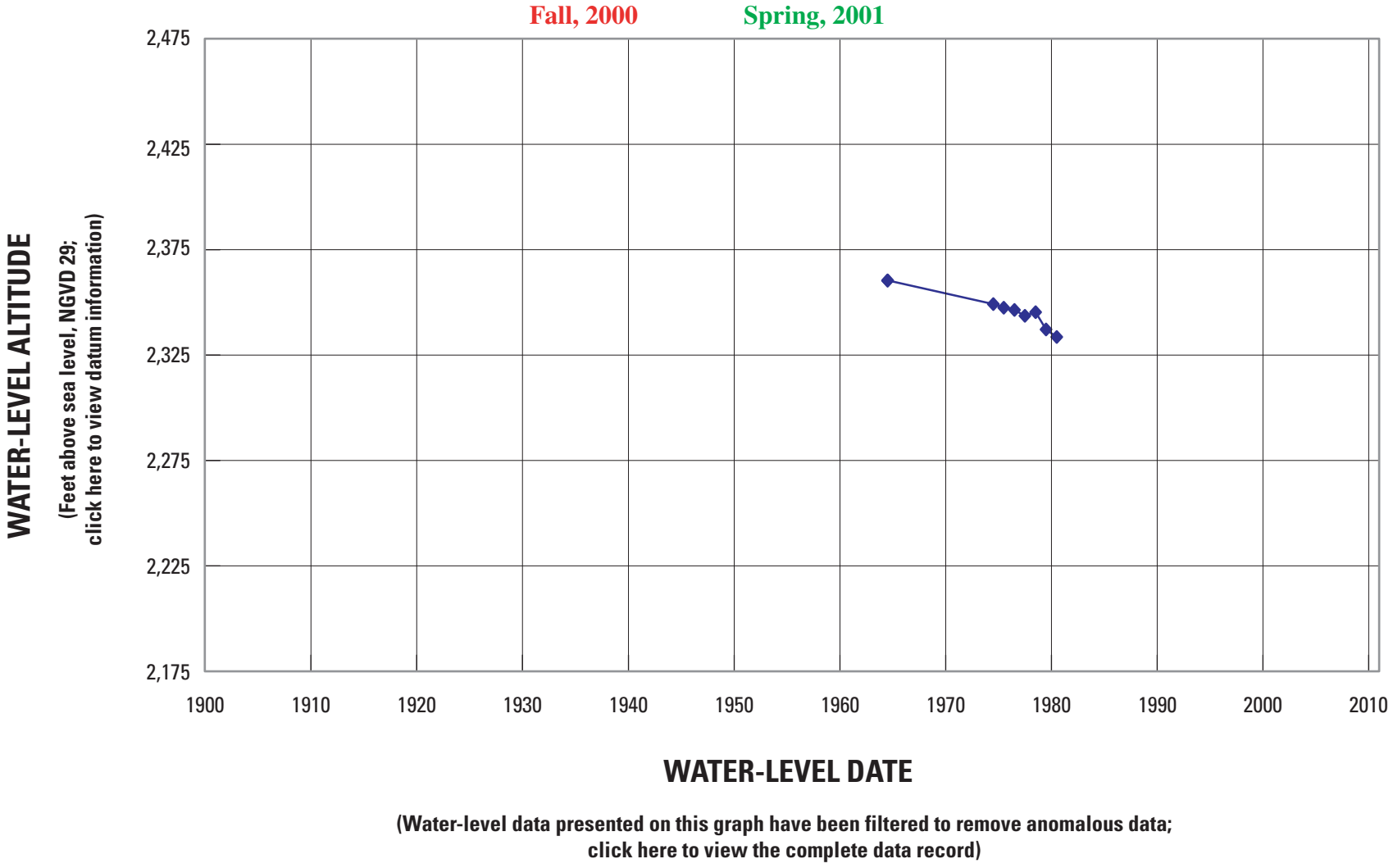
(Feet above sea level, NGVD 29; click here to view datum information)

WATER-LEVEL DATE

(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

007N011W28P001S

(Click here to view well location)



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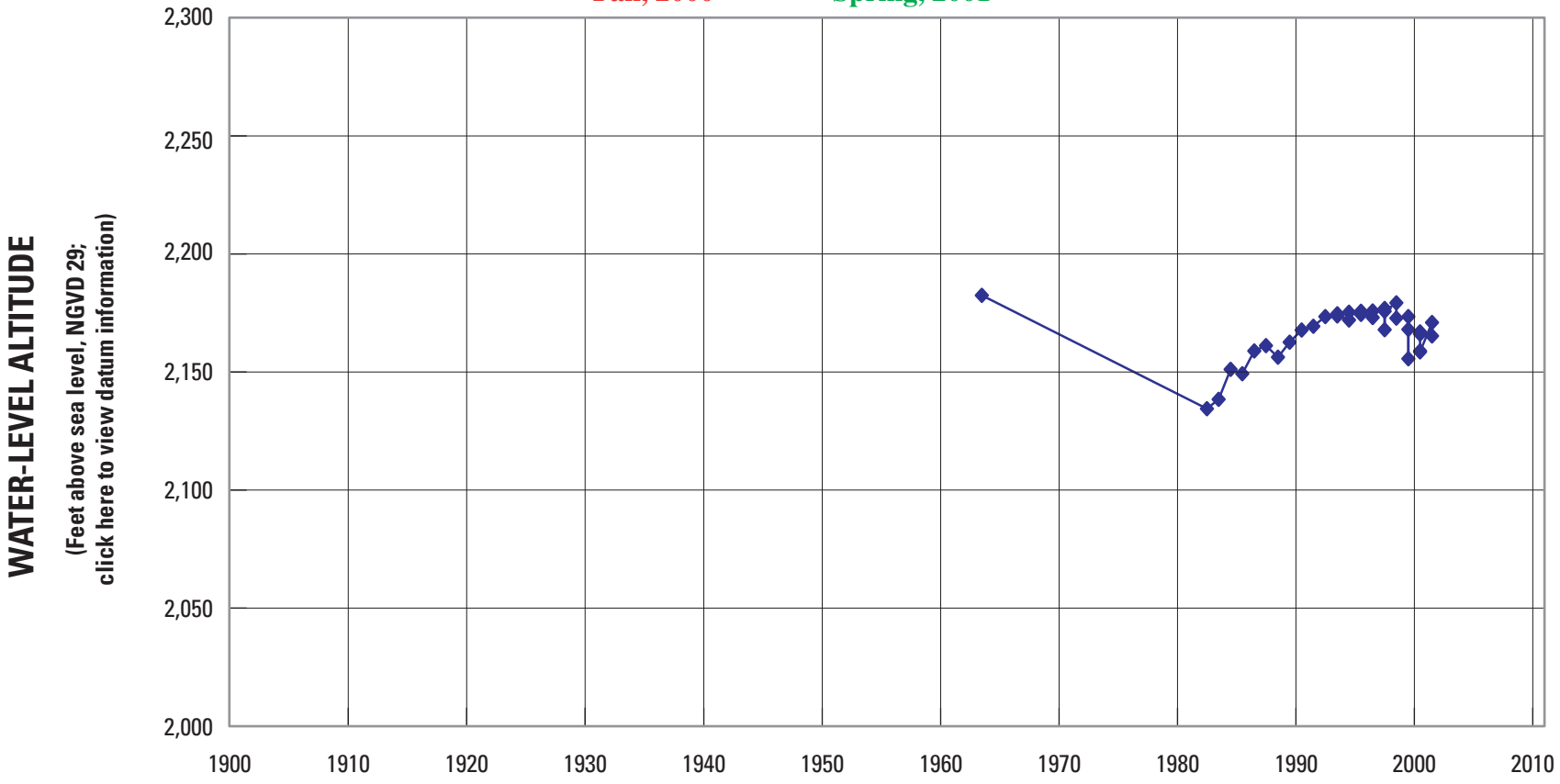
Fall, 2000 Spring, 2001



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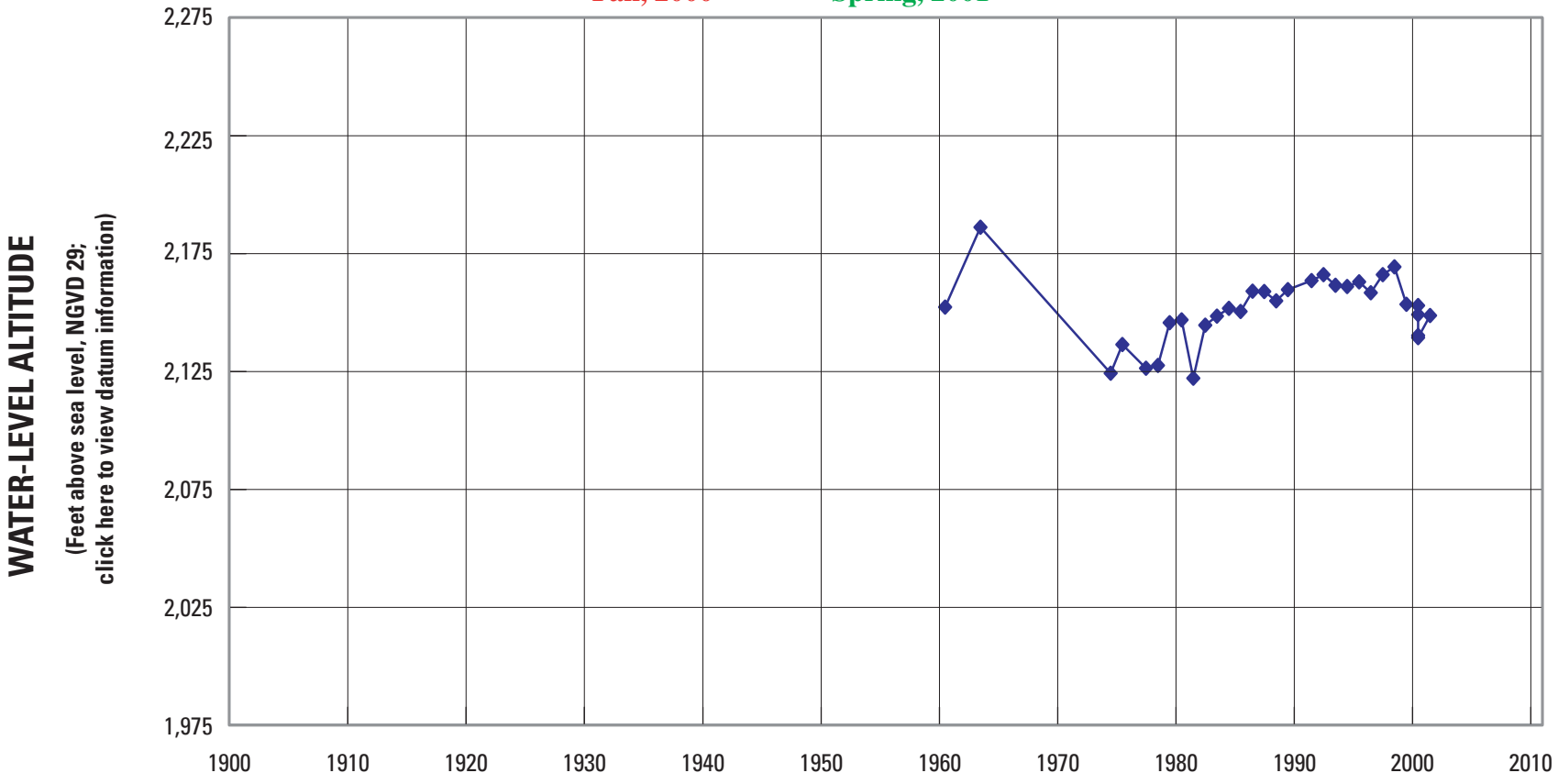
Fall, 2000 Spring, 2001



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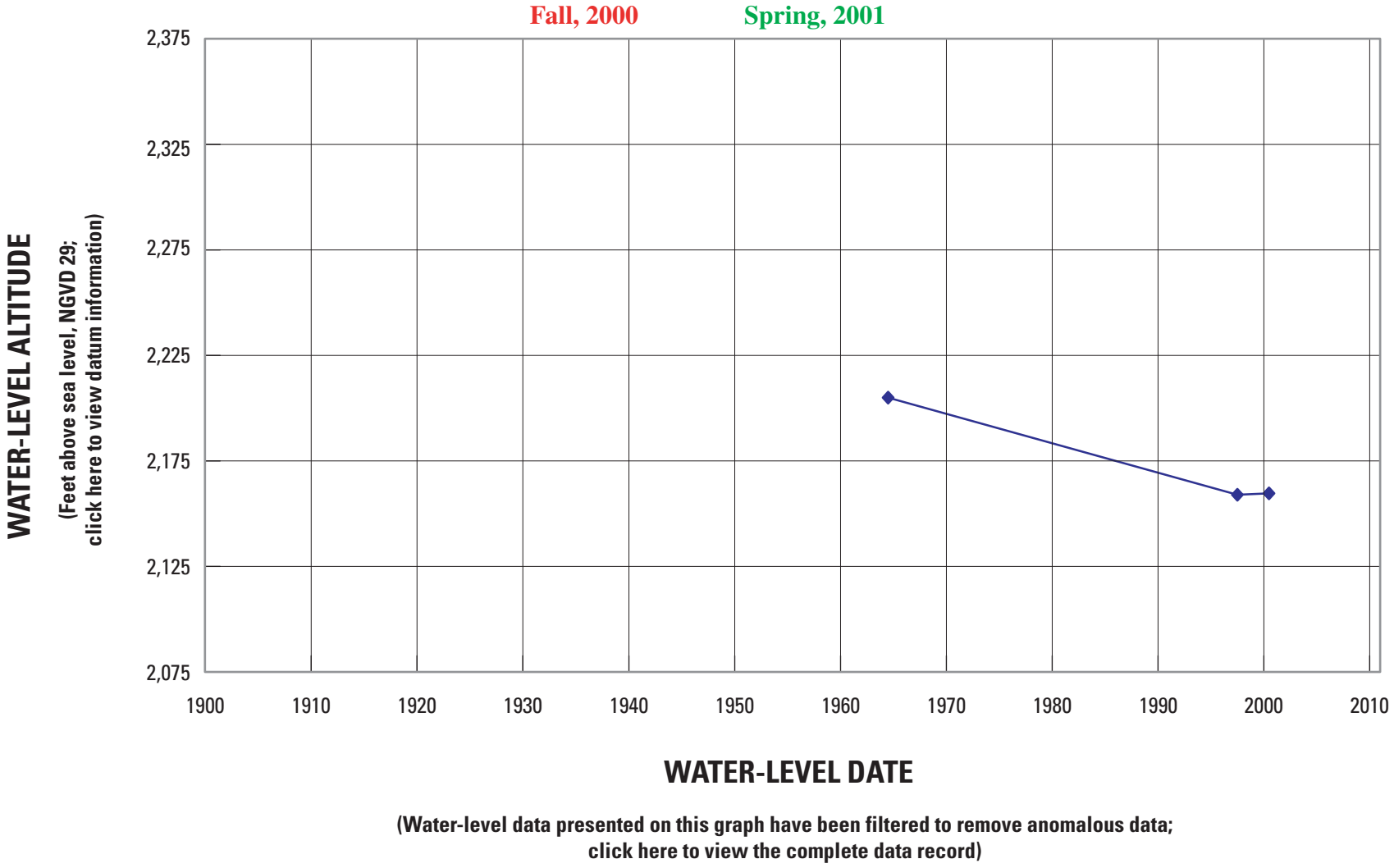

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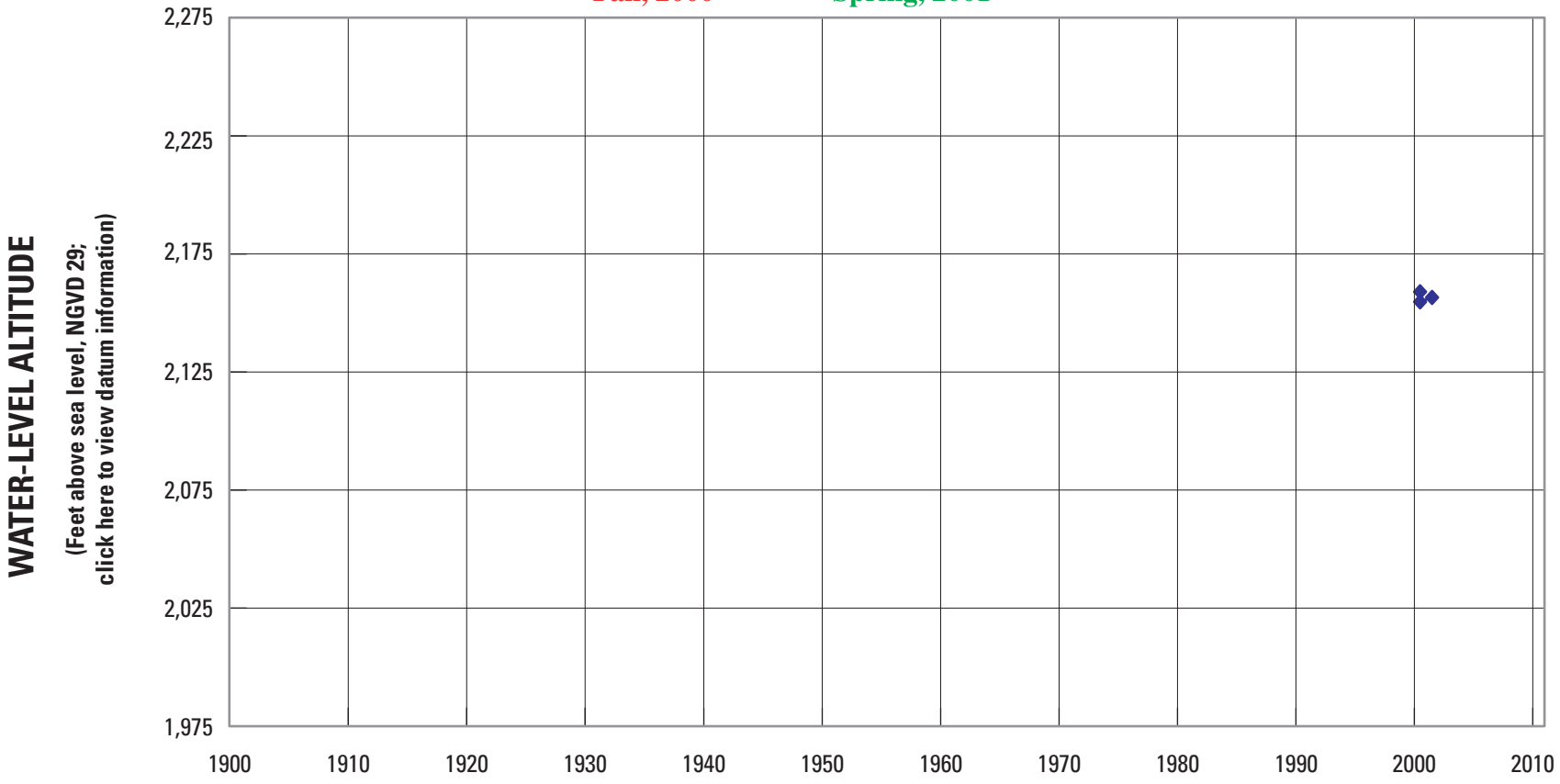
(Click here to view well location)

Fall, 2000 Spring, 2001



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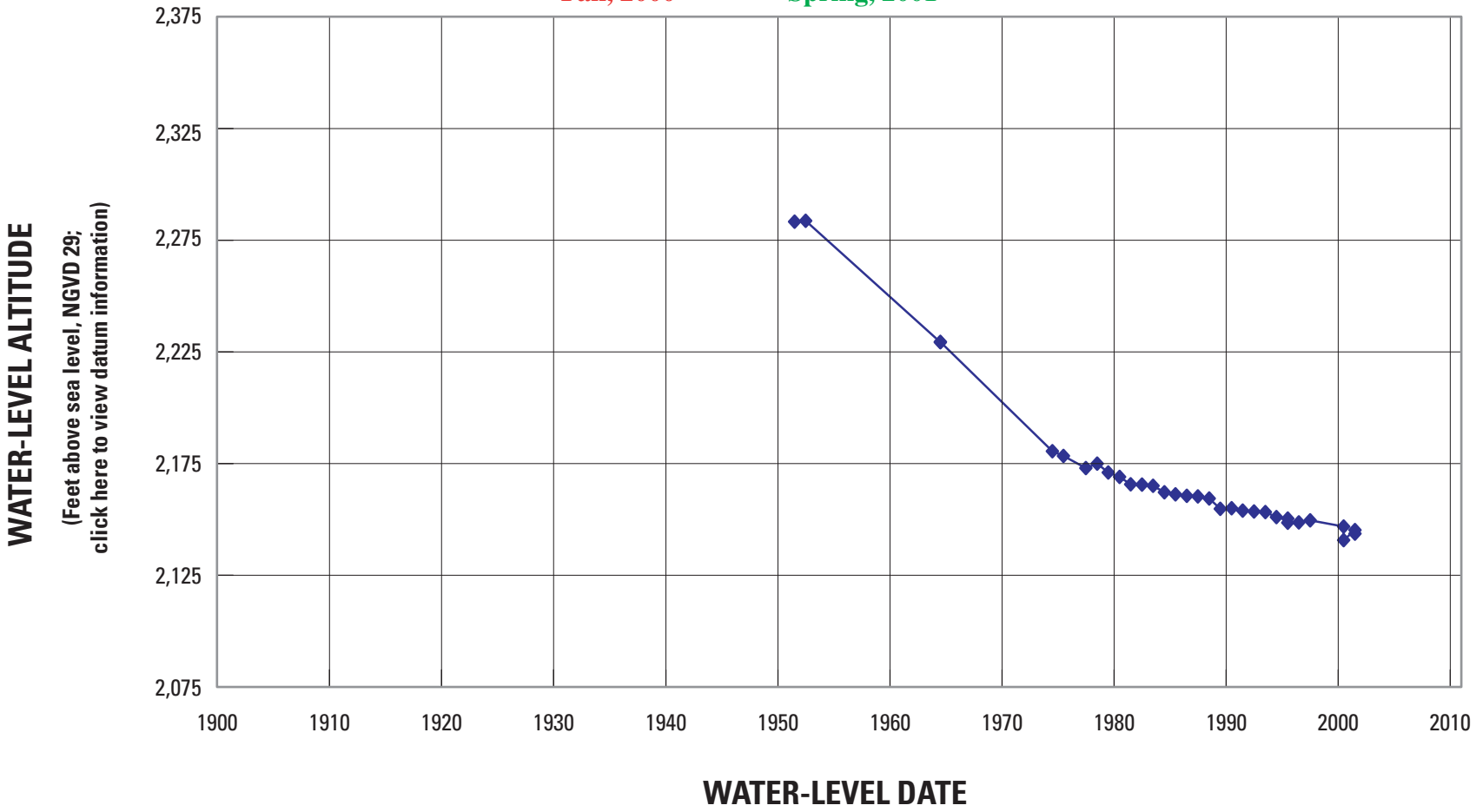
007N011W31M001S

(Click here to view well location)

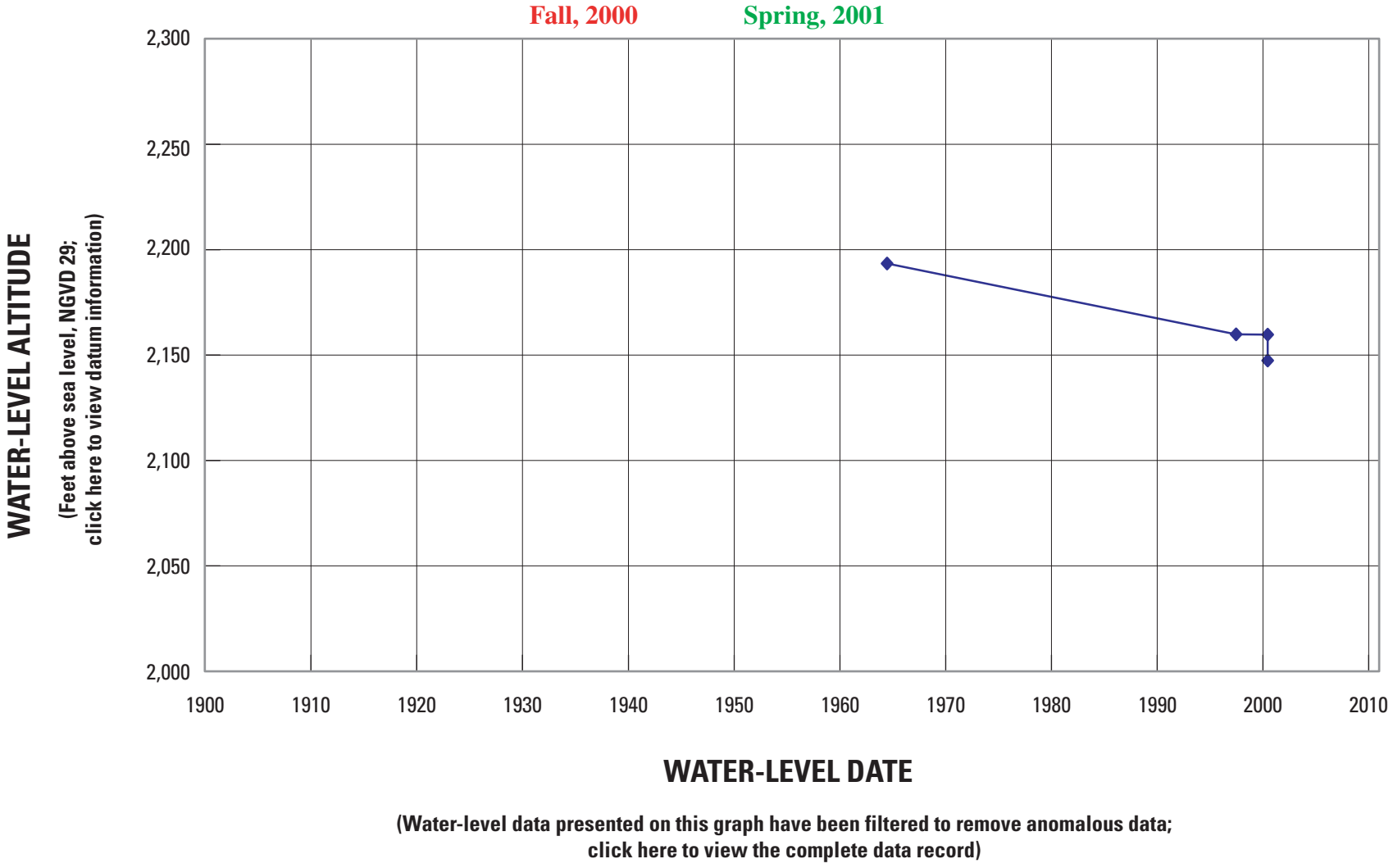
Fall, 2000 Spring, 2001



(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

007N011W32A002S

(Click here to view well location)



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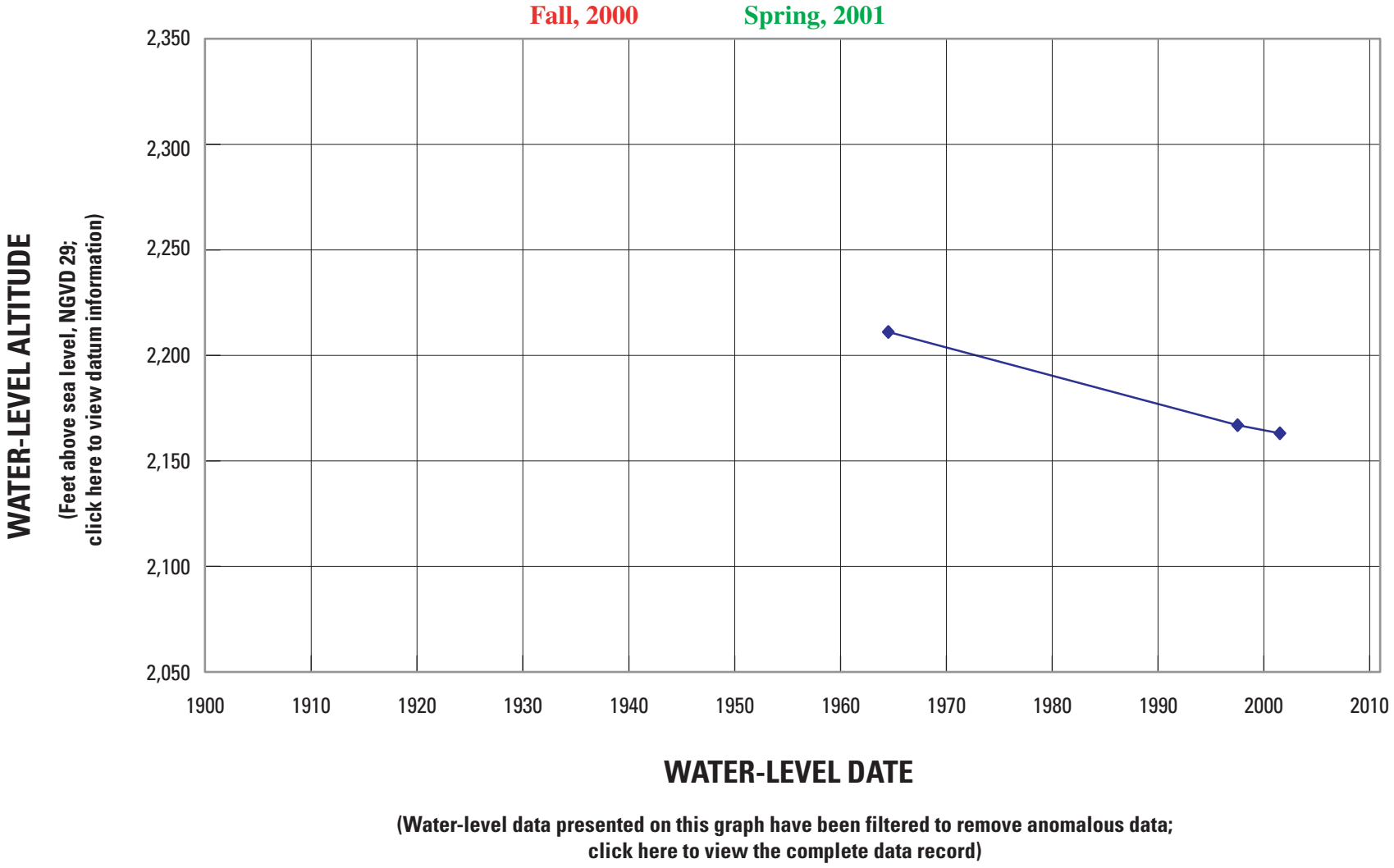

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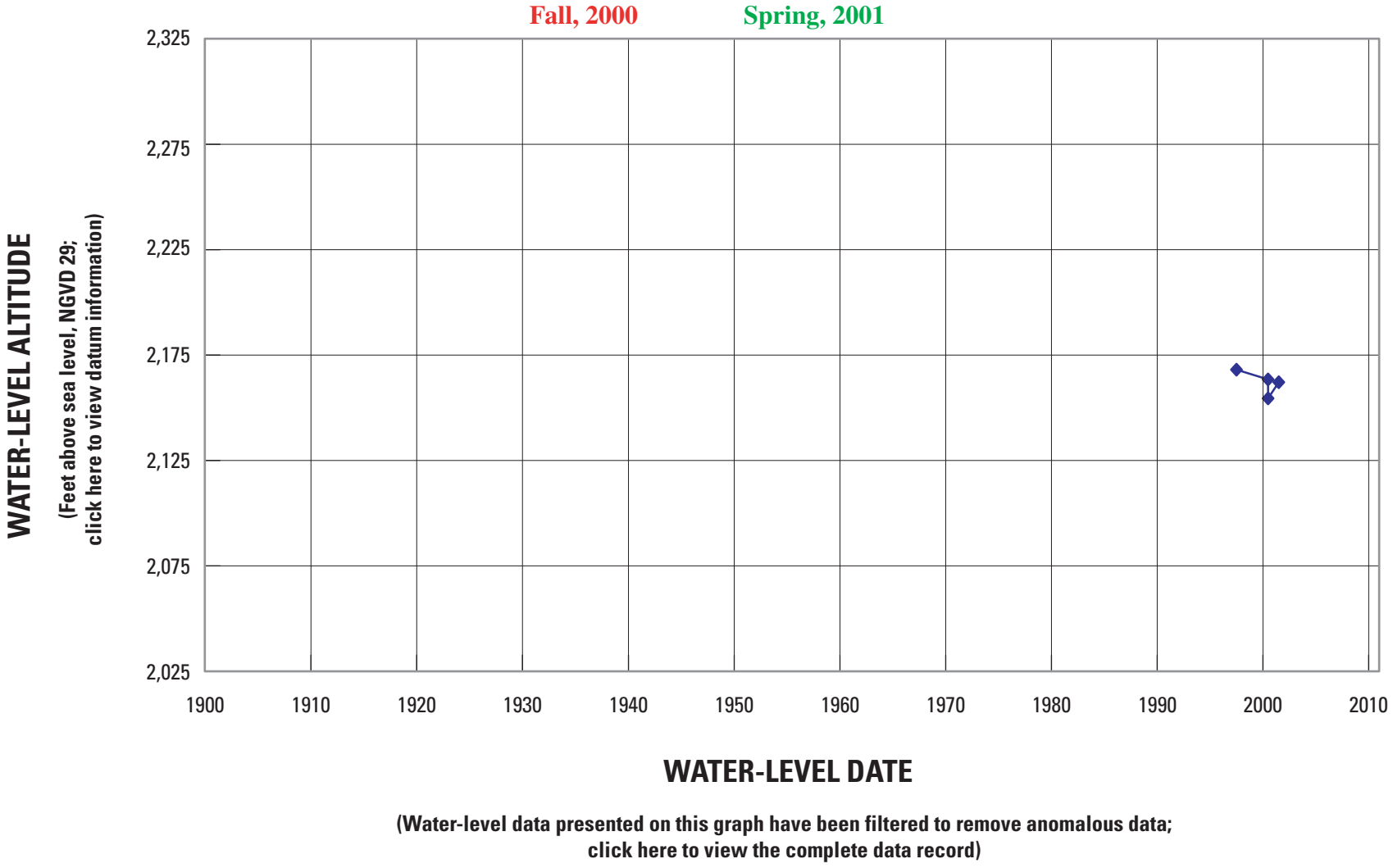

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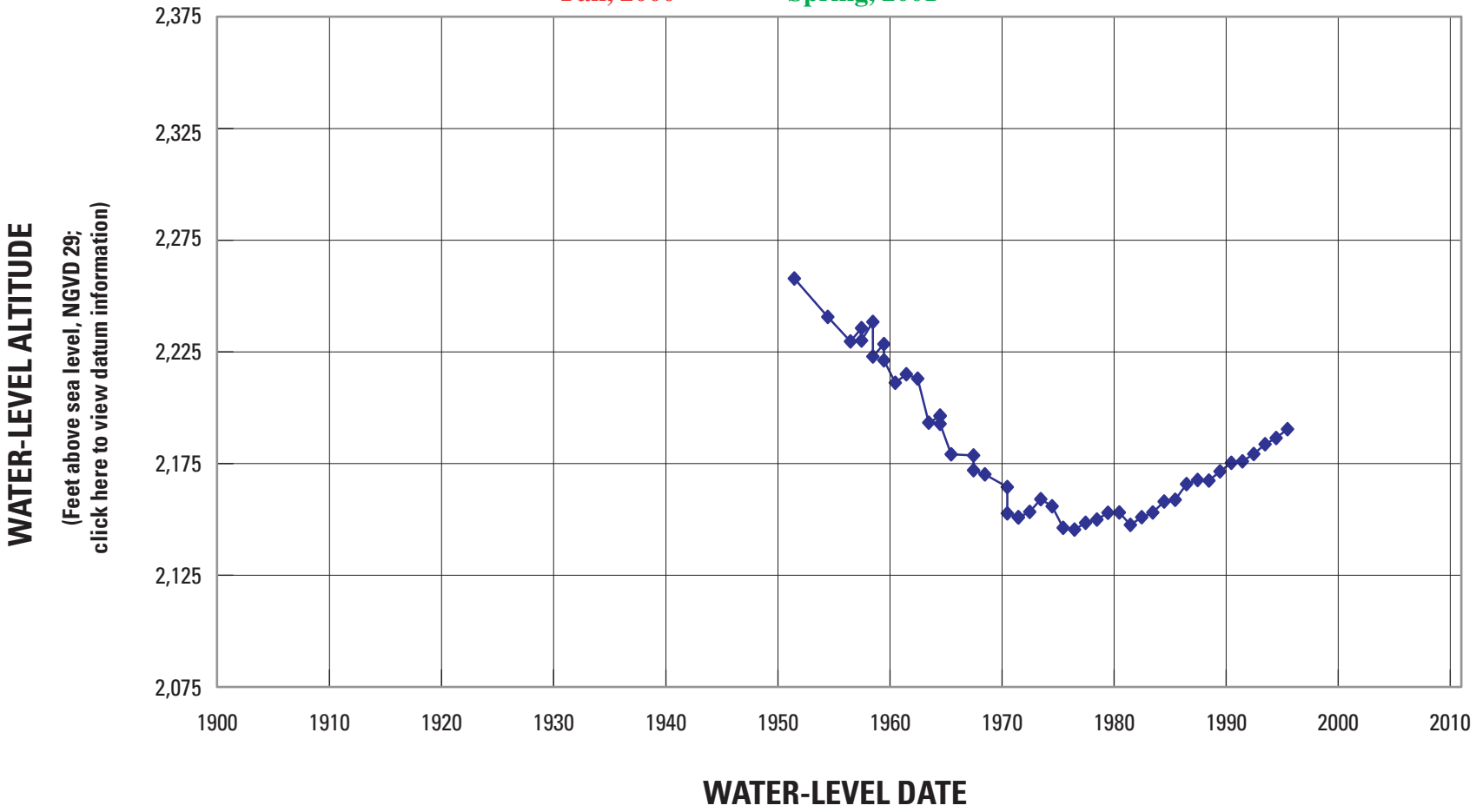
Fall, 2000 Spring, 2001



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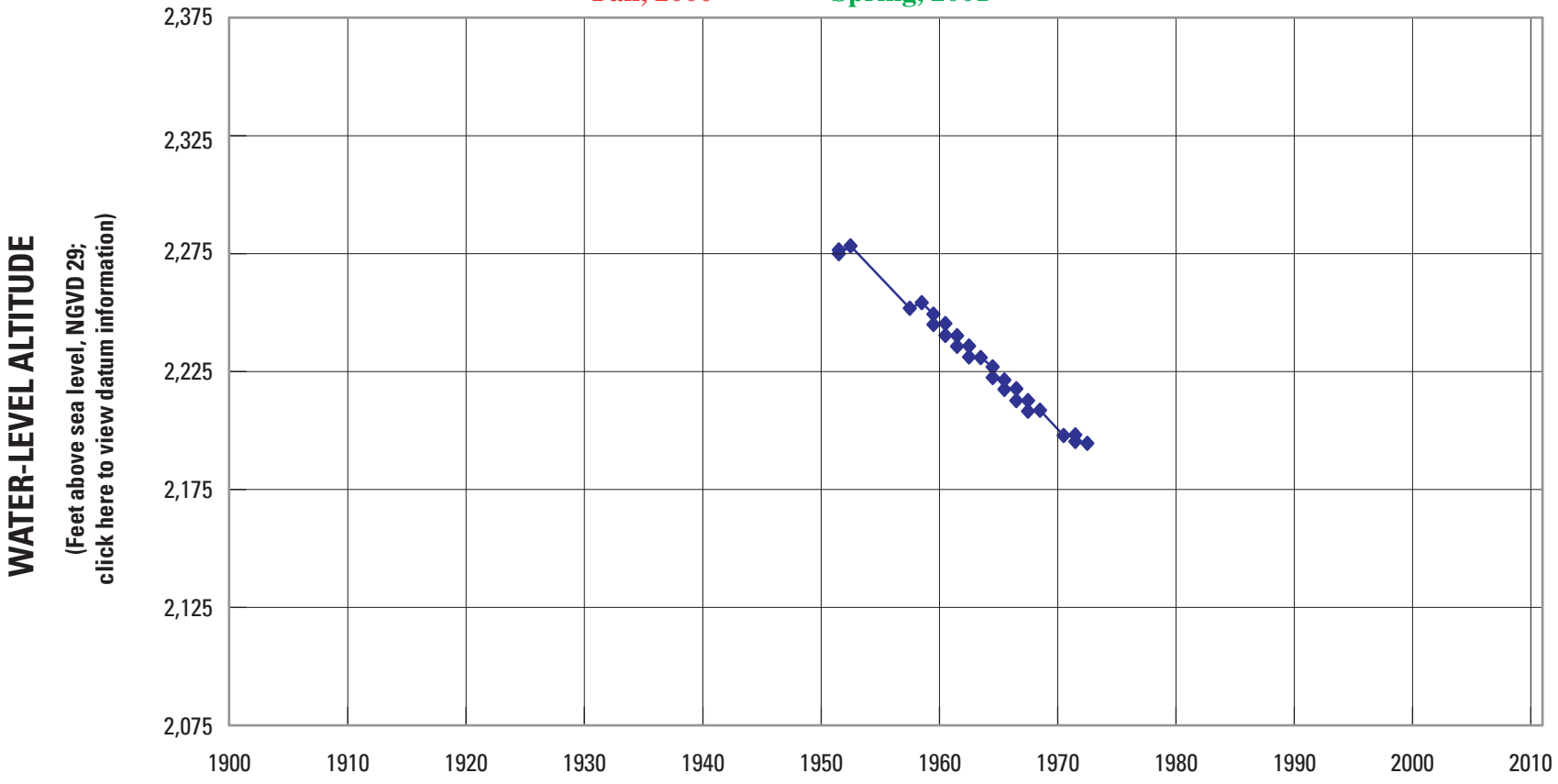
007N012W25M001S

(Click here to view well location)

Fall, 2000 Spring, 2001



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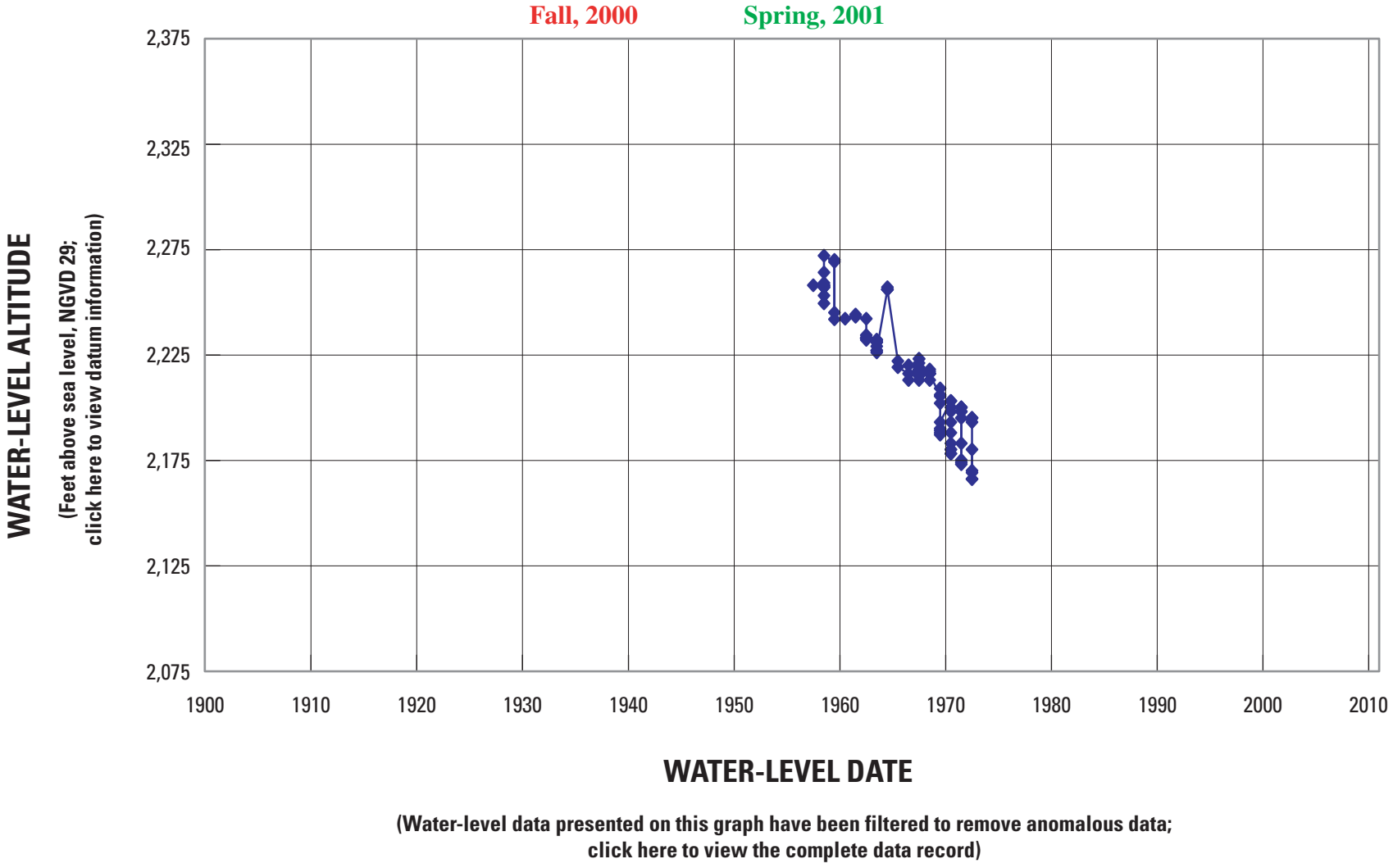
007N012W26K001S

(Click here to view well location)



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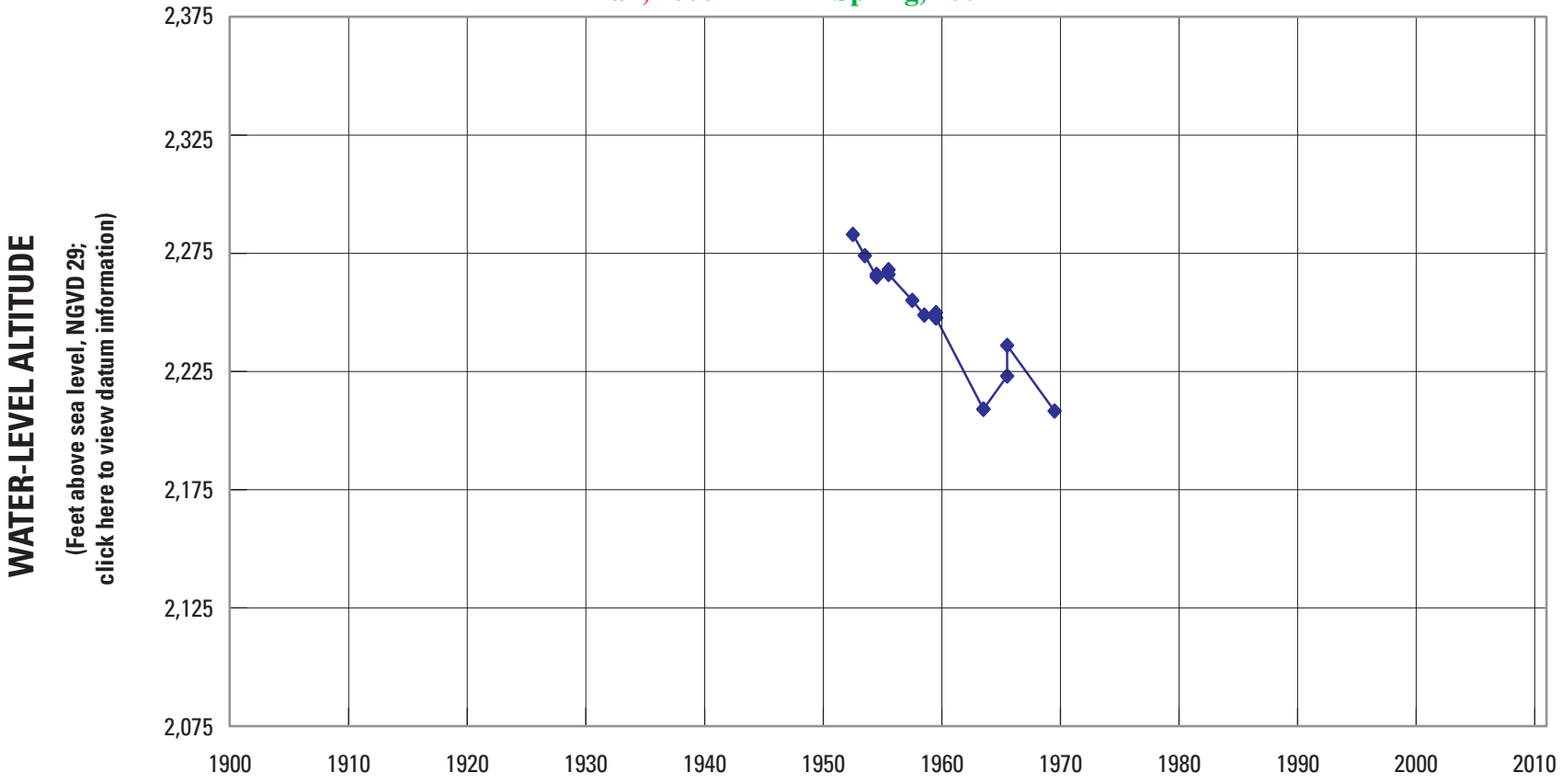
(Click here to view well location)

Fall, 2000 Spring, 2001



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007N012W26K003S

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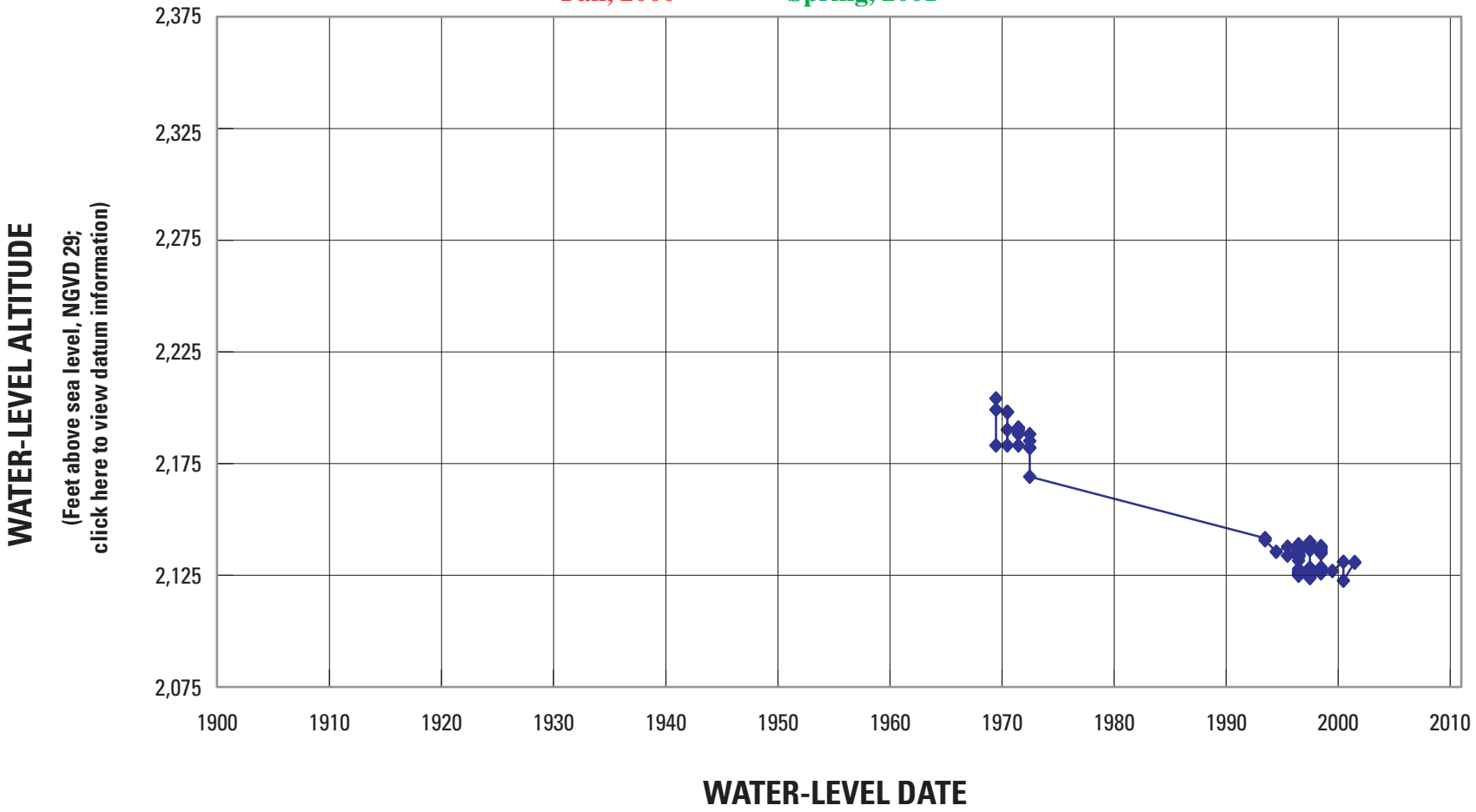
Fall, 2000 Spring, 2001

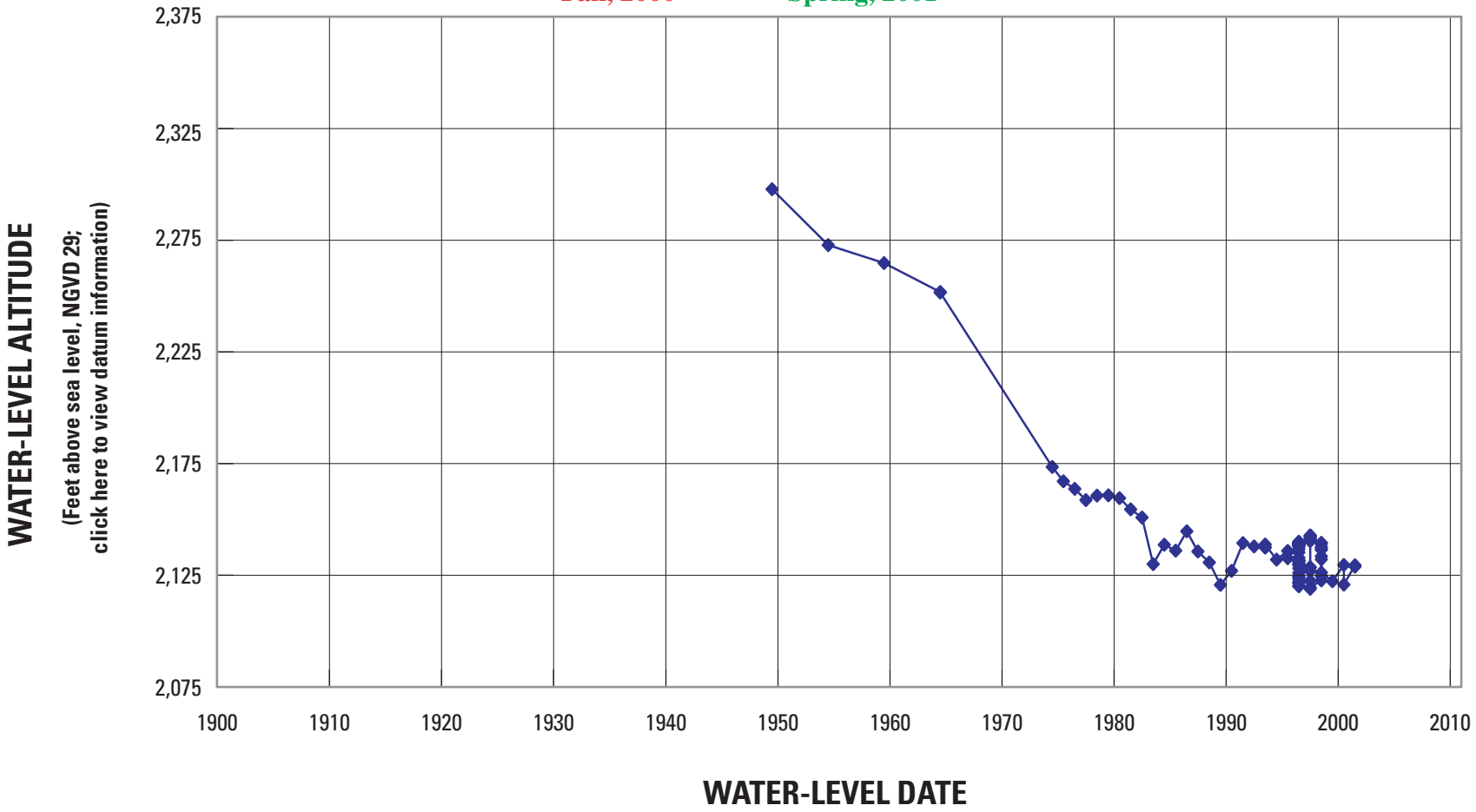


(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

007N012W27H001S

(Click here to view well location)

Fall, 2000 Spring, 2001

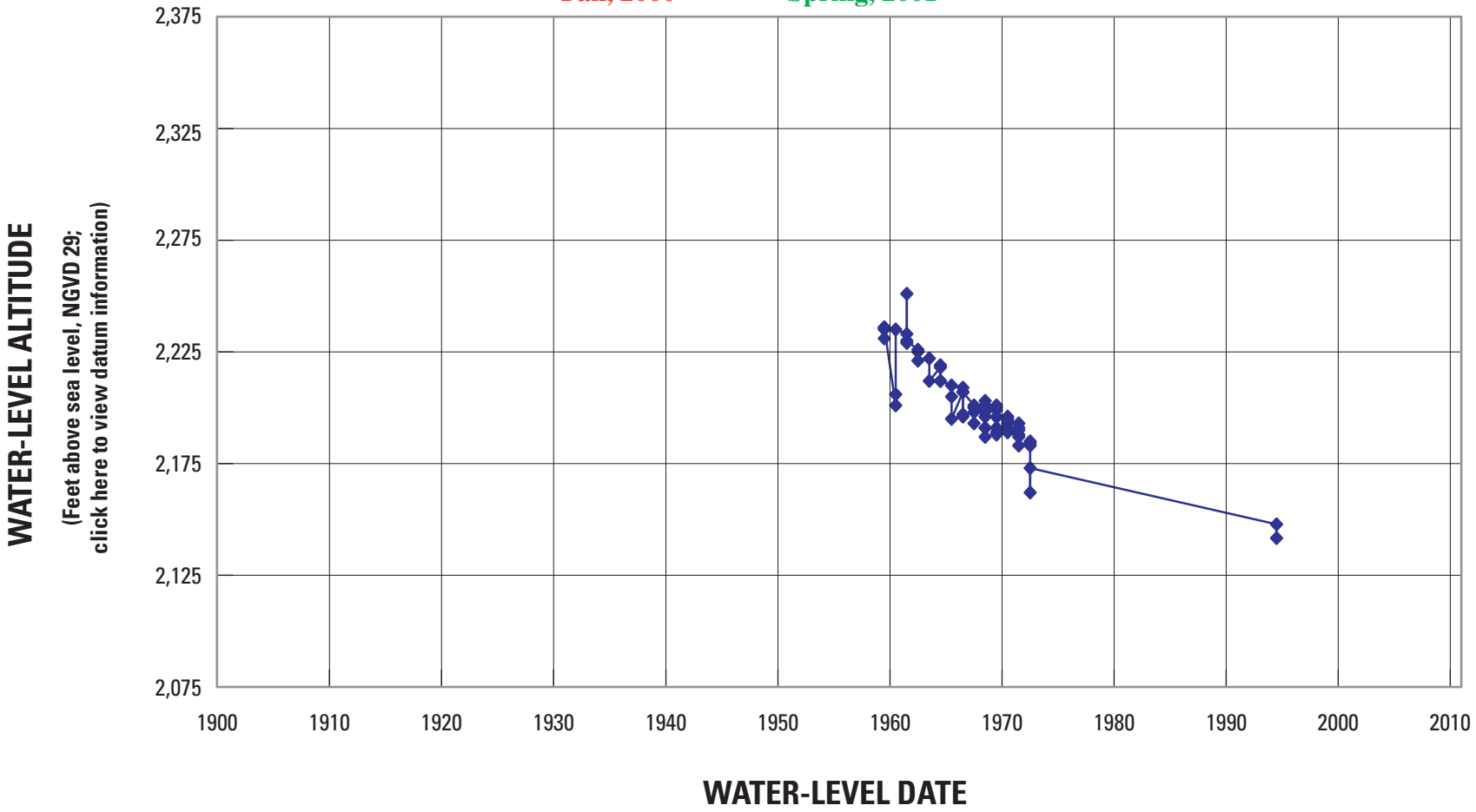


(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

007N012W27H002S

(Click here to view well location)

Fall, 2000 Spring, 2001



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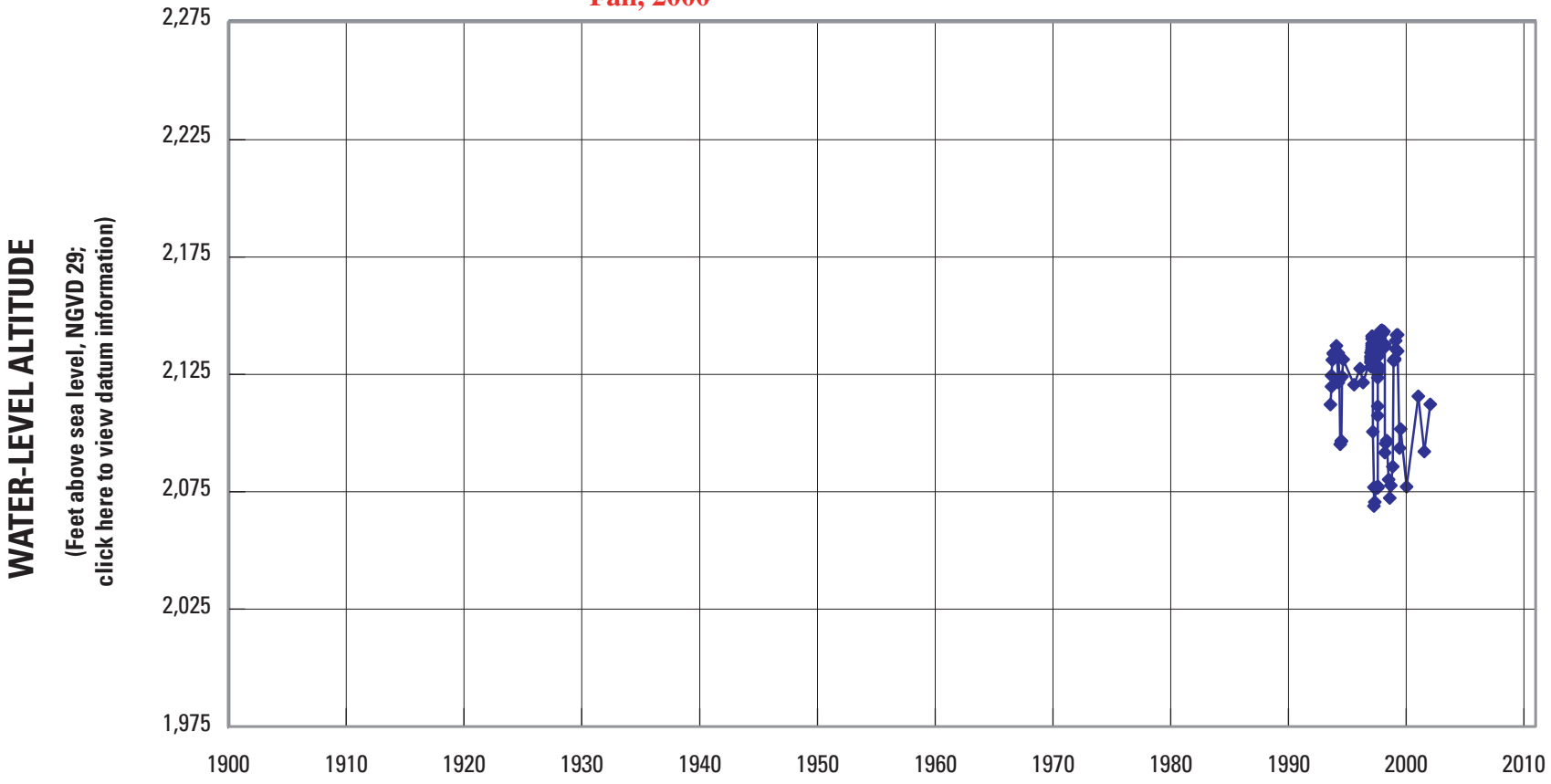
(Click here to view well location)

Fall, 2000



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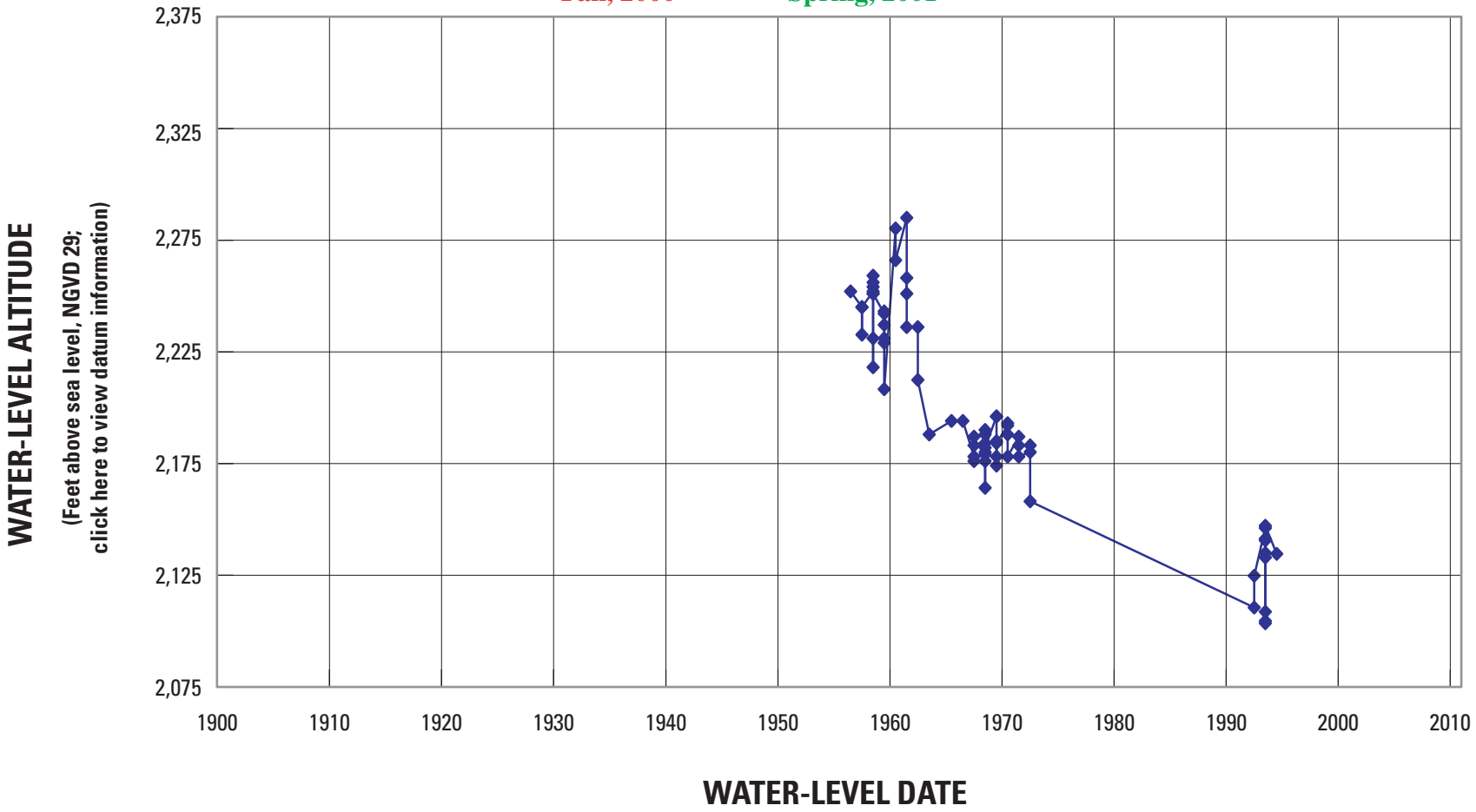
007N012W27J004S

(Click here to view well location)

Fall, 2000 Spring, 2001



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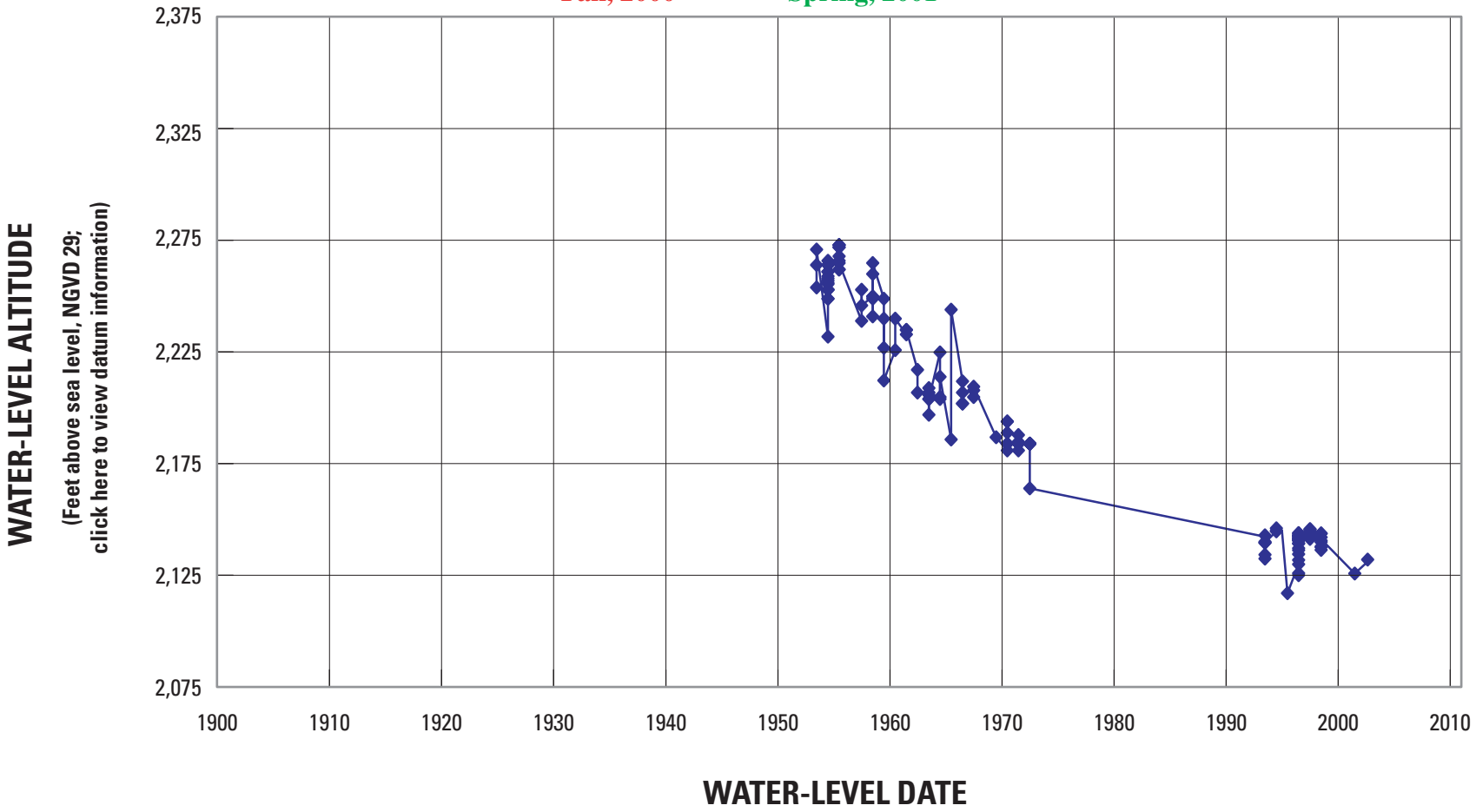
007N012W27J005S

(Click here to view well location)

Fall, 2000 Spring, 2001



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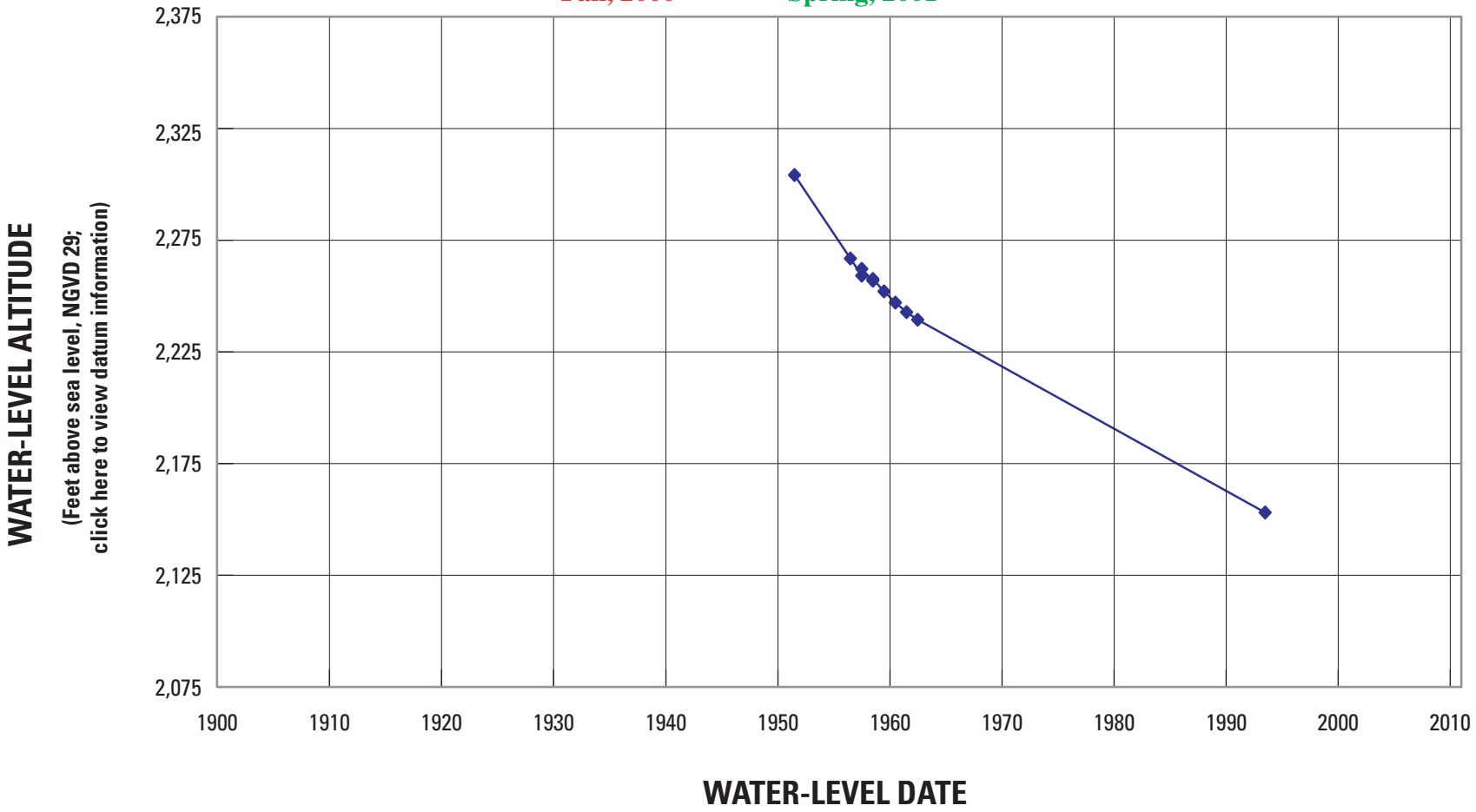
007N012W33R001S

(Click here to view well location)

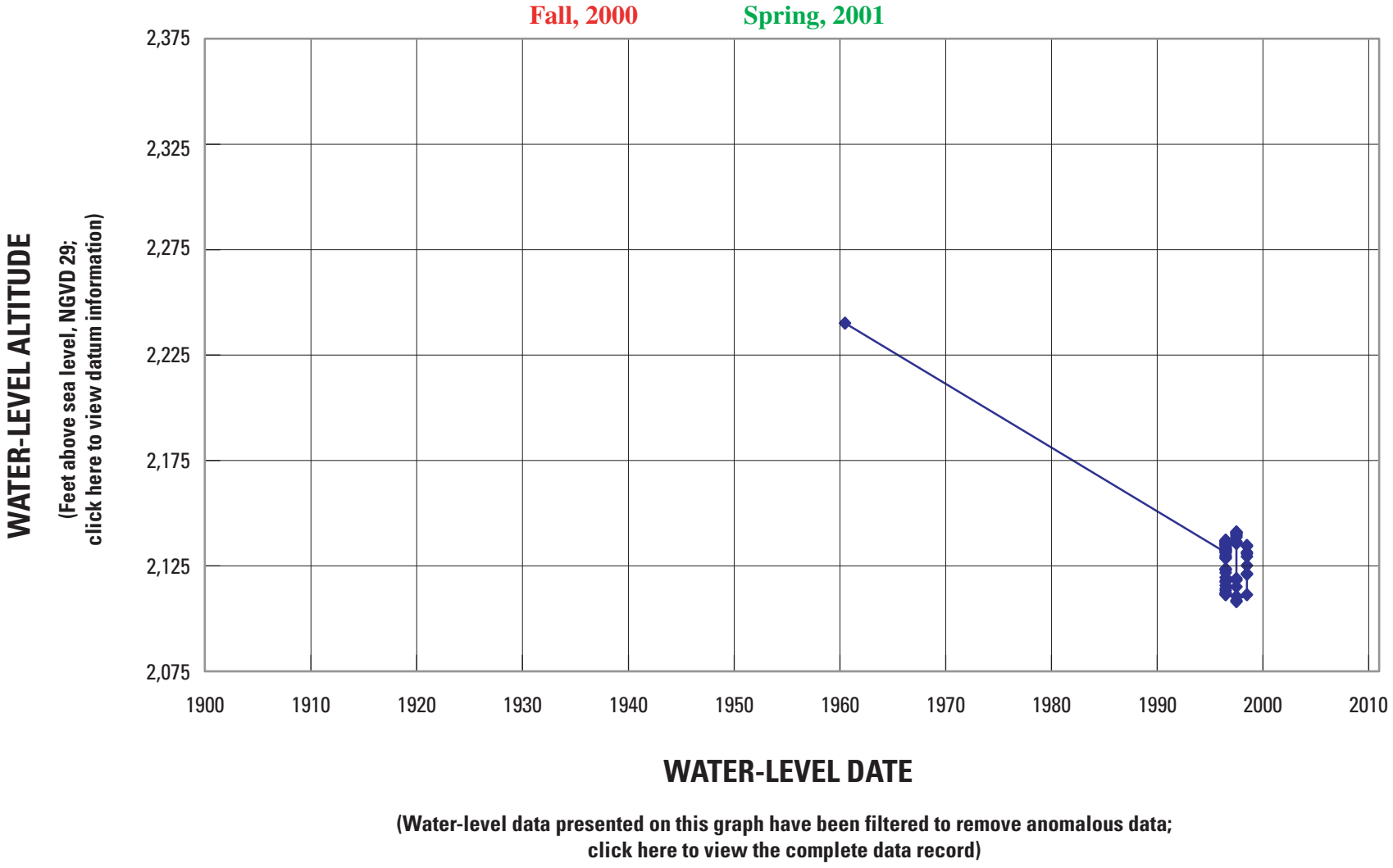
Fall, 2000 Spring, 2001



(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

007N012W34B001S

(Click here to view well location)



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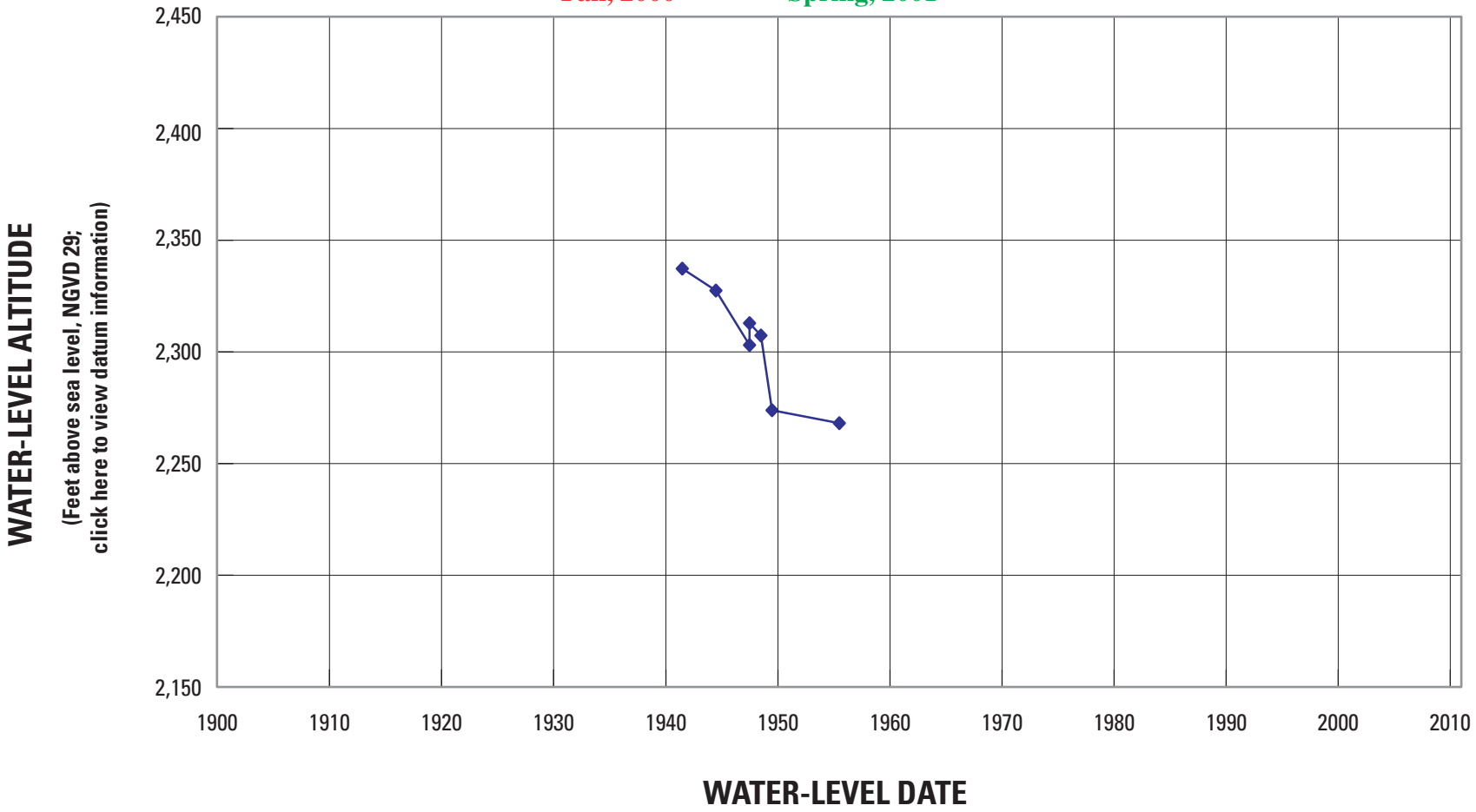
007N012W34E001S

(Click here to view well location)

Fall, 2000 Spring, 2001



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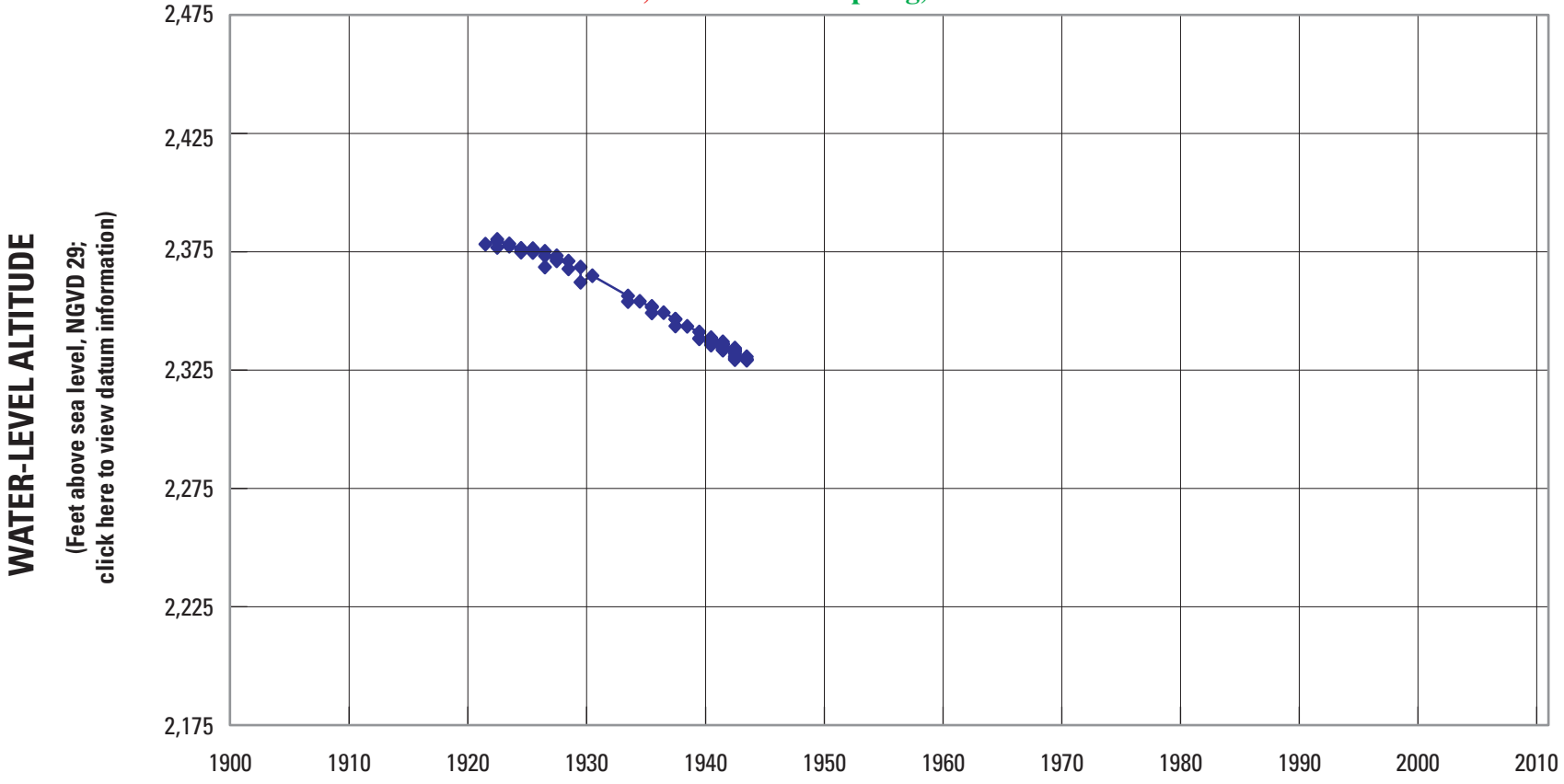
(Click here to view well location)

Fall, 2000 Spring, 2001



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007N012W34N001S

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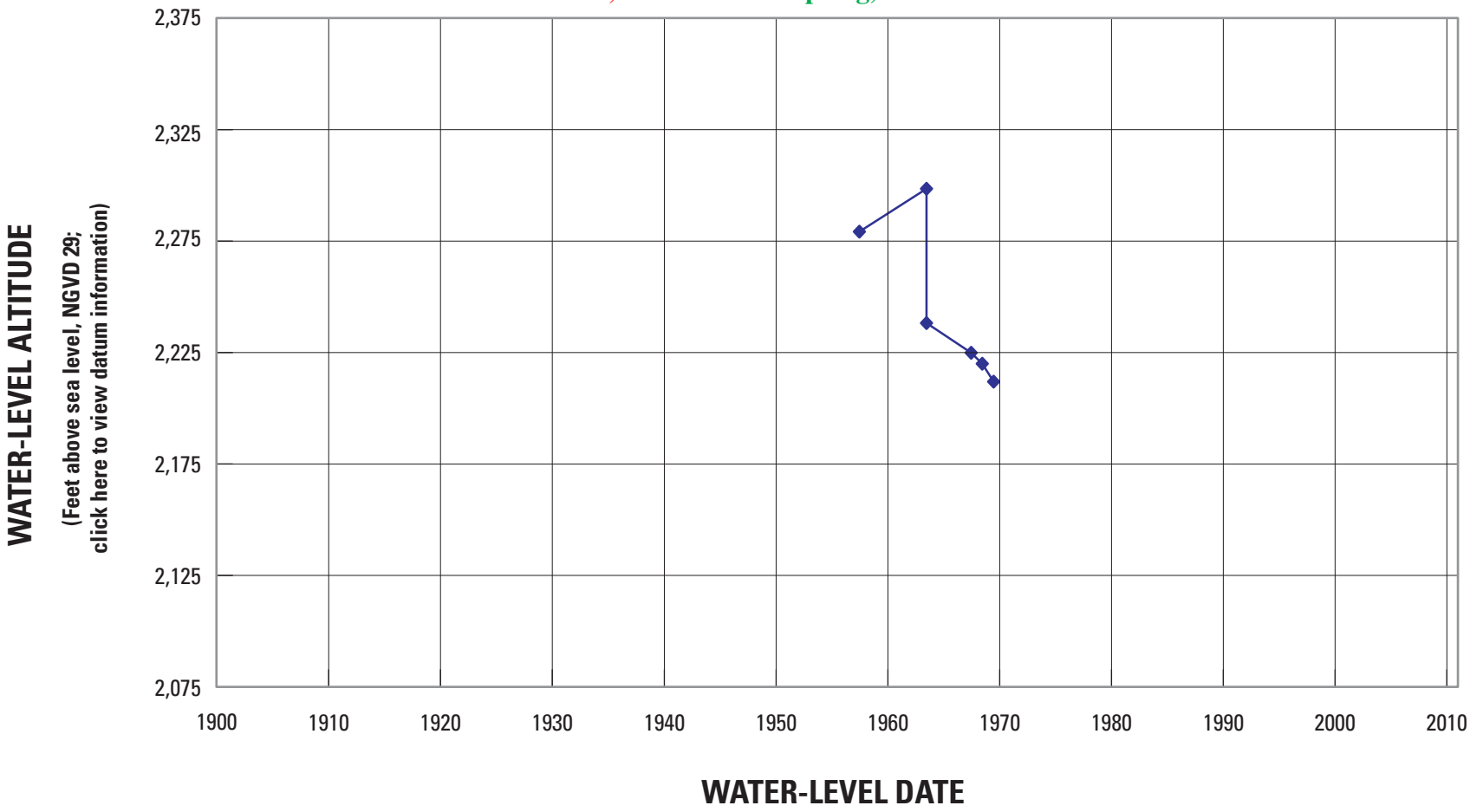
Fall, 2000 Spring, 2001



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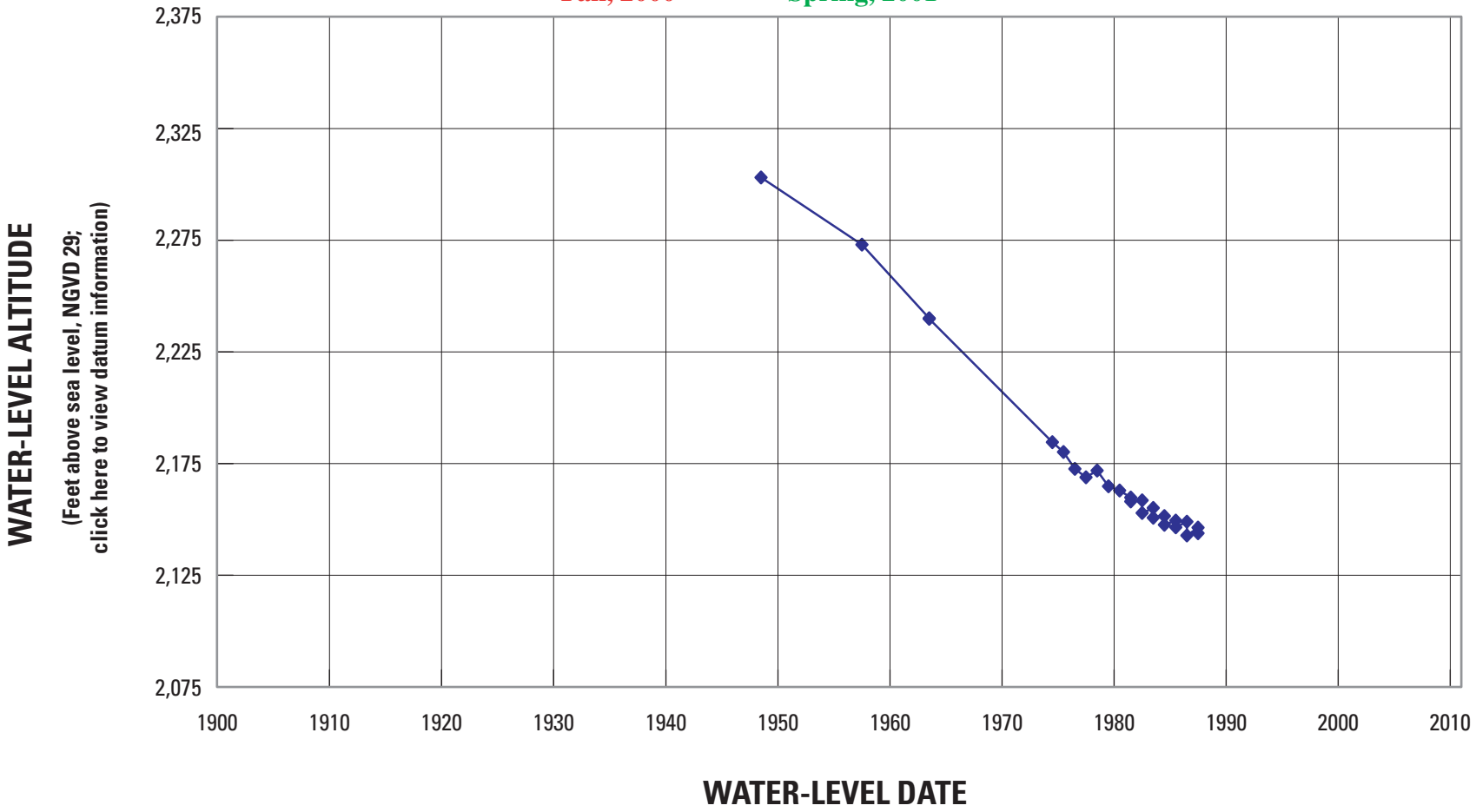
(Click here to view well location)

Fall, 2000 Spring, 2001



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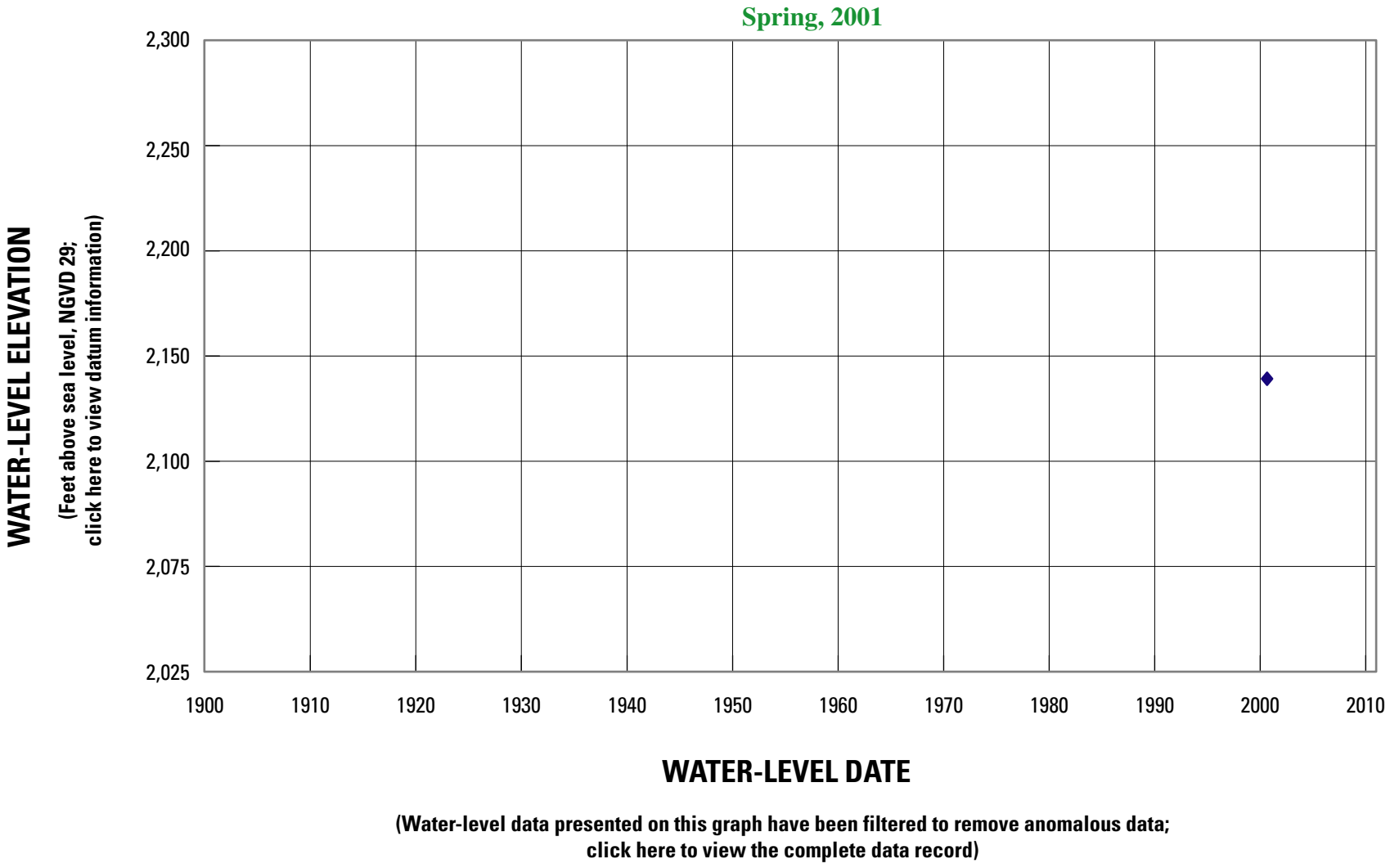
006N012W01B001S

(Click here to view well location)



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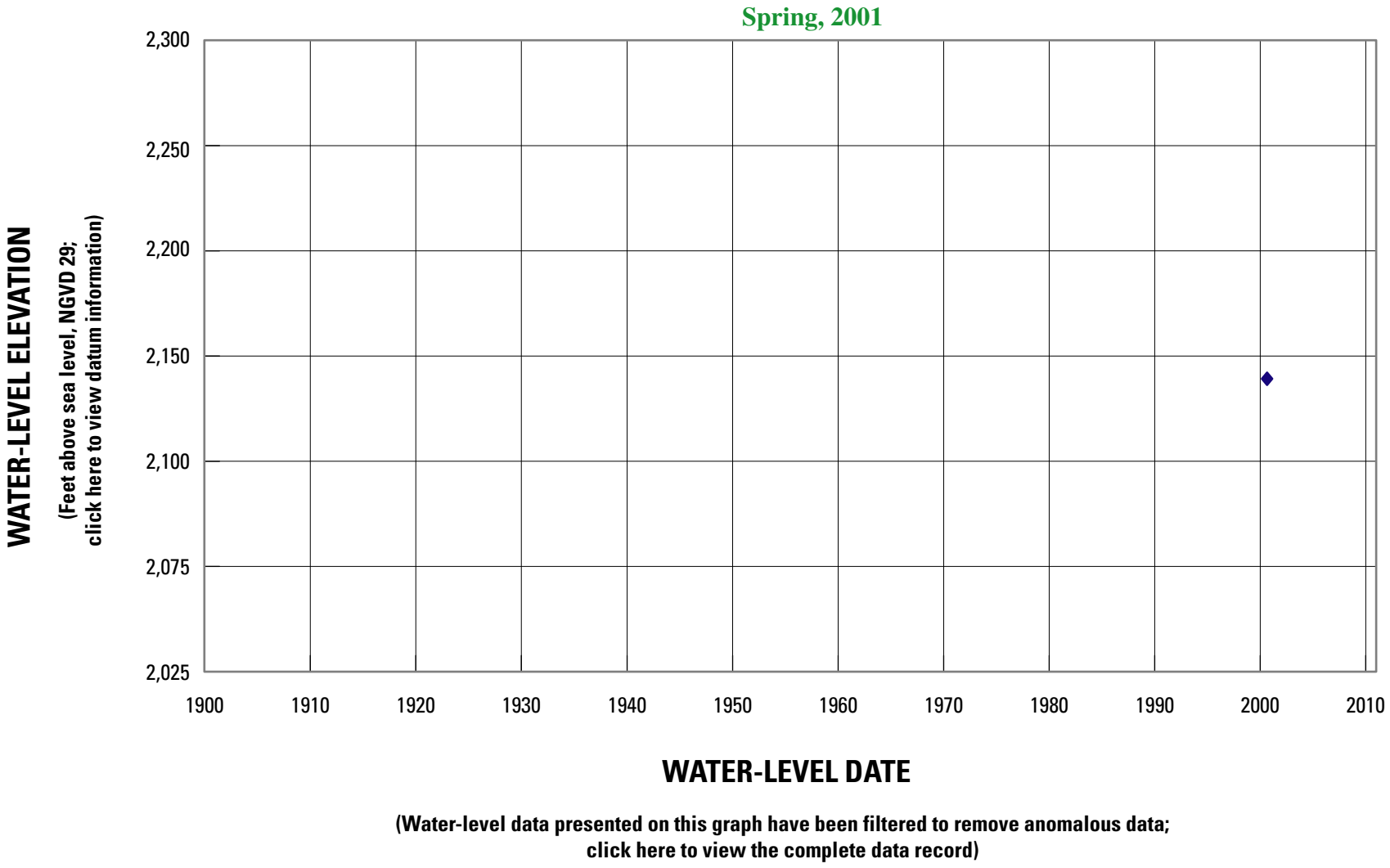
click here to view the complete data record)

006N012W01J002S

(Click here to view well location)



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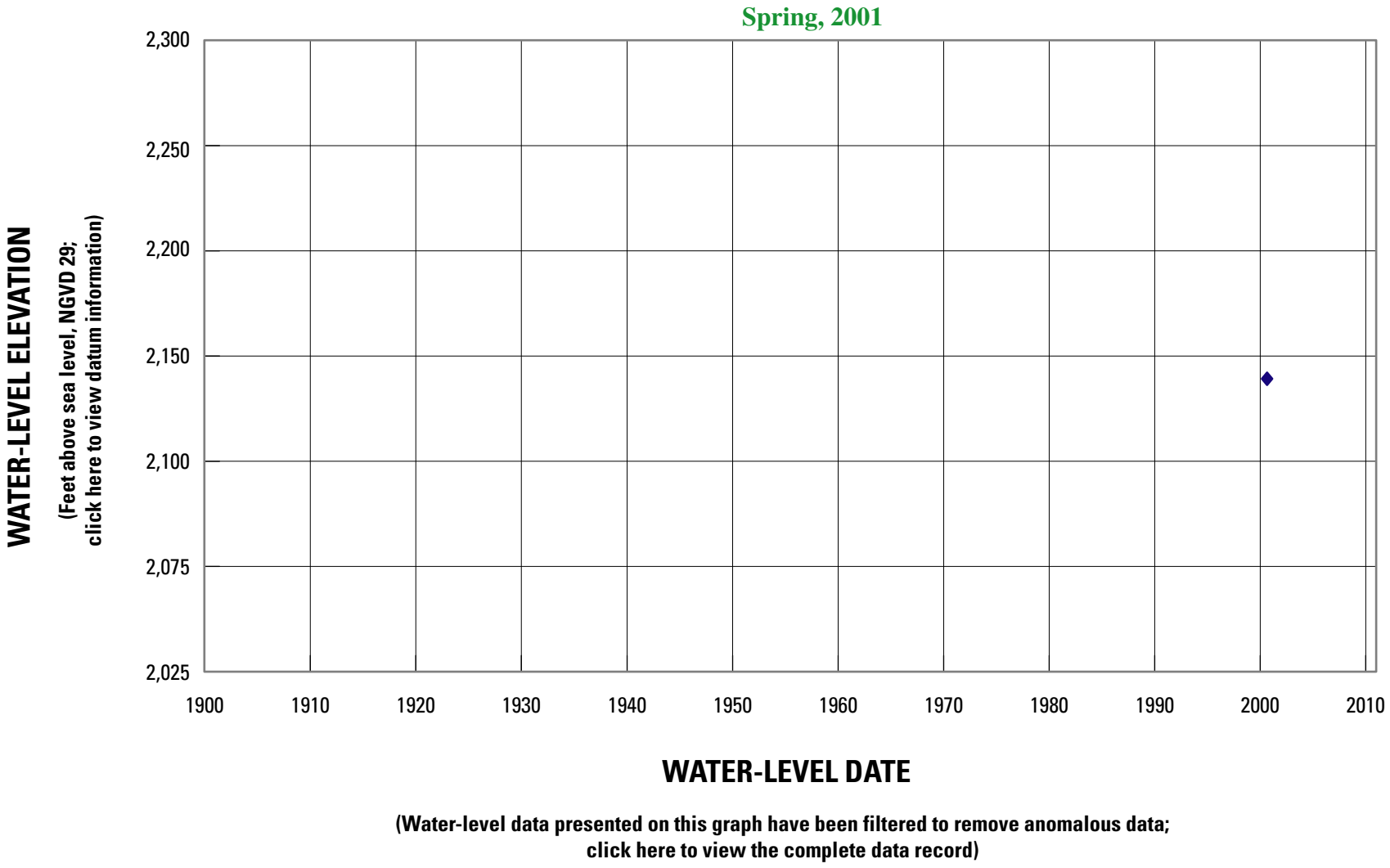
006N012W01K002S

(Click here to view well location)

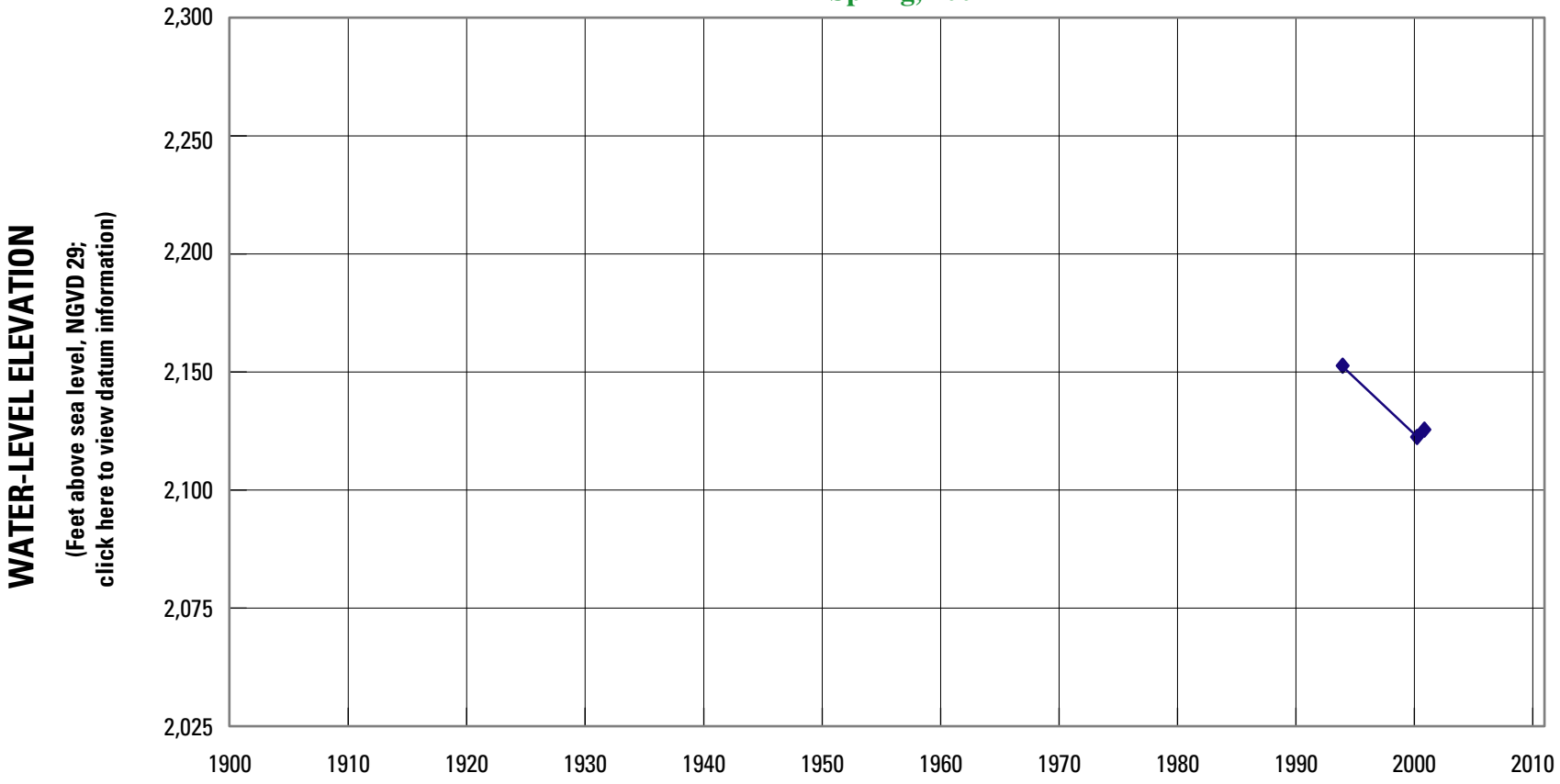


(Water-level data presented on this graph have been filtered to remove anomalous data;
click here to view the complete data record)

007N012W27J006S

(Click here to view well location)

Spring, 2001



WATER-LEVEL ELEVATION

(Feet above sea level, NGVD 29; click here to view datum information)

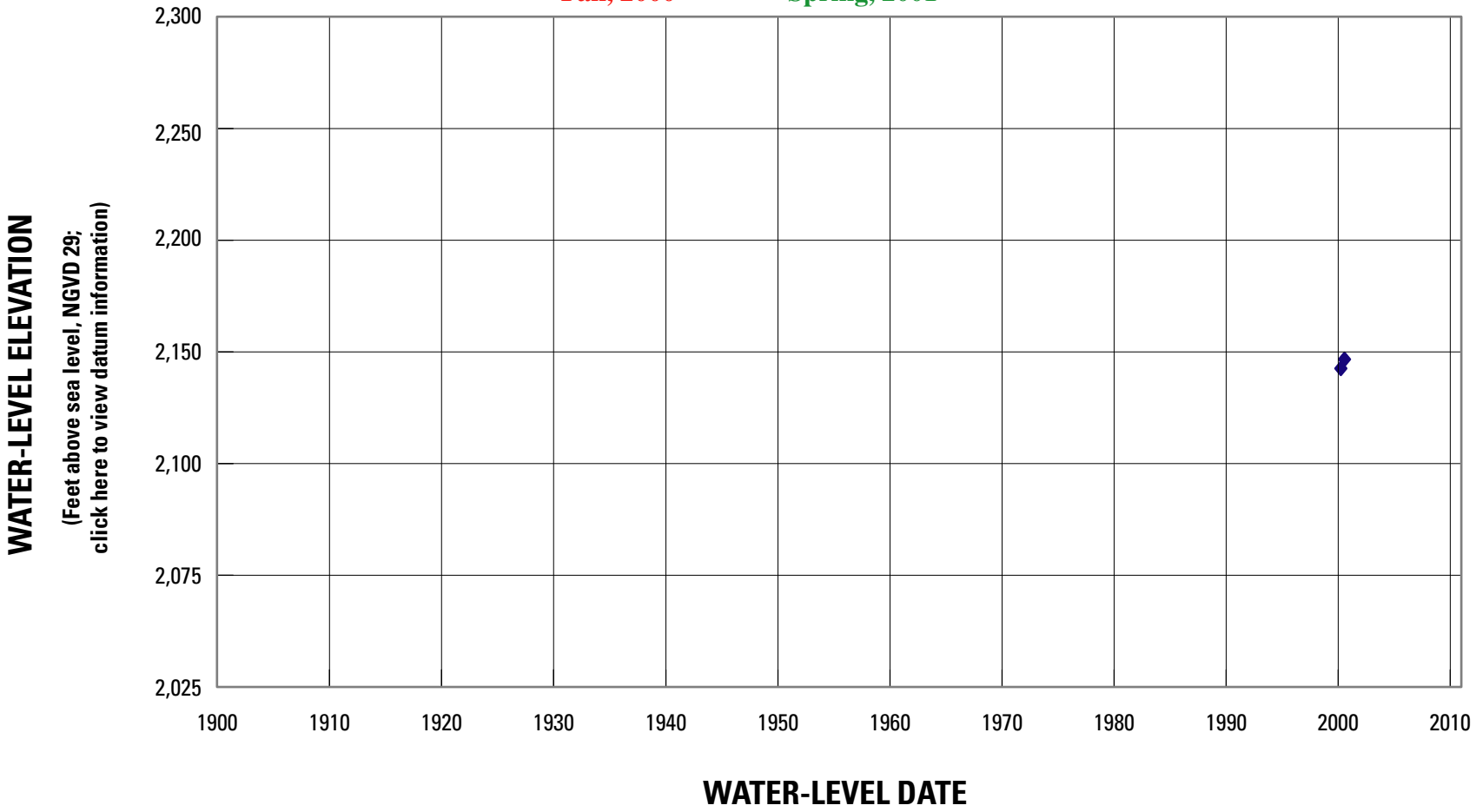
WATER-LEVEL DATE

(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

006N011W06K002S

(Click here to view well location)

Fall, 2000 Spring, 2001



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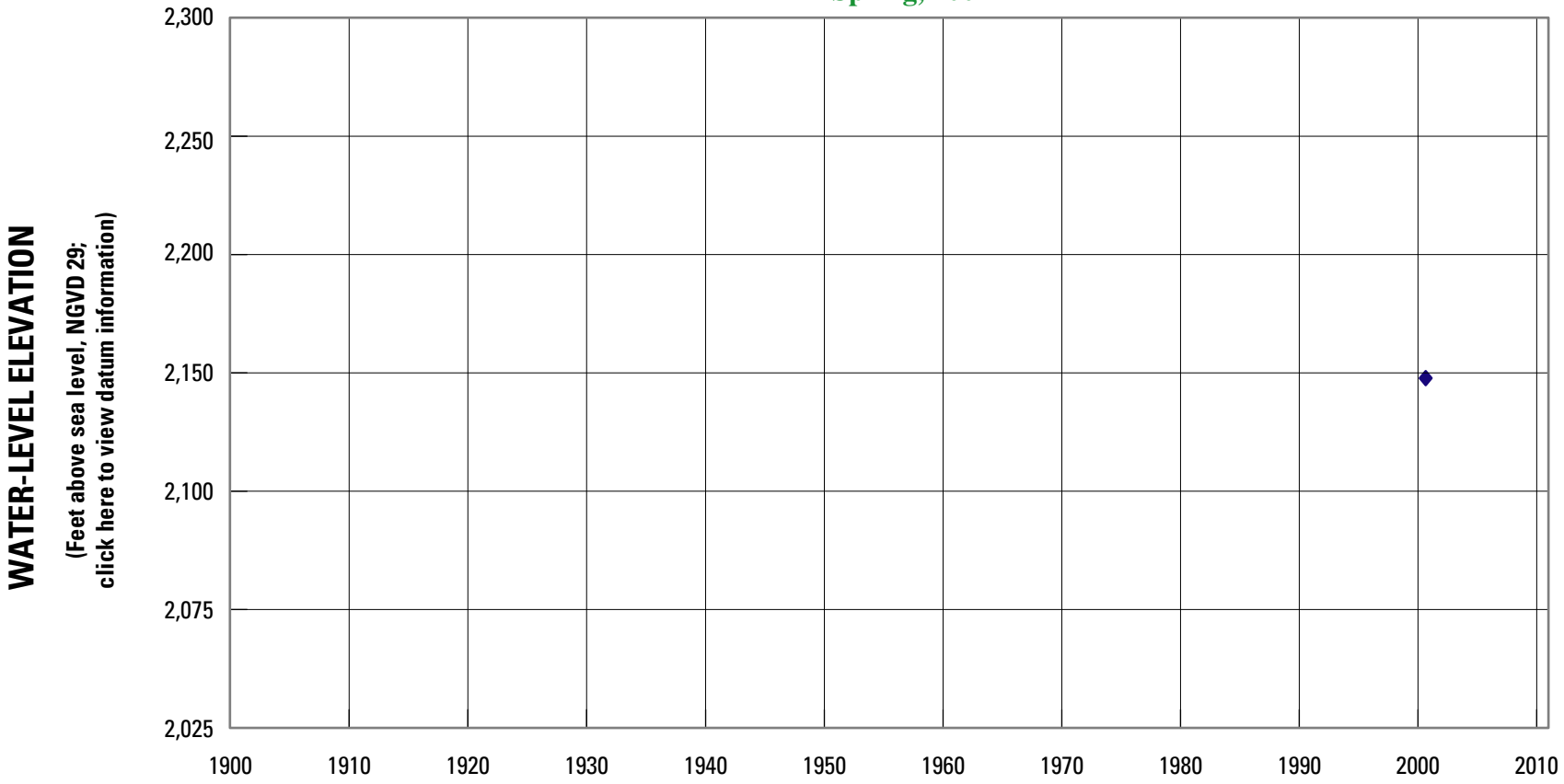
006N011W06B001S

(Click here to view well location)

Spring, 2001



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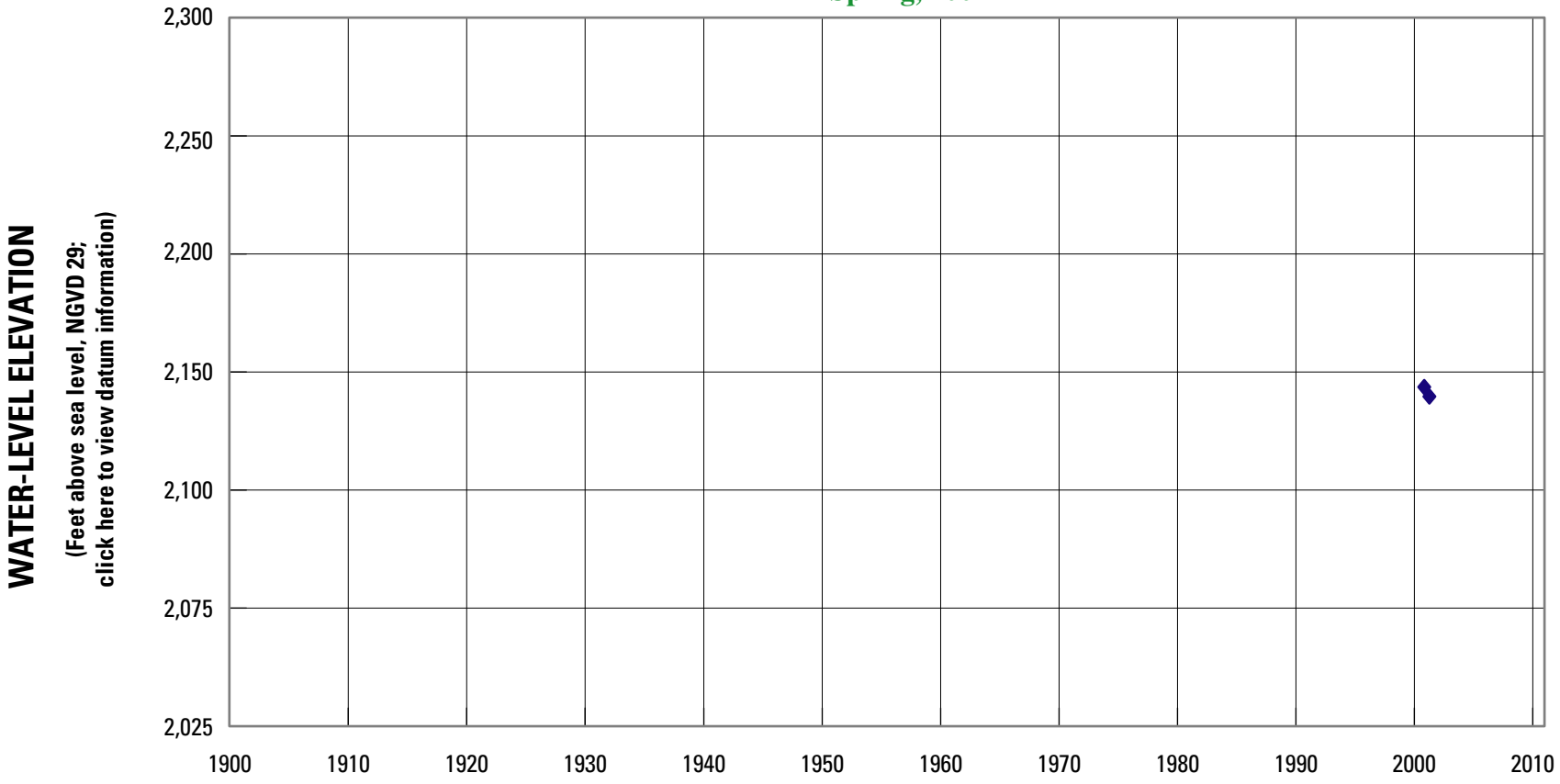
click here to view the complete data record)

006N011W06E002S

(Click here to view well location)

Spring, 2001



WATER-LEVEL ELEVATION

(Feet above sea level, NGVD 29; click here to view datum information)

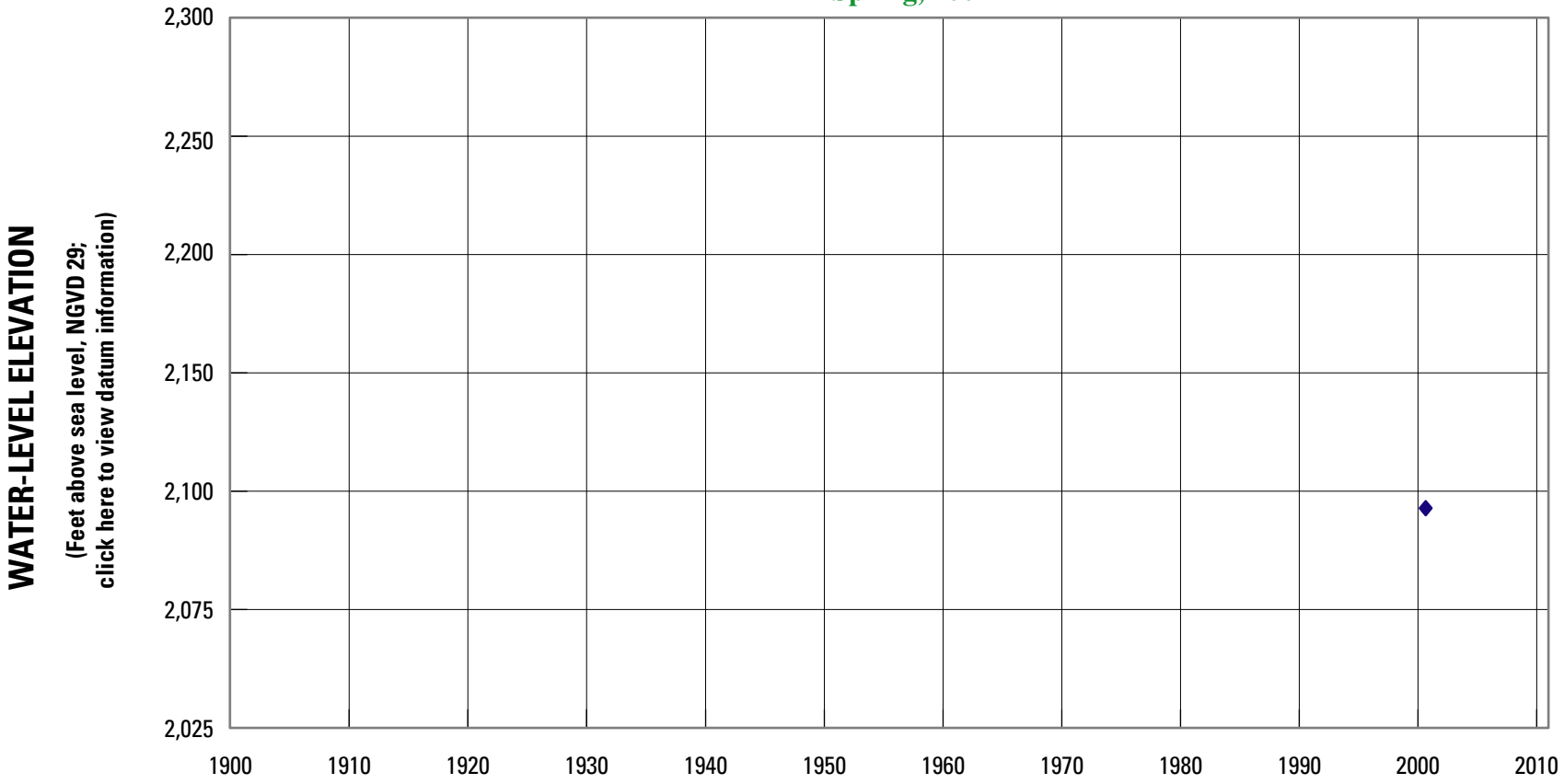
WATER-LEVEL DATE

(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

006N011W08L001S

(Click here to view well location)

Spring, 2001



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006N011W17B001S

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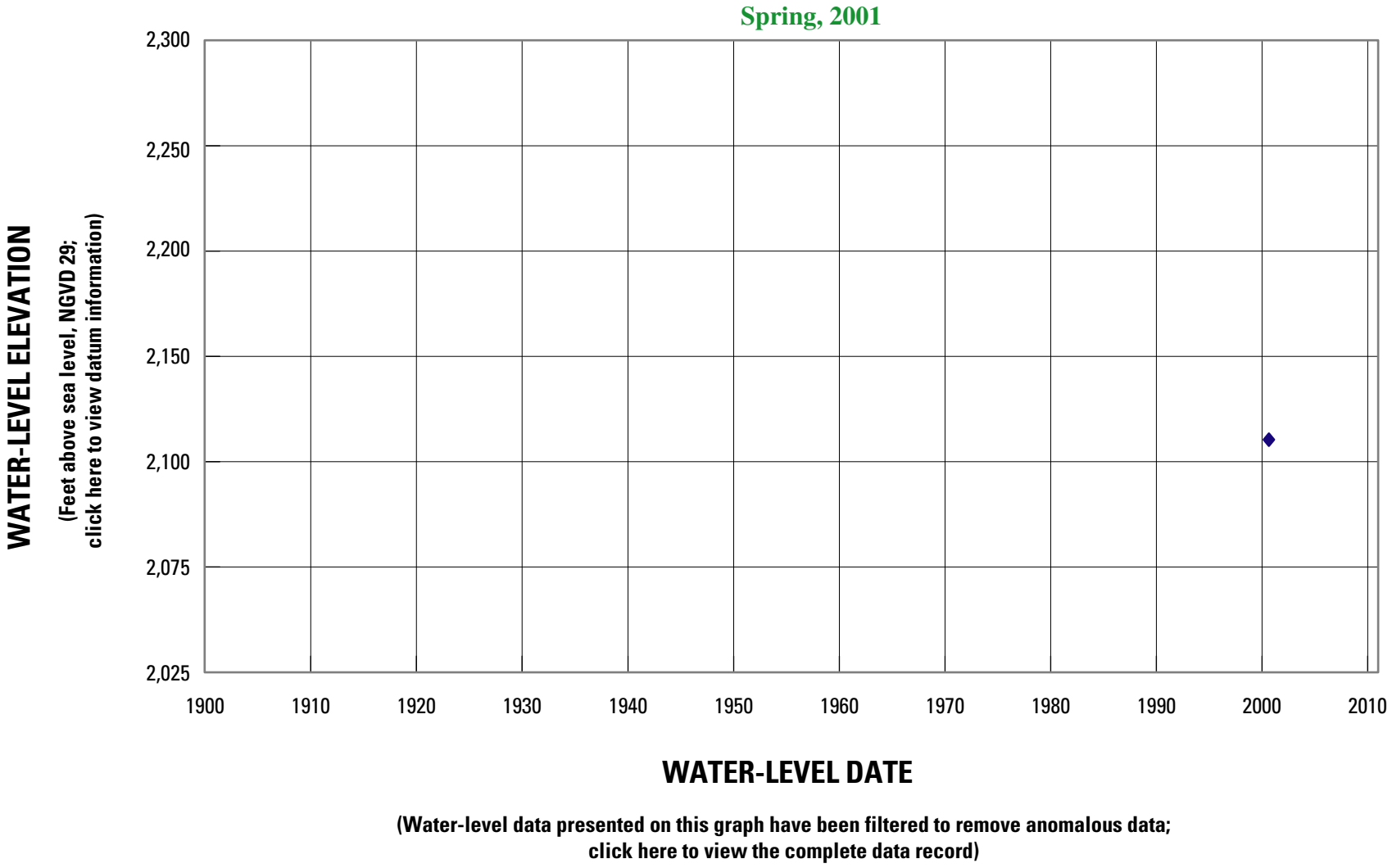

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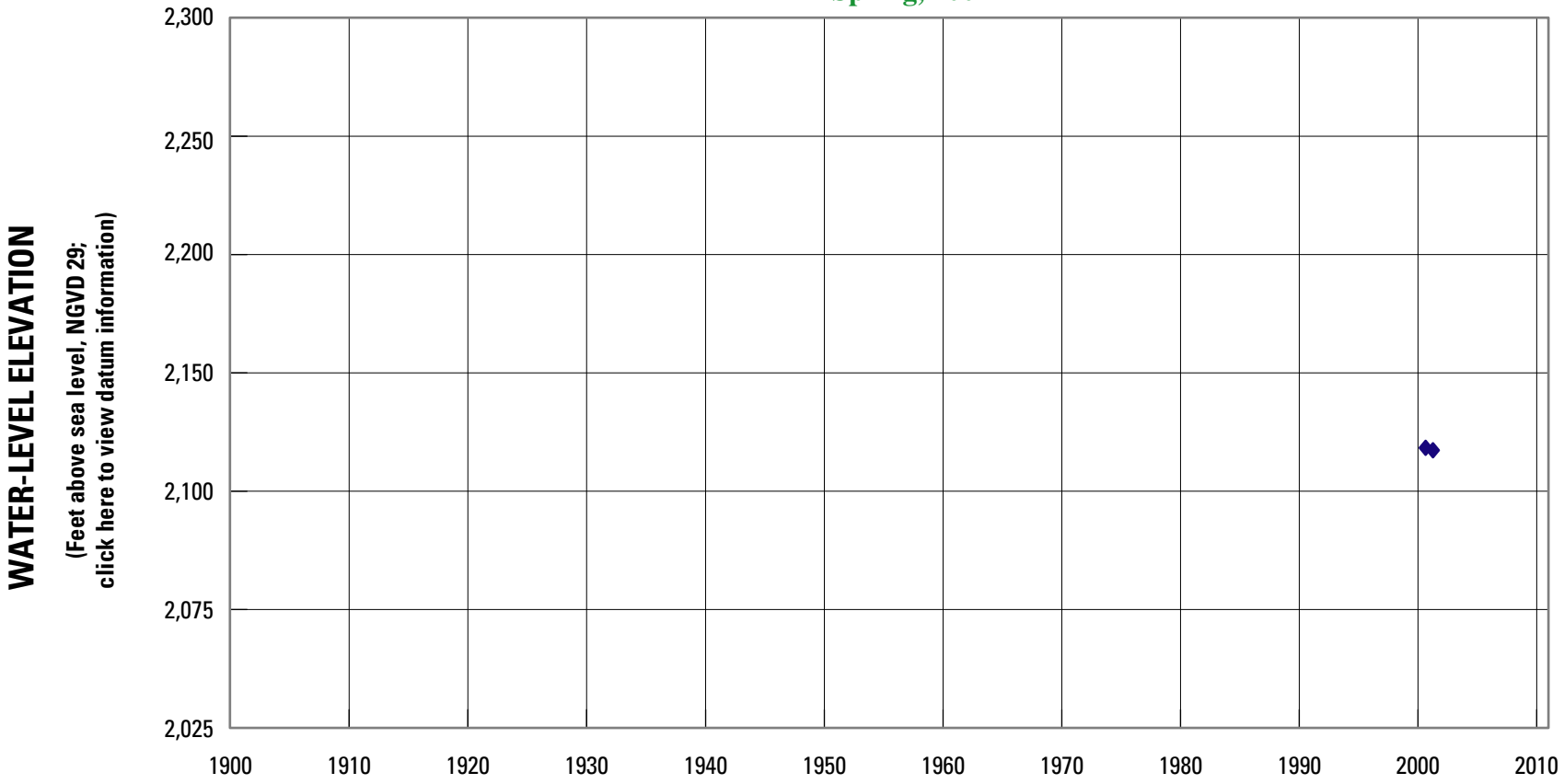
006N012W12M003S

(Click here to view well location)

Spring, 2001



WATER-LEVEL ELEVATION

(Feet above sea level, NGVD 29; click here to view datum information)

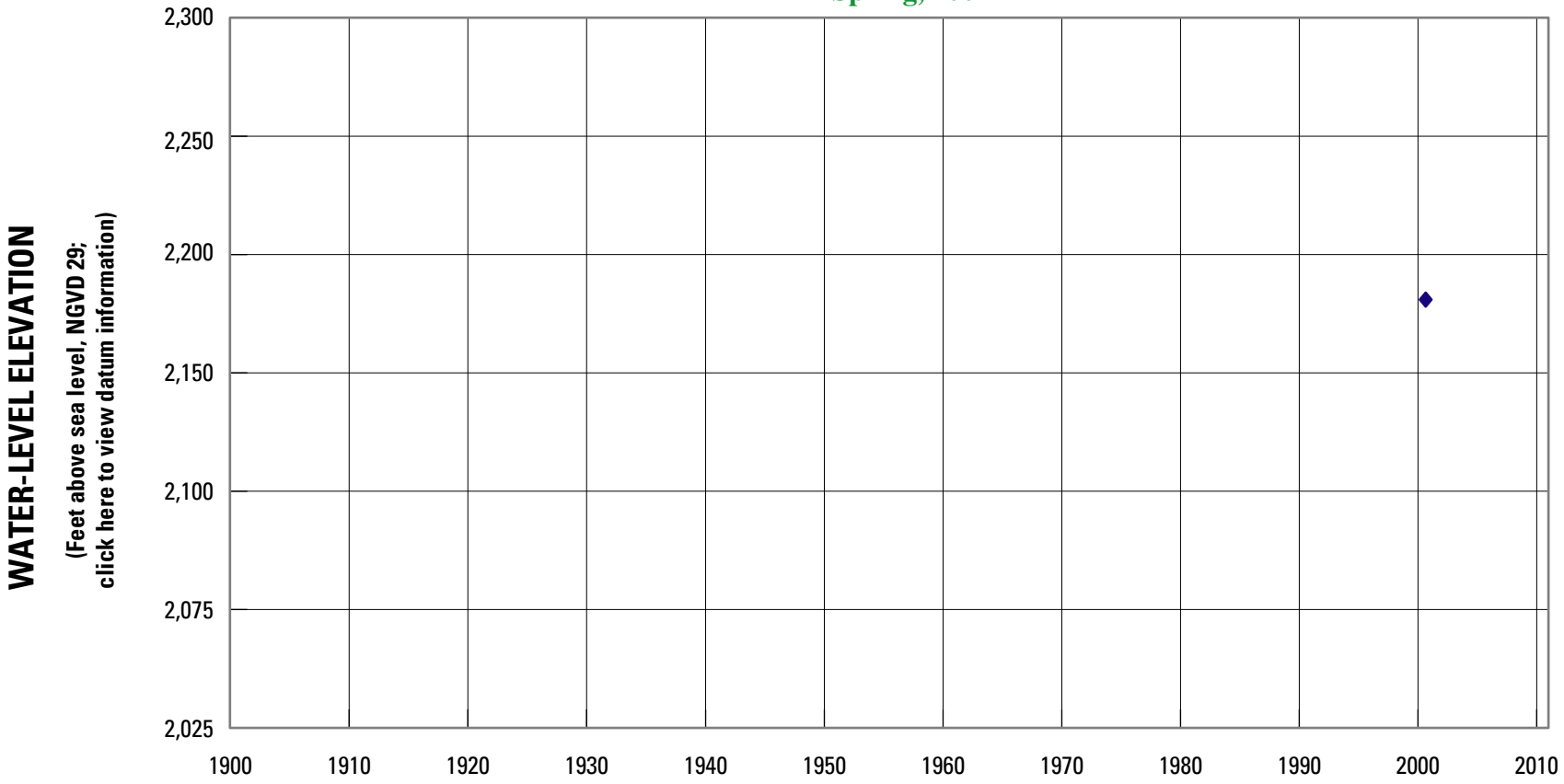
WATER-LEVEL DATE

(Water-level data presented on this graph have been filtered to remove anomalous data; click here to view the complete data record)

007N011W31K001S

(Click here to view well location)

Spring, 2001



(Water-level data presented on this graph have been filtered to remove anomalous data;
click here to view the complete data record)

007N011W31Q001S

(Click here to view well location)

Fall, 2000 Spring, 2001

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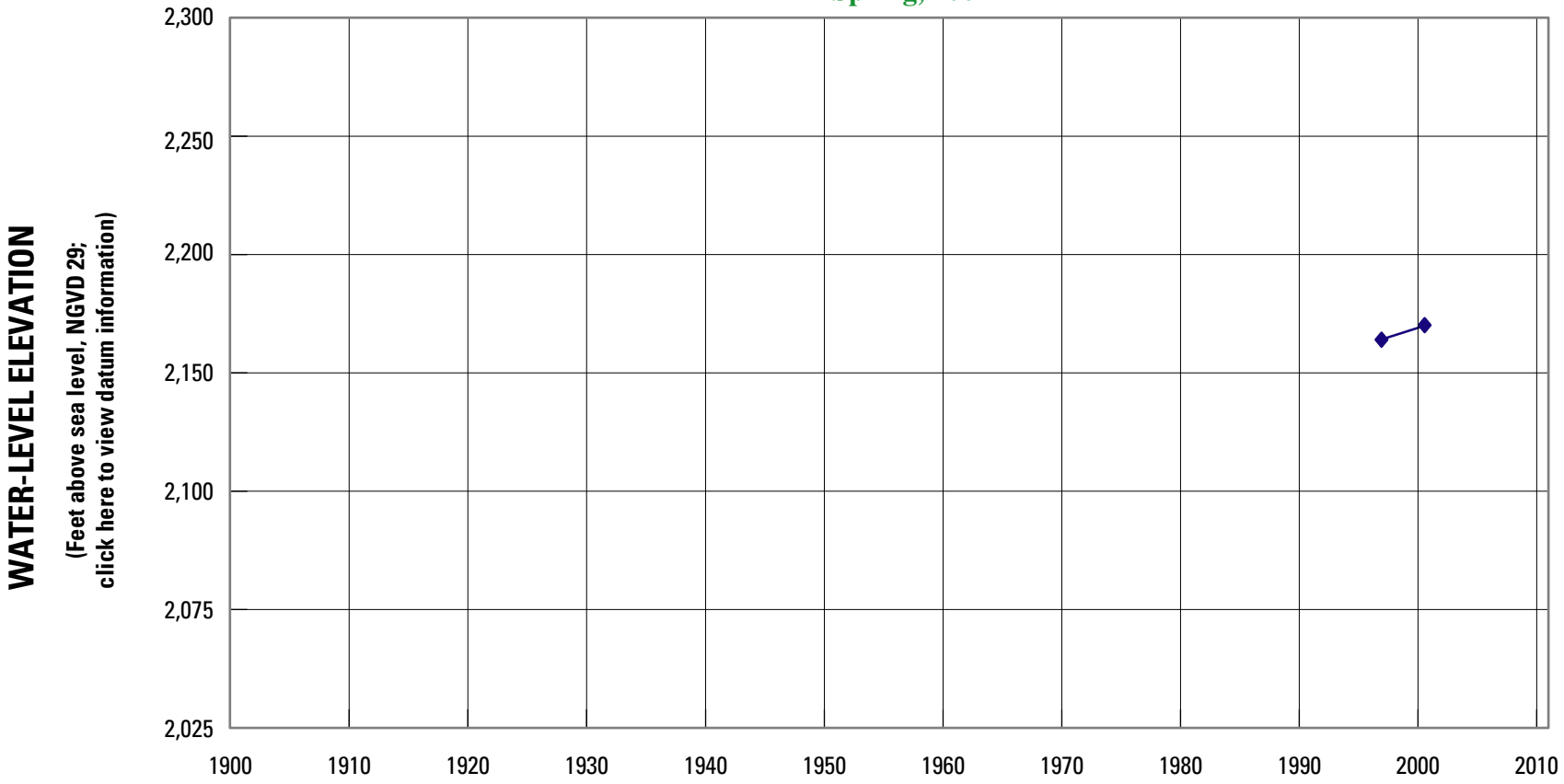
click here to view the complete data record)

007N011W32P004S

(Click here to view well location)

Spring, 2001



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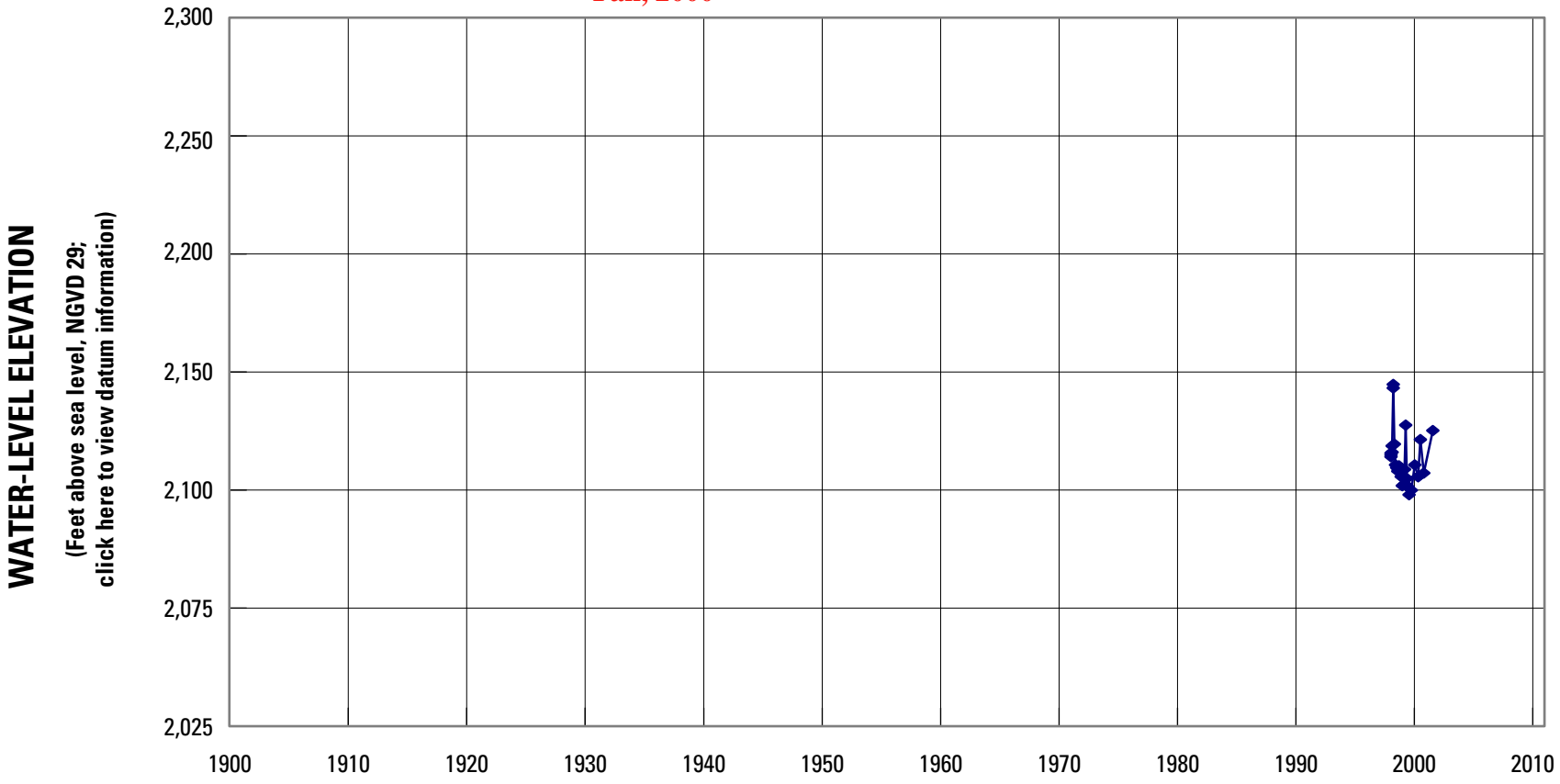
click here to view the complete data record)

007N012W27P008S

(Click here to view well location)

Fall, 2000



(Water-level data presented on this graph have been filtered to remove anomalous data;
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